AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.1.2

Speed

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**148**
Available paper years	**2003–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.5.6.1.2 Speed

Answer 01 · Mark scheme June 2003 | 3451H | Original Q10 | Legacy

The full source mark scheme begins on page 197. Follow original question 10 in that document.

Answer 02 · Mark scheme June 2003 | 3451H | Original Q13 | Legacy

The full source mark scheme begins on page 197. Follow original question 13 in that document.

Answer 03 · Mark scheme June 2003 | 3451H | Original Q16 | Legacy

The full source mark scheme begins on page 197. Follow original question 16 in that document.

Answer 04 · Mark scheme June 2003 | 3462H3 | Original Q8 | Legacy

The full source mark scheme begins on page 219. Follow original question 8 in that document.

Answer 05 · Mark scheme June 2003 | 3462H3 | Original Q11 | Legacy

The full source mark scheme begins on page 219. Follow original question 11 in that document.

4.5.6.1.2 Speed

Answer 06 · Mark scheme June 2004 | 3451H | Original Q5 | Legacy

The full source mark scheme begins on page 236. Follow original question 5 in that document.

Answer 07 · Mark scheme June 2004 | 3451H | Original Q9 | Legacy

The full source mark scheme begins on page 236. Follow original question 9 in that document.

Answer 08 · Mark scheme June 2004 | 3451H | Original Q14 | Legacy

The full source mark scheme begins on page 236. Follow original question 14 in that document.

Answer 09 · Mark scheme June 2004 | 3462H3 | Original Q5 | Legacy

The full source mark scheme begins on page 257. Follow original question 5 in that document.

Answer 10 · Mark scheme June 2004 | 3462H3 | Original Q7 | Legacy

The full source mark scheme begins on page 257. Follow original question 7 in that document.

4.5.6.1.2 Speed

Answer 11 · Mark scheme June 2004 | 3462H3 | Original Q12 | Legacy

The full source mark scheme begins on page 257. Follow original question 12 in that document.

Answer 12 · Mark scheme June 2005 | 3451 | Original Q2 | Legacy

The full source mark scheme begins on page 274. Follow original question 2 in that document.

Answer 13 · Mark scheme June 2005 | 3451 | Original Q4 | Legacy

The full source mark scheme begins on page 274. Follow original question 4 in that document.

Answer 14 · Mark scheme June 2005 | 3451 | Original Q5 | Legacy

The full source mark scheme begins on page 274. Follow original question 5 in that document.

Answer 15 · Mark scheme June 2005 | 3451 | Original Q7 | Legacy

The full source mark scheme begins on page 274. Follow original question 7 in that document.

4.5.6.1.2 Speed

Answer 16 · Mark scheme June 2005 | 3451 | Original Q15 | Legacy

The full source mark scheme begins on page 274. Follow original question 15 in that document.

Answer 17 · Mark scheme June 2005 | 3462 | Original Q2 | Legacy

The full source mark scheme begins on page 292. Follow original question 2 in that document.

Answer 18 · Mark scheme June 2005 | 3462 | Original Q4 | Legacy

The full source mark scheme begins on page 292. Follow original question 4 in that document.

Answer 19 · Mark scheme June 2005 | 3462 | Original Q5 | Legacy

The full source mark scheme begins on page 292. Follow original question 5 in that document.

Answer 20 · Mark scheme June 2005 | 3462 | Original Q11 | Legacy

The full source mark scheme begins on page 292. Follow original question 11 in that document.

4.5.6.1.2 Speed

Answer 21 · Mark scheme June 2006 | 3451 | Original Q4 | Legacy

The full source mark scheme begins on page 306. Follow original question 4 in that document.

Answer 22 · Mark scheme June 2006 | 3451 | Original Q14 | Legacy

The full source mark scheme begins on page 306. Follow original question 14 in that document.

Answer 23 · Mark scheme June 2006 | 3462 | Original Q4 | Legacy

The full source mark scheme begins on page 326. Follow original question 4 in that document.

Answer 24 · Mark scheme June 2006 | 3462 | Original Q12 | Legacy

The full source mark scheme begins on page 326. Follow original question 12 in that document.

Answer 25 · Mark scheme November 2006 | PHY1B | Original Q3 | Legacy

Three	**A**	10	**1**
	B	15	**3**
	C	60	**2**
	D	200	**4**

Answer 26 · Mark scheme November 2006 | PHY1B | Original Q8 | Legacy

Eight	**3**	**2**	**3**	**3**

4.5.6.1.2 Speed

Answer 27 · Mark scheme

January 2007 | PHY1H | Original Q3 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 28 · Mark scheme

January 2007 | PHY1H | Original Q5 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 29 · Mark scheme

March 2007 | PHY1B | Original Q7 | Legacy

Seven	**4**	**1**	**1**	**2**

Answer 30 · Mark scheme

June 2007 | PHY1B | Original Q3 | Legacy

Three	**1**	**4**	**3**	**1**

Answer 31 · Mark scheme

June 2007 | PHY1B | Original Q7 | Legacy

Seven	**3**	**1**	**1**	**4**

4.5.6.1.2 Speed

Question 5 continued

	answers	extra information	mark
(b)(i)		any mention of alpha, beta, gamma waves scores **0** marks	
	emit / uses / transmit / receive microwaves	accept radiation for microwaves throughout ignore radio waves	1
	some microwave / energy absorbed by / enters the body	ecf for their given electromagnetic wave do **not** accept goes through the body	1
	raises temperature of (body) cells / tissue / water	accept reference to water molecules vibrating faster accept it could cause mutation / harm / kill cells do **not** accept answers in terms of ionisation ignore references to cancer	1
(ii)	any **two** from: • research (may be) biased **or** may have been misled in the past • some research suggests a link • long-term effect not proven / studied • residents may not have seen the research	accept not independent **or** may be lying accept not studied for long enough	2
total			8

4.5.6.1.2 Speed

PHY1H Question 6

	answers	extra information	mark
(a)	four calculations correctly shown	200 × 10 – 1800 = £200 100 × 10 – 2400 = –£1400 50 × 10 – 600 = –£100 20 × 10 – 75 = 125 accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly shown **or** showing each saving × 10 of all four calculations = **1** mark answers in terms of savings as a percentage of installation cost **may** score savings mark only	2
	hot water boiler	correct answers only	1
(b)	less electricity / energy to be generated / needed from power stations	accept less demand	1
	reduction in (fossil) fuels being burnt	accept correctly named fuel accept answer in terms of: fewer light bulbs required because they last longer (1 mark) less energy used / fuels burnt in production / transport etc. (1 mark) ignore reference to CO_2 or global warming ignore reference to conservation of energy	1
total			5

4.5.6.1.2 Speed

Answer 33 · Mark scheme

November 2007 | PHY1A | Original Q7 | Legacy

Seven	**4**	**4**	**1**	**1**

4.5.6.1.2 Speed

Answer 34 · Mark scheme

Question 5

question	answers	extra information	mark
(a) E	C or 0.18 mm		1
(b) E	0.6 m	allow **1** mark for correct transformation and substitution allow **1** mark for changing frequency to Hz answer 600 gains **1** mark	2
(c) E	creates an alternating current with the same frequency as the radio wave **or** it gets hotter	accept 'ac' for alternating current accept alternating voltage accept signal for radio wave	1 1
(d) E	X-rays cannot penetrate the atmosphere **or** X-rays are absorbed *(*by the atmosphere*)*	accept atmosphere stops X-rays do **not** accept atmosphere in the way before reaching Earth ignore explanations	1
total			6

4.5.6.1.2 Speed

Answer 34 · Mark scheme

January 2008 | PHY1H | Original Q5 | Legacy

PHY1H

4.5.6.1.2 Speed

Answer 35 · Mark scheme

Question 3

question	answers	extra information	mark
(a)(i)	24(V)		1
(ii)	current always flows in the same direction **or** current only flows one way		1
(b)(i)	more power / force needed work done to lift the scooter uphill **or** work done against gravity	accept energy transformed faster accept it moves against gravity accept energy is transformed to gravitational potential energy	1 1
(ii)	reduces it		1
(c)	375	**1** mark for correct substitution **1** mark for an answer = 250 **1** mark for an answer = 125	2
(d)	86400 coulomb	**1** mark for correct substitution **1** mark for an answer = 43200 answer 24 gains **1** mark answer 24 Ah gains **2** marks answer 12 Ah gains **1** mark only accept C	2 1
total			10

4.5.6.1.2 Speed

Answer 35 · Mark scheme

January 2008 | PHY2H | Original Q3 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 36 · Mark scheme

Question 6

question	answers	extra information	mark
(a)(i)	velocity includes direction	accept velocity is a vector	1
(ii)	64	allow **1** mark for obtaining values of 16 and 4 from the graph **or** marking correct area or correct attempt to calculate an area	2
(iii)	any **two** from: • velocity zero from 0 to 4 seconds • increasing in 0.2 s (or very rapidly) to 8 m/s • decreasing to zero over the next 8 seconds		2
(iv)	momentum before does not equal momentum after **or** total momentum changes **or** an external force was applied	ignore reference to energy	1
(b)	to reduce the momentum of the driver a smaller (constant) force would be needed	 do **not** accept reduces the impact / impulse on the driver	1 1
total			8

4.5.6.1.2 Speed

Answer 37 · Mark scheme

Question 7

question	answers	extra information	mark
(a)	(magnetic) field / lines of force / flux rotate(s) / move(s) / through / in / cut(s) the coil	do **not** credit the idea that movement 'creates' the magnetic field	1
	potential difference / p.d. / voltage induced across the coil	do **not** credit just 'current induced'	1
(b)	any **one** from: • more powerful / stronger / lighter magnet • larger / more / bigger / lighter cups / with a bigger surface area • longer arms • lubricate the spindle • add more turns to the coil / nail	do **not** credit 'a bigger magnet'	1
total			3

4.5.6.1.2 Speed

Answer 37 · Mark scheme January 2008 | PHY3H | Original Q7 | Legacy

PHY3H

Answer 38 · Mark scheme March 2008 | PHY1AP | Original Q4 | Legacy

Four	**A**	coal	**2**
	B	natural gas	**4**
	C	oil	**1**
	D	renewable sources	**3**

Answer 39 · Mark scheme March 2008 | PHY1BP | Original Q1 | Legacy

Question	***Key***		
One	**A**	2	**3**
	B	3	**2**
	C	4	**1**
	D	6	**4**

Answer 40 · Mark scheme March 2008 | PHY1BP | Original Q6 | Legacy

Six	**3**	**2**	**4**	**2**

Answer 41 · Mark scheme June 2008 | PHY1BP | Original Q7 | Legacy

Seven	**2**	**2**	**3**	**3**

4.5.6.1.2 Speed

Answer 42 · Mark scheme

June 2008 | PHY1BP | Original Q9 | Legacy

Nine	**4**	**1**	**2**	**4**

4.5.6.1.2 Speed

Answer 43 · Mark scheme

June 2008 | PHY2H | Original Q3 | Legacy

Question 3

	answers	extra information	mark
(a)(i)	as one goes up so does the other **or** (directly) proportional	 accept change by the same ratio	1
(ii)	steeper straight line through the origin	judge by eye	1
(iii)	Yes with reason eg data would have been checked / repeated **or** No with reason eg does not apply to all conditions / cars / drivers **or** are only average values **or** Maybe with a suitable reason eg cannot tell due to insufficient information	 accept produced by a reliable/ official/ government source do **not** accept it needs to be reliable	1
(b)(i)	stopping distance = thinking distance + braking distance		1

4.5.6.1.2 Speed

Answer 43 · Mark scheme June 2008 | PHY2H | Original Q3 | Legacy

(ii)	any **two** from: • smooth road / loose surface • rain / snow / ice • badly maintained brakes • worn tyres • downhill slope/gradient • heavily loaded car	factors must be to do with increasing braking distance accept wet road/ petrol spills do **not** accept condition of road unless suitably qualified accept worn brakes accept bad/ worn/ rusty brakes do **not** accept old brakes accept bald tyres accept lack of grip on tyres do **not** accept old tyres	2
total			6

4.5.6.1.2 Speed

Answer 43 · Mark scheme June 2008 | PHY2H | Original Q3 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 44 · Mark scheme June 2008 | PHY2H | Original Q5 | Legacy

Question 5

	answers	extra information	mark
(a)	4	allow **1** mark for extracting correct information 12	2
	m/s^2	ignore negative sign	1
(b)	9 (s)		1
total			4

4.5.6.1.2 Speed

Answer 44 · Mark scheme June 2008 | PHY2H | Original Q5 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 45 · Mark scheme

Question 8

question	answers	extra information	mark
(a)	any **two** ideas: • (acceleration occurs when) the direction (of each capsule) changes • velocity has direction • acceleration is (rate of) change of velocity		2
(b)	to(wards) the centre (of the wheel)		1
(c)	centripetal	allow minor misspellings but do **not** credit a response which could be 'centrifugal'	1
(d)	the greater the radius / diameter / circumference (of the wheel) the smaller the (resultant) force (required)	accept 'the size' both parts required for the mark accept converse	1
total			5

4.5.6.1.2 Speed

Answer 46 · Mark scheme

November 2008 | PHY1BP | Original Q5 | Legacy

Five	**3**	**2**	**1**	**2**

Answer 47 · Mark scheme

November 2008 | PHY1BP | Original Q9 | Legacy

Nine	**3**	**4**	**2**	**3**

4.5.6.1.2 Speed

Answer 48 · Mark scheme January 2009 | PHY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	Mark
3(a)	1/25 **or** 1:25 **or** 0.04	accept 4 % **or** $\frac{15}{375}$ **or** $\frac{3}{75}$ **or** 1 in *25* for both marks allow **1** mark for total of 375 allow **1** mark for a clearly correct method using a clearly incorrect total do **not** accept 1:26	2
3(b)(i)	**B** (only) burning fossil fuels produces carbon dioxide / carbon (emissions) **or** nuclear fuels don't produce carbon dioxide	do **not** credit reason if **B** is not chosen insufficient – smallest amount of fossil fuels accept less carbon dioxide	1 1
3(b)(ii)	accept anything reasonable eg increased level of insulation use energy efficient light bulbs do not leave appliances on standby switch thermostats down (1 ^{o}C) generate own electricity install solar panels	accept insulate accept specific examples eg loft	1

Question 3 continues on the next page

PHY1H

Question 3 continued

question	answers	extra information	Mark
3(c)(i)	any **three** from: • no power output until wind speed exceeds 4 m/s • output rises rapidly after 4 m/s • output begins to level out / rises less rapidly at / after 13 m/s • output peaks at 21 / 22 m/s • output constant between 21 / 22 and 25 / 26 m/s • output falls (rapidly) after 25 / 26 m/s	accept for **1** mark goes up then comes down	3
3(c)(ii)	any **one** from: • unreliable energy source • dilute energy source • take up too much land	accept wind does not always blow accept need thousands / lots of turbines ignore reference to visual / noise pollution ignore reference to kill birds	1
Total			**9**

4.5.6.1.2 Speed

Answer 48 · Mark scheme

PHY1H

4.5.6.1.2 Speed

Answer 49 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)(i)	radio(waves)		1
5(a)(ii)	energy	correct answer only	1
5(b)(i)	0.0125 (m)	allow **1** mark for correct transformation and substitution	2
5(b)(ii)	make it hot(ter)	do **not** accept cook it accept (air) particles inside ball will move faster accept water in the ball gets hotter	1
5(b)(iii)	wavelength decreases frequency increases	ignore reference to speed	1 1
5(c)(i)	both variables are continuous	accept the data is continuous	1

Question 5 continues on the next page

4.5.6.1.2 Speed

PHY1H

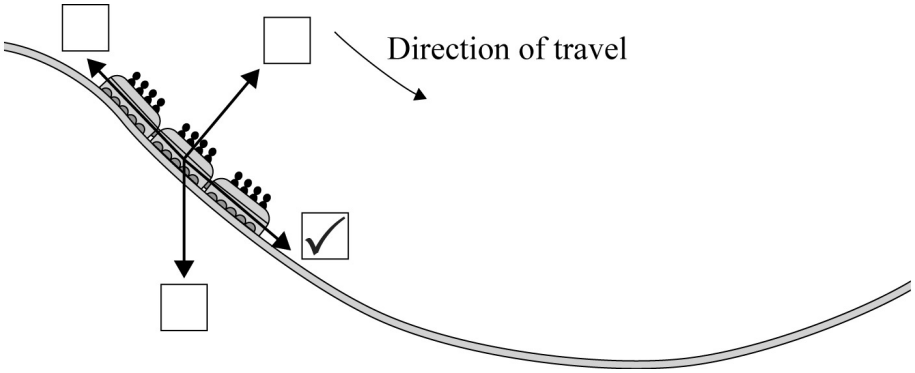
Question 5 continued

question	answers	extra information	Mark
5(c)(ii)	digital data can be (easily) processed by a computer **or** digital analogue data cannot (easily) be processed by a computer	both parts needed do **not** accept answers in terms of interference / quality / clearer signals	1
5(c)(iii)	digital a signal that has only two states / discrete values analogue a signal that varies continuously	accept can only be on or off accept made up of 1 and 0 only allow both marks for two correct diagrams correctly labelled digital and analogue allow **1** mark for two correct diagrams but not labelled	1 1
Total			**11**

4.5.6.1.2 Speed

Answer 50 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	correct box ticked 		1
1(b)	each passenger has a different mass	accept weight for mass ignore other irrelevant factors about the person e.g. mass and height do **not** accept a list with incorrect factors e.g. mass and position accept passengers started with different (gravitational) potential energy	1
1(c)(i)	30	ignore added units	1
1(c)(ii)	2400	accept their (c)(i) × 80 correctly calculated for both marks allow **1** mark for correct substitution of their (c)(i) and 80 an answer of 800 gains **1** mark only if answer to (c)(i) is not 10	2
Total			**5**

4.5.6.1.2 Speed

Answer 50 · Mark scheme

PHY2H

4.5.6.1.2 Speed

Answer 51 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	4.5	allow **1** mark for correct substitution i.e. 9 ÷ 2	2
2(a)(ii)	m/s^2	accept answer given in (a)(i) if not contradicted here	1
2(a)(iii)	speed		1
2(a)(iv)	straight line from the origin passing through (2s, 9 m/s)	allow **1** mark for straight line from the origin passing through to t = 2 seconds allow **1** mark for an attempt to draw a straight line from the origin passing through (2,9) allow **1** mark for a minimum of 3 points plotted with no line provided if joined up would give correct answer. Points must include(0,0) and (2,9)	2
2(b)(i)	**B** smallest (impact) force on all/ every/ any surfaces	if **A** or **C** given scores **0** marks in total these marks are awarded for comparative answers	1 1 1

Question 2 continues on the next page

4.5.6.1.2 Speed

PHY2H

Question 2 continued

2(b)(ii)	(conditions) can be repeated **or** difficult to measure forces with human athletes	accept answers in terms of variations in human athletes e.g. athletes may have different weights area / size of feet may be different difficult to measure forces athletes run at different speeds accept any answer that states or implies that with humans the conditions needed to repeat tests may not be constant e.g. athletes unable to maintain constant speed during tests (or during repeat tests) do **not** accept the robots are more accurate human error is insufficient fair test is insufficient	1
Total			**10**

4.5.6.1.2 Speed

Answer 51 · Mark scheme

PHY2H

4.5.6.1.2 Speed

Answer 52 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)(i)	Uranus is twice the distance from the Sun as Saturn (1) (but) 6.8 is not half of 9.6 (1)	**or** 'Saturn is half the distance from the Sun as Uranus' **or** '(but) 9.6 is not twice 6.8' **or** 'the products are not the same'	2
5(a)(ii)	the greater the (average) distance from the Sun the less the (average orbital) speed (of the planet) (2)	**or** the converse **or** should have concluded that distance is inversely proportional to the square of the orbital speed allow a correct but non comparative statement e.g. 'a far away planet moves slowly', for (1)	2
5(b)	<u>average</u> distance/speed given (1) (because) the distance/speed is not constant/will vary (slightly)(because the orbit is an ellipse not a circle) (1)		2
Total			**6**

4.5.6.1.2 Speed

Answer 52 · Mark scheme January 2009 | PHY3H | Original Q5 | Legacy

PHY3H

Answer 53 · Mark scheme March 2009 | PHY1BP | Original Q7 | Legacy

Seven	**1**	**2**	**4**	**1**

Answer 54 · Mark scheme June 2009 | PHY1BP | Original Q6 | Legacy

Six	**3**	**4**	**2**	**2**

4.5.6.1.2 Speed

Answer 55 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	gravity	accept weight do **not** accept mass accept gravitational pull	1
3(b)(i)	Initially force L greater than force M	accept there is a resultant force downwards	1
	(as speed increases) force M increases	accept the resultant force decreases	1
	when M = L, (speed is constant)	accept resultant force is 0 accept gravity/weighty for L accept drag/ upthrust/ resistance/friction for M do **not** accept air resistance for M but penalise only once	1
3(b)(ii)	terminal <u>velocity</u>		1
3(b)(iii)	0.15	accept an answer between 0.14 – 0.16 an answer of 0.1 gains no credit allow **1** mark for showing correct use of the graph	2
Total			**7**

4.5.6.1.2 Speed

Answer 55 · Mark scheme June 2009 | PHY2H | Original Q3 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 56 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	210	allow **1** mark for correct substitution i.e. 35 × 6	2
	kg m/s **or** Ns	do **not** accept n for N accept 210 000g m/s for **3** marks	1
4(a)(ii)	840	if answer given is not 840 accept their (a)(i) in kg m/s ÷ 0.25 correctly calculated for both marks allow **1** mark for correct substitution i.e. 210 ÷ 0.25 or their (a)(i) ÷ 0.25	2
4(b)	increases the time to stop	accept increases impact time do **not** accept any references to slowing down time	1
	decreases rate of change in momentum	accept reduces acceleration/ deceleration reduces momentum is insufficient	1
	reduces the force (on the child)		1
4(c)	any **two** from: • insufficient range of tests/ thicknesses for required cfh	accept need data for thicknesses above 80 mm/ cfh 2.7m not enough tests is insufficient	2
	• (seems to be) some anomalous data		
	• *(*repeats) needed to improve reliability (of data)	accept data/ results are unreliable do **not** accept maybe systematic/ random error do **not** accept reference to precision	
	• need to test greater range/variety of dummies	accept children for dummies accept specific factor such as weight/height/size	

Question 4 continues on the next page . . .

4.5.6.1.2 Speed

PHY2H

Question 4 continued . . .

question	answers	extra information	mark
4(d)	Tyres do not need to be dumped/ burned/ less land-fill/ saves on raw materials	accept less waste do **not** accept recycling on its own	1
Total			**11**

4.5.6.1.2 Speed

Answer 56 · Mark scheme June 2009 | PHY2H | Original Q4 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 57 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	47250	answers of 1350/ 33750/ 48600 gain **1** mark allow **1** mark for correct substitution using both 18 and 3	2
5(b)(i)	47250 or their (a)	accept statement 'same as the KE (lost)' ignore any units	1
5(b)(ii)	transformed into heat/ thermal energy	sound on its own is insufficient accept transferred/ lost/ for transformed do **not** accept any other form of energy included as a list	1
Total			**4**

4.5.6.1.2 Speed

Answer 57 · Mark scheme June 2009 | PHY2H | Original Q5 | Legacy

PHY2H

Answer 58 · Mark scheme November 2009 | PHY1BP | Original Q7 | Legacy

Seven	**4**	**1**	**3**	**3**

4.5.6.1.2 Speed

Answer 59 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)(i)	microwaves		1
3(a)(ii)	can pass through the ionosphere	accept travels in a straight line accept atmosphere for ionosphere do **not** accept air for ionosphere	1
3(b)	any **two** from: • analogue is continuously varying • digital has only discrete values • digital is less prone to interference (than analogue) • digital can be processed more easily (than analogue) by a computer	 do **not** accept analogue has many values accept digital is on or off accept digital is 1 or 0 accept digital is binary accept digital is easier to restore	2
3(c)	higher the frequency, further the wave travels (into the atmosphere before reflection)		1
3(d)	15 000	allow **1** mark for correct transformation and substitution ie $\frac{300\,000\,000}{20}$ an answer of 15 000 000 only gains **1** mark allow both marks for an answer of 15 MHz (unit must be changed) an answer of 15 gains no credit	2
Total			**7**

4.5.6.1.2 Speed

Answer 59 · Mark scheme

January 2010 | PHY1H | Original Q3 | Legacy

PHY1H

4.5.6.1.2 Speed

Answer 60 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	96	allow **1** mark for correct substitution ie 80 × 1.2	2
	newton or N	allow Newton do **not** allow n	1
1(b)(i)	direction		1
1(b)(ii)	velocity and time are continuous (variables)	answers must refer to both variables accept the variables are continuous / not categoric accept the data / 'it' is continuous accept the data / 'it' is not categoric	1
1(b)(iii)	**C**		1
	velocity is not changing	the **2** marks for reason may be scored even if **A** or **B** are chosen accept speed for velocity accept speed is constant (9 m/s) accept **not** decelerating accept **not** accelerating accept reached terminal velocity	1
	forces must be balanced **or** resultant force is zero	accept forces are equal accept arrows are the same length / size do **not** accept the arrows are equal	1
Total			**8**

4.5.6.1.2 Speed

Answer 60 · Mark scheme

January 2010 | PHY2H | Original Q1 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 61 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	distance (from the Sun in millions of km) and time taken for orbit	both required in either order **not** just 'time taken'	1
1(b)(i)	**either** distance (from the Sun in millions of km) **or** time taken for orbit (and) (average) temperature	 **not** just 'time taken' both required in either order	1
1(b)(ii)	(+) 430 / (+) 470 **or** Mercury / Venus		1
1(c)	25 (hours)	do **not** accept 24 (hours)	1
1(d)	...different positions at different times		1
1(e)	…direction…speed gravitational	both and in the correct order	1 1
Total			**7**

4.5.6.1.2 Speed

Answer 61 · Mark scheme January 2010 | PHY3H | Original Q1 | Legacy

PHY3H

Answer 62 · Mark scheme March 2010 | PHY1BP | Original Q4 | Legacy

Four	**2**	**4**	**2**	**1**

Answer 63 · Mark scheme June 2010 | PHY1AP | Original Q7 | Legacy

Seven	4	3	4	4

Answer 64 · Mark scheme June 2010 | PHY1BP | Original Q3 | Legacy

Three	3	3	4	2

Answer 65 · Mark scheme June 2010 | PHY1BP | Original Q6 | Legacy

Six	2	2	2	2

Answer 66 · Mark scheme June 2010 | PHY1BP | Original Q8 | Legacy

Eight	2	4	3	4

4.5.6.1.2 Speed

Answer 67 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	any **two** from: • travel at the same speed (through a vacuum) • can travel through a vacuum / space • transfer energy • can be reflected • can be refracted • can be diffracted • can be absorbed • can be transmitted • transverse	 accept travel at the speed of light accept air for vacuum do **not** accept air for vacuum accept any other property common to electromagnetic waves accept travel at the same speed through a vacuum for both marks do **not** accept both radiated from the Sun	2
4(a)(ii)	infra red radio(waves)	**both** required for the mark accept IR for infra red	1

Question 4 continues on the next page . . .

4.5.6.1.2 Speed

PHY1H

Question 4 continued . . .

question	answers	extra information	mark
4(b)	2400000000	correct transformation and substitution gains **1** mark ie $\frac{300000000}{0.125}$ **or** $\frac{300000000}{12.5}$ an answer of 24000000 gains **1** mark **either** 2400000 kHz **or** 2400 MHz scores **3** marks but the symbol only scores the 3rd mark if it is correct in every detail	2
	hertz	accept Hz do **not** accept hz	1
4(c)(i)	presented (scientific) evidence / data	do an experiment / investigation is insufficient	1
4(c)(ii)	to find out if there is a hazard (or not)	accept to find out if it is safe accept not enough evidence to make a decision not enough evidence is insufficient	1
Total			**8**

4.5.6.1.2 Speed

Answer 67 · Mark scheme June 2010 | PHY1H | Original Q4 | Legacy

PHY1H

4.5.6.1.2 Speed

Answer 68 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	wavelength (of light appears to) increase	accept frequency (appears to) decrease accept light moves to the red end of the spectrum do **not** accept it moves to the red end of the spectrum do **not** accept light becomes redder	1
6(b)(i)	**M** is closer (to the Earth) than **N** **M** is moving (away from the Earth) slower than **N**		1 1
6(b)(ii)	520	an answer between 510 and 530 inclusive gains **1** mark	2
6(b)(iii)	more recent data more reliable **or** improved equipment / techniques **or** data obtained from more (distant) galaxies	no mark for this but must be given to gain reason mark accept data is more accurate more technology is insufficient accept a wider range of data accept data closer to the line of best fit **or** data less scattered accept no anomalous result(s) accept all data fits the pattern	 1
6(c)	wavelength is decreased frequency is increased		1 1
Total			**8**

4.5.6.1.2 Speed

Answer 69 · Mark scheme

June 2019 | PHY2H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	75 000 newtons / N	accept correct substitution for **1** mark ie 7500 × 10 do **not** accept n full credit for using g = 9.8 **or** 9.81	2 1
1(a)(ii)	60 000 000	accept for both marks their (a)(i) × 800 correctly calculated accept correct substitution for **1** mark ie their (a)(i) × 800	2
1(b)(i)	arrow drawn parallel (to) **and** down (the) slope	accept arrow drawn anywhere on the diagram	1
1(b)(ii)	increases GPE transformed to KE **or** speed increasing	 accept is accelerating however 'speed increasing' only scores if correctly linked to increasing kinetic energy	1 1
1(c)	so more likely to wear one **or** they know wearing a helmet is likely to / will reduce (risk) head injury **or** so can make an (informed) choice (about wearing one)		1
Total			**9**

4.5.6.1.2 Speed

Answer 69 · Mark scheme June 2010 | PHY2H | Original Q1 | Legacy

PHY2H

Answer 70 · Mark scheme November 2010 | PHY1AP | Original Q3 | Legacy

Three	**4**	**1**	**3**	**4**

Answer 71 · Mark scheme November 2010 | PHY1AP | Original Q4 | Legacy

Four	**2**	**3**	**3**	**4**

Answer 72 · Mark scheme November 2010 | PHY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	decreased	**3**
	B	increased	**2**
	C	shifted	**1**
	D	not changed	**4**

Answer 73 · Mark scheme November 2010 | PHY1BP | Original Q5 | Legacy

Five	**3**	**3**	**1**	**4**

4.5.6.1.2 Speed

Answer 74 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	120		1
1(a)(ii)	20	accept 140-their (a)(i) provided answer is not negative	1
1(a)(iii)	as speed increases drag force / water resistance / friction / **D** increases (until) **D** = 140 N or (until) **D** = **T**	 forces balance is insufficient	1 1 1
1(b)(i)	(average) speed (of swimmer)		1
1(b)(ii)	any **two** from: • more data • force may vary (a lot) / change • give more <u>reliable average</u>	 accept results for data do **not** accept more accurate data ignore references to anomalies ignore accurate / precise	2

Question 1 continues on the next page . . .

4.5.6.1.2 Speed

PHY2H

Question 1 continued . . .

question	answers	extra information	mark
1(b)(iii)	examples of acceptable responses: • most / some females produce smaller forces • most / some males produce larger forces • some females swim as fast as males but use a smaller force • most of the faster swimmers are male • most of the slower swimmers are female • range of the (average) speed of males is smaller than the range of the (average) speed of females • range of the (average) force of the males is greater than the range of the (average) force of the females	do **not** accept <u>all</u> females produce smaller forces do **not** accept <u>all</u> males produce larger forces do **not** accept <u>all</u> males swim faster do **not** accept <u>all</u> females swim slower	1
1(b)(iv)	exert maximum (hand) force (throughout the swim / stroke)	accept (any method to) increase (hand) force practise more is insufficient	1
Total			**10**

4.5.6.1.2 Speed

Answer 74 · Mark scheme

January 2011 | PHY2H | Original Q1 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 75 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	1 080 000	allow **1** mark for correct substitution ie ½ × 15 000 × 12 × 12	2
4(b)	any **one** from: • KE (of wind) more than doubles • mass of air (hitting blades) more than doubles • area swept out by blades more than doubles • area swept out by blades increases × 4	do **not** accept blades are larger / have a bigger area	1
Total			**3**

4.5.6.1.2 Speed

Answer 75 · Mark scheme January 2011 | PHY2H | Original Q4 | Legacy

PHY2H

Answer 76 · Mark scheme March 2011 | PHY1AP | Original Q5 | Legacy

Five	**A**	economical	**2**
	B	efficient	**1**
	C	environmental	**3**
	D	ethical	**4**

	A	**B**	**C**	**D**

Answer 77 · Mark scheme March 2011 | PHY1BP | Original Q3 | Legacy

Three	**A**	bacteria	**3**
	B	cells	**2**
	C	isotopes	**1**
	D	particles	**4**

Answer 78 · Mark scheme March 2011 | PHY1BP | Original Q5 | Legacy

Five	**A**	a belief that science cannot disprove	**1**
	B	a conclusion based on observations of red-shift	**3**
	C	a theory supported by scientific evidence but not direct observations	**4**
	D	a theory that science has disproved	**2**

	A	**B**	**C**	**D**

Answer 79 · Mark scheme June 2011 | PHY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	frequency	**2**
	B	red-shift	**4**
	C	wavelength	**1**
	D	wave speed	**3**

Answer 80 · Mark scheme June 2011 | PHY1BP | Original Q5 | Legacy

Five	**1**	**4**	**2**	**3**

4.5.6.1.2 Speed

Answer 81 · Mark scheme

June 2011 | PHY1BP | Original Q9 | Legacy

Nine	**4**	**3**	**3**	**1**

The AQA UMS Conversion Calculator can be found at the following web address:

http://www.aqa.org.uk/umsconversion

4.5.6.1.2 Speed

Answer 82 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)(i)	microwave(s)		1
3(a)(ii)	has discrete values only **or** has only 2 states	accept can only be on or off accept made up of 1 and 0 only accept has high and low (values only) accept a diagram with discrete levels do **not** accept can be switched on and off	1
3(a)(iii)	any **one** from: • less (prone to) interference • can be (easily) processed by computers • better quality (signal) • digital signals can be restored • information / data can be compressed	it refers to signal accept no interference accept interference causes less / no permanent damage accept noise / distortion for interference accept can be processed without an analogue to digital converter better on its own is insufficient accept can send more information in same time do **not** accept faster	1

Question 3 continues on the next page

4.5.6.1.2 Speed

PHY1H

Question 3 continued

question	answers	extra information	mark
3(b)	2 000 000 000	allow **1** mark for correct transformation and substitution ie $\frac{300\,000\,000}{0.15}$ or $\frac{300\,000\,000}{15}$	2
	hertz	accept Hz do **not** accept hz accept kHz / MHz / GHz **but** for full credit the answer and unit must be consistent eg answers 2 GHz; 2000 MHz; 2 000 000 kHz gain **3** marks	1
3(c)(i)	infra red (radiation)	accept IR ignore reference to light	1
3(c)(ii)	travel a shorter distance	do **not** accept faster	1
Total			**8**

4.5.6.1.2 Speed

Answer 82 · Mark scheme June 2011 | PHY1H | Original Q3 | Legacy

PHY1H

4.5.6.1.2 Speed

Answer 83 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)	572	allow **1** mark for correct substitution, ie 220 × 2.6 allow **1** mark for 220 x 260 = 57 200 **or** 220 x 2600 = 572 000 but to score this mark the entire calculation must be shown	2
2(b)(i)	smooth curve drawn	accept a line that is extrapolated back to 0 degrees, but not through the origin accept a straight line of best fit (point at 40 degrees can be treated as anomalous and line may stop at 30 degrees) do **not** accept straight lines drawn 'dot to dot' or directly from first to last point or a line going through the origin	1
2(b)(ii)	increases	accept a positive correlation do **not** accept proportional	1

Question 2 continues on the next page

4.5.6.1.2 Speed

PHY2H

Question 2 continued

question	answers	extra information	mark
2(b)(iii)	long plank	no mark for this, the marks are for the explanation	
	makes the angle small(er) (than a short plank)	accept increases the distance accept small(er) slope	1
	a small(er) force is needed		1
	or		
	short plank	no mark for this, the marks are for the explanation	
	a large(r) force is used over a short(er) distance (1)		
	less work done (1)	accept less energy transfer	
Total			**6**

4.5.6.1.2 Speed

Answer 83 · Mark scheme June 2011 | PHY2H | Original Q2 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 84 · Mark scheme

June 2011 | PHY2H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	48	allow for **1** mark correct method shown, ie 6 × 8 **or** correct area indicated on the graph	2
5(b)	diagonal line from (0,0) to (6,48) / (6, their (a))	if answer to (a) is greater than 50, scale must be changed to gain this mark	1
	horizontal line at 48m between 6 and 10 seconds	accept horizontal line drawn at their (a) between 6 and 10 seconds	1
Total			**4**

4.5.6.1.2 Speed

Answer 84 · Mark scheme June 2011 | PHY2H | Original Q5 | Legacy

PHY2H

4.5.6.1.2 Speed

Answer 85 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	4.2	2 marks for correct substitution **and** transformation, ie 1155/275 allow **1** mark for correct resultant force with a subsequent incorrect method, ie 1155 allow **1** mark for an incorrect resultant force with a subsequent correct method, eg answers of 7.27 or 10.34 gain **1** mark	3
7(b)(i)	YES any **two** from: • data (from police files) can be trusted • data answers the question asked • large sample used NO any **two** from: • the sample is not representative • the sample size is too small • accident files do not indicate age / experience of riders	marks are for the explanation allow a conclusion can be made from the data an answer YES and NO can score **1** mark from each set of mark points	2

Question 7 continues on the next page

PHY2H

Question 7 continued

question	answers	extra information	mark
7(b)(ii)	more accidents with motorbikes up to 125 cc	accept for **2** marks an answer in terms of number of under 125 cc to accidents ratio compared correctly with number of over 500 cc to accidents ratio	1
	even though there are fewer of these bikes than bikes over 500 cc		1
7(c)(i)	increases the time taken to stop	accept increases collision time	1
	decreases rate of change in momentum	accept reduces acceleration / deceleration accept $F = \frac{\Delta mv}{\Delta t}$ reduces momentum is insufficient	1
	reduces the force (on the rider)		1
7(c)(ii)	YES any sensible reason, eg: • cannot put a price on life / injury • fewer (serious) injuries • reduces cost of health care / compensation NO any sensible suggestion, eg: • money better spent on … • total number of riders involved is small	the mark is for the reason accept may save lives accept reduces risk of injury needs to be specific	1
Total			**11**

4.5.6.1.2 Speed

Answer 86 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)	microphone		1
1(b)(i)	vertical line from any maxima or minima to axis	do **not** penalise minor errors but do **not** allow unless intention is clear	1
1(b)(ii)	loudness / volume / intensity / energy	do **not** accept noise	1
1(c)	17	this answer only	1
1(d)	the greater the distance, the smaller the amplitude **or** there is a (strong) negative correlation between distance and amplitude **or** there is an inverse square relationship between distance and amplitude	accept volume / intensity / energy / loudness for amplitude do **not** accept distance and amplitude are inversely proportional	1
1(e)	20 Hz 20,000 Hz	either order accept 20 kHz provided unit has been clearly changed	1 1
Total			**7**

4.5.6.1.2 Speed

Answer 86 · Mark scheme

June 2011 | PHY3H | Original Q1 | Legacy

PHY3H

4.5.6.1.2 Speed

Answer 87 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	turning effect	accept turning force accept force x distance (accept symbols only if correctly defined) do **not** accept newtons x metres	1
2(a)(ii)	stop apparatus falling over	accept holds the stand in place accept make it safer / stable references to balanced / equilibrium are insufficient	1
2(a)(iii)	as x increases y increases in same proportion / ratios	 allow both marks for they are directly proportional **or** a specific example eg doubling y, doubles x allow both marks for a correct answer giving figures eg they increase in the ratio of 1 to 7 allow for **1** mark positive correlation	1 1
2(a)(iv)	the centre of mass of the ruler is at the axis of rotation		1
2(b)	108 newton metres / Nm	allow **1** mark for correct substitution ie 240 x 0.45 symbols must be correct for full credit the unit must be consistent with the numerical answer	2 1
Total			8

4.5.6.1.2 Speed

Answer 87 · Mark scheme June 2011 | PHY3H | Original Q2 | Legacy

PHY3H

4.5.6.1.2 Speed

Answer 88 · Mark scheme

June 2011 | PHY3H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	(Jupiter's) gravitational pull	accept (Jupiter's) gravity	1
3(b)	extrapolation which takes account of the line of best fit passing through the origin (+ / - 1 square) a correct reading taken from the candidate's line (+ / - ½ square)	accept a straight line or curve do **not** accept a line dot to dot if no line drawn allow for **1** mark a value between 8 – 12 inclusive	1 1
3(c)	as the distance increases the time increases **or** as the distance decreases the time decreases **or** there is a positive correlation		1
3(d)	any **one** from: • computers able to process data • telescopes in space / on satellites / above the Earth / atmosphere • instruments other than optical telescopes (available)	accept better / advanced technology reference to satellites alone insufficient accept any valid reason do **not** accept just better telescopes	1
Total			**5**

4.5.6.1.2 Speed

Answer 88 · Mark scheme June 2011 | PHY3H | Original Q3 | Legacy

PHY3H

Answer 89 · Mark scheme November 2011 | PHY1AP | Original Q8 | Legacy

Eight	3	4	4	2

Answer 90 · Mark scheme November 2011 | PHY1BP | Original Q8 | Legacy

Eight	3	2	2	2

4.5.6.1.2 Speed

Answer 91 · Mark scheme

June 2012 | PH1HP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	any **two** from: • travel (at same speed) through a vacuum / space • transverse • transfer energy • can be reflected • can be refracted • can be diffracted • can be absorbed • travel in straight lines	do **not** accept air for vacuum	2
5(b)	can pass through the ionosphere	accept atmosphere for ionosphere do **not** accept air for ionosphere accept travel in straight lines accept not refracted / reflected / absorbed by the ionosphere	1
5(c)	diffraction (of waves around hills) wavelength needs to be similar size to the obstacle / gap radio has a long enough wavelength **or** TV doesn't have a long enough wavelength	an answer TV (waves / signals) have short wavelengths so do not diffract (around the hill) scores **2** marks	1 1 1

Question 5 continues on the next page

4.5.6.1.2 Speed

Answer 91 · Mark scheme

PH1HP

Question 5 continued

question	answers	extra information	mark
5(d)		$v = f \times \lambda$	
	1.2×10^6 / 1200 000	allow **1** mark for correct substitution ie $3.0 \times 10^8 = f \times 2.5 \times 10^2$	2
	hertz / Hz	do **not** accept hz **or** HZ accept kHz **or** MHz answers 1.2 MHz **or** 1200 kHz gain all **3** marks for full credit the unit and numerical value must be consistent	1
Total			**9**

4.5.6.1.2 Speed

Answer 91 · Mark scheme

June 2012 | PH1HP | Original Q5 | Legacy

PH1HP

4.5.6.1.2 Speed

Answer 92 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	13 500 (J)	allow **1** mark for correct substitution, ie 90 x 10 x 15 provided no subsequent step shown	2
4(b)	17 **or** $\sqrt{\frac{their\ (a)}{45}}$ correctly calculated and answer given to 2 or 3 significant figures	accept 17.3 allow **2** marks for an answer with 4 or more significant figures, ie 17.32 **or** allow **2** marks for correct substitution, ie 13 500/ their (a) = ½ x 90 x v^2 **or** allow **1** mark for a statement or figures showing KE = GPE	3
4(c)	work is done (against) friction (between the miner and slide) (due to the) slide not (being perfectly) smooth **or** causing (kinetic) energy to be transferred as heat/internal energy of surroundings	 accept 'air resistance' **or** 'drag' for friction accept miners clothing is rough accept lost/transformed for transferred accept air for internal energy of surroundings	1 1 1
Total			8

4.5.6.1.2 Speed

Answer 92 · Mark scheme June 2012 | PH2HP | Original Q4 | Legacy

PH2HP

4.5.6.1.2 Speed

Answer 93 · Mark scheme

January 2013 | PH1HP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	gamma	accept correct symbol	1
5(a)(ii)	any **one** from: • (ultraviolet has a) higher frequency • (ultraviolet has a) greater energy • (ultraviolet has a) shorter wavelength	ultraviolet cannot be seen is insufficient ignore ultraviolet causes cancer etc	1
5(b)	1.2×10^7 / 12 000 000 hertz / Hz / kHz / MHz	allow **1** mark for correct substitution, ie $3 \times 10^8 = f \times 25$ do **not** accept hz **or** HZ answers 12 000 kHz **or** 12 MHz gain **3** marks for full credit the numerical answer and unit must be consistent	2 1
5(c)(i)	away (from each other)	accept away (from the Earth) accept receding	1
5(c)(ii)	distance (from the Earth) speed galaxy is moving	accept how far away (it is)	1 1
5(c)(iii)	(Universe is) expanding		1
Total			**9**

4.5.6.1.2 Speed

Answer 93 · Mark scheme

January 2013 | PH1HP | Original Q5 | Legacy

PH1HP

4.5.6.1.2 Speed

Answer 94 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	more streamlined air resistance is smaller (for same speed) so reaches a higher speed (before resultant force is 0)	accept decrease surface area accept drag for air resistance friction is insufficient ignore reference to mass	1 1 1
5(b)(i)	1.7	allow **1** mark for correct method, ie $\frac{5}{3}$ **or** allow **1** mark for an answer with more than 2 sig figs that rounds to 1.7 **or** allow **1** mark for an answer of 17	2
5(b)(ii)	7.5	allow **1** mark for correct use of graph, eg $\frac{1}{2} \times 5 \times 3$	2
5(b)(iii)	air (resistance)	accept wind (resistance) drag is insufficient friction is insufficient	1
Total			**8**

4.5.6.1.2 Speed

Answer 94 · Mark scheme

January 2013 | PH2HP | Original Q5 | Legacy

PH2HP

4.5.6.1.2 Speed

Answer 95 · Mark scheme

June 2013 | PH1HP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	10^{-15} metres to 10^{4} metres		1
7(b)(i)	any **one** from: • (TV / video / DVD) remote controls • (short range) data transmission • optical fibre (signals)	mobile phones is insufficient accept specific example, eg linking computer peripherals do **not** accept Bluetooth	1
7(b)(ii)	0.17	an answer 17 cm gains **3** marks an answer given to more than 2 significant figures that rounds to 0.17 gains **2** marks allow **1** mark for correct substitution, ie $3 \times 10^{8} = 1.8 \times 10^{9} \times \lambda$	3
7(c)	(maybe) other factors involved	accept a named 'sensible' factor, eg higher stress / sedentary lifestyle / overweight / smoking more / diet / hot office / age not testing enough people is insufficient unreliable data is insufficient	1
Total			**6**

4.5.6.1.2 Speed

Answer 95 · Mark scheme

June 2013 | PH1HP | Original Q7 | Legacy

PH1HP

4.5.6.1.2 Speed

Answer 96 · Mark scheme

June 2013 | PH2HP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	distance vehicle travels during driver's reaction time	accept distance vehicle travels while driver reacts	1
4(a)(ii)	any **two** from: • tiredness • (drinking) alcohol • (taking) drugs • speed • age	accept as an alternative factor distractions, eg using a mobile phone	2
4(b)(i)	320 000	allow **1** mark for correct substitution, ie $\frac{1}{2} \times 1600 \times 20^2$ provided no subsequent step shown	2
4(b)(ii)	320 000 **or** their (b)(i)		1
4(b)(iii)	40 **or** $\frac{\text{their (b)(ii)}}{8000}$ correctly calculated	allow **1** mark for statement work done = KE lost **or** allow **1** mark for correct substitution, ie 8000 × distance = 320 000 **or** their (b)(ii)	2
4(b)(iv)	any **one** from: • icy / wet roads • (worn) tyres • road surface • mass (of car and passengers) • (efficiency / condition of the) brakes	accept weather conditions accept number of passengers	1

Question 4 continues on the next page . . .

PH2HP

Question 4 continued . . .

question	answers	extra information	mark
4(b)(v)	(work done by) friction (between brakes and wheel)	do **not** accept friction between road and tyres / wheels	1
	(causes) decrease in KE and increase in thermal energy	accept heat for thermal energy accept KE transferred to thermal energy	1
4(c)	the battery needs recharging less often **or** increases the range of the car	accept car for battery accept less demand for other fuels **or** lower emissions **or** lower fuel costs environmentally friendly is insufficient	1
	as the efficiency of the car is increased	accept it is energy efficient	1
	the decrease in (kinetic) energy / work done charges the battery (up)	accept because not all work done / (kinetic) energy is wasted	1
Total			**14**

4.5.6.1.2 Speed

Answer 96 · Mark scheme

June 2013 | PH2HP | Original Q4 | Legacy

PH2HP

4.5.6.1.2 Speed

Answer 97 · Mark scheme

June 2013 | PH3HP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	centripetal (force)	allow tension (between astronaut and seatbelt)	1
	towards the centre (of the G-machine / circle)	do **not** accept towards the centre of the Earth allow inwards	1
5(b)(i)		answers must be comparative accept velocity for speed	
	the greater the speed (of a centrifuge), the greater the force	accept positive correlation between speed and force speed and force are not proportional – treat as neutral	1
	the smaller the radius, the greater the force (at a given speed)	allow **(G machine) 1** has / produces a greater force (than **G machine 2**) at the same speed must be comparative, eg a small radius produces a large force = 0 marks on own	1
	as the speed increases the rate of change in force increases	accept force is proportional to the square of the speed **or** doubling speed, quadruples the force accept any clearly correct conclusion	1
5(b)(ii)	12000 (N) **or** 12 k(N)		1

Question 5 continues on the next page . . .

PH3HP

Question 5 continued . . .

question	answers	extra information	mark
5(c)(i)	the current (in the coil) creates a magnetic field (around the coil) so the magnetic field of the coil interacts with the (permanent) magnetic field of the magnets (producing a force)	accept the coil is an electromagnet accept the two magnetic fields interact (producing a force) if no marks scored an answer in terms of current is perpendicular to the (permanent) magnetic field is worth max **1** mark	1 1
5(c)(ii)	vertically downwards arrow on side A **and** vertically upwards arrow on side C	one arrow insufficient	1
5(c)(iii)	the current is parallel to the magnetic field	allow the current and magnetic field are in the same direction allow it / the wire is parallel to the magnetic field	1
5(d)	increase the current / p.d. (of the coil)	accept decrease resistance accept voltage for p.d. accept increase strength of magnetic field / electromagnet	1

Question 5 continues on the next page . . .

4.5.6.1.2 Speed

PH3HP

Question 5 continued . . .

question	answers	extra information	mark
5(e)	yes with suitable reason **or** no with suitable reason	**eg** **yes** – it has increased our knowledge **yes** – It has led to more (rapid) developments / discoveries (in technology / materials / transport) accept specific examples **no** – the money would have been better spent elsewhere on such things as hospitals (must quote where, other things not enough) **no** mark for just **yes** / **no** reason must match **yes** / **no**	1
Total			**12**

4.5.6.1.2 Speed

Answer 97 · Mark scheme

June 2013 | PH3HP | Original Q5 | Legacy

PH3HP

4.5.6.1.2 Speed

Answer 98 · Mark scheme

June 2014 | PH1HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
3(a)	infrared / IR	correct answer only	1	AO1 1.1.1a
3(b)	any **two** from: • increase the power / watts • decrease the speed • put biscuits through again	 allow increase the temperature of the oven or make the oven hotter allow leave the biscuits in for longer increase radiation is insufficient ignore changes to the design of the oven	2	AO2 1.3.1c
3(c)	(inside) surface is a (good) reflector or poor absorber (of IR) (and) outside surface is poor emitter (of IR) (so) increases the energy reaching the biscuits	ignore bounce for reflect surface is a (good) reflector of light does not score surface is a (good) reflector of light and infrared / heat does score allow reduces energy loss or makes oven more efficient do **not** accept no energy losses keeps oven hotter is insufficient	1 1 1	AO1 1.1.1c, d
Total			**6**	

4.5.6.1.2 Speed

Answer 99 · Mark scheme

June 2014 | PH1HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
4(a)(i)	440 (sound) waves produced in one second	accept vibrations / oscillations for waves	1	AO1 1.5.1i
4(a)(ii)	0.773 (metres)	allow **2** marks for an answer that rounds to 0.773 allow **2** marks for an answer of 0.77̇2̇ allow **2** marks for an answer of 0.772 allow **1** mark for correct substitution ie 340 = 440 × λ	3	AO2 1.5.1j
4(b)	(sound is) louder as amplitude is larger higher pitch/frequency as more waves are seen	do **not** accept the converse waves are taller is insufficient reference to wavelengths alone is insufficient waves are closer together is insufficient	1 1 1 1	AO1 AO3 1.5.3b
Total			8	

4.5.6.1.2 Speed

Answer 100 · Mark scheme

June 2014 | PH3HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
1(a)	(sound waves) which have a frequency higher than the upper limit of hearing for humans **or** a (sound) wave (of frequency) above 20 000 Hz	sound waves that cannot be heard is insufficient a wave of frequency 20 000 Hz is insufficient	1	AO1 3.1.2a
1(b)	640	an answer of 1280 gains **2** marks allow **2** marks for the correct substitution ie 1600 × 0.40 provided no subsequent step allow **2** marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow **1** mark for the substitution 1600 × 0.80 provided no subsequent step allow **1** mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c
1(c)	any **one** from: • pre-natal scanning / imaging • imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles • Doppler scanning blood flow	accept heart do **not** allow brain **or** lungs (either of these negates a correct answer)	1	AO1 3.1.2d

Question 1 continues on the next page . . .

Question 1 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
1(d)	advantage any **one** from: • (images are) high quality or detailed or high resolution • (scan) produces a slice through the body • image can be viewed from any direction • an image can be made of <u>any</u> part (inside the body) • easier to diagnose **or** see a problem (on the image) disadvantage any **one** from: • (the X-rays used **or** scans) are ionising • mutate cells **or** cause mutations **or** increase chances of mutations • turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells • kill cells • metal/lead/glass/concrete shielding is needed	clearer / better image is sufficient allow images are (always) 3D / 360° allow whole body can be scanned allow a description of what ionising is allow for cells: DNA / genes / chromosomes / nucleus / tissue damage cells is insufficient can be dangerous (to human health) unqualified, is insufficient	1 1	AO1 3.1
Total			**7**	

4.5.6.1.2 Speed

Answer 101 · Mark scheme

Question	Answers	Extra information	Mark	AO spec ref
2(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
2(b)	any **two** from: • mass of satellite • speed / velocity (of satellite) • radius of orbit / circle	allow height above the Earth radius / height alone is insufficient	2	AO1 3.2.4c
2(c)(i)	increasing the height (above the Earth's surface) increases the time (for one orbit)	allow a positive correlation allow as one gets bigger, the other gets bigger, or vice versa ignore they are directly proportional	1	AO3 4.5.3
2(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
2(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			6	

4.5.6.1.2 Speed

Answer 101 · Mark scheme June 2014 | PH3HP | Original Q2 | Legacy

Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information	Mark	AO spec ref

Answer 102 · Mark scheme June 2015 | PH1HP | Original Q6 | Legacy

The full source mark scheme begins on page 340. Follow original question 6 in that document.

4.5.6.1.2 Speed

Answer 103 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
4(a)(i)	distance travelled under the braking force	accept distance travelled between applying the brakes and stopping	1	AO1 2.1.3c	E
4(a)(ii)	any **one** from: • icy/wet roads • (worn) tyres • road surface • mass (of car and passengers) • (efficiency/condition of the) brakes	accept weather (conditions) accept gradient of road accept number of passengers friction/traction is insufficient	1	AO1 2.1.3f	E
4(a)(iii)	greater the speed the greater the braking force (required)	must mention both speed and force	1	AO1 2.1.3b	E
4(b)	22.5	allow **1** mark for showing correct use of the graph with misread figures **or** for showing e.g. 90÷4 an answer 17 gains **1** mark any answer such as 17.4 or 17.5 scores 0	2	AO2 2.1.2b/c	E
4(c)(i)	momentum before = momentum after **or** (total) momentum stays the same	accept no momentum is lost accept no momentum is gained ignore statements referring to energy	1	AO1 2.2.2b	E

Question 4 continues on the next page . . .

4.5.6.1.2 Speed

Question 4 continued . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
4(c)(ii)	5	allow **2** marks for correctly obtaining momentum before as 12 000 **or** allow **2** marks for 1500 x 8 = 2400 x v **or** allow **1** mark for a relevant statement re conservation of momentum **or** allow **1** mark for momentum before = 1500 x 8	3	AO2 2.2.2a/b	**E**
4(d)	the seat belt stretches driver takes a longer *(impact)* time to slow down and stop (than a driver hitting a hard surface/windscreen/ steering wheel) for the (same) change of momentum a smaller force is exerted (so driver less likely to have serious injury than driver without seat belt) **or** the seat belt stretches ***(1)*** driver travels a greater distance while slowing down and stopping (than a driver hitting a hard surface/windscreen/ steering wheel) ***(1)*** for (same) amount of work done (**1**) a smaller force is exerted (so driver less likely to have serious injury than driver without seat belt) ***(1)***	 accept so smaller deceleration/negative acceleration do not accept impact for force accept for (same) change of KE do not accept impact for force	1 1 1 1	AO1/3 2.2	**E**

4.5.6.1.2 Speed

Answer 103 · Mark scheme

June 2015 | PH2HP | Original Q4 | Legacy

Total			**13**

4.5.6.1.2 Speed

Answer 104 · Mark scheme

June 2015 | PH2HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
6(a)(i)	decreases (to zero) resultant force acts in opposite direction to motion	 accept air resistance and weight for resultant force accept resultant force acts downwards do **not** accept air resistance increases	1 1	AO1 2.1.1c/e	E
6(a)(ii)	velocity includes direction **or** velocity is a vector (quantity)		1	AO1 2.1.2d	E
6(b)(i) mark with 6bii 6biii	3.6	allow **1** mark for correct substitution i.e. ½ x 0.05 x 12^2 provided no subsequent step	2	AO2 2.2.1g	E
6(b)(ii) mark with 6bi, 6biii	3.6 **or** their (b)(i)		1	AO1 2.2	E
6(b)(iii) mark with 6bi, 6bii	7.2 **or** their (b)(ii) ÷ 0.5 correctly calculated	allow **1** mark for correct substitution i.e. 3.6 or their (b)(ii) = 0.05 x 10 x h	2	AO2 2.2.1f	E
6(b)(iv)	**B**		1	AO3 2.1	A
6(c)	range increases up to 45° range decreases from 45°	 the range is a maximum at 45° gains both marks for any two angles that add up	1 1	AO3 2.1	E

4.5.6.1.2 Speed

Answer 104 · Mark scheme

		to 90° the range is the same gains both marks the range increases then decreases gains **1** mark			
Total			**11**		

4.5.6.1.2 Speed

Answer 105 · Mark scheme

June 2015 | PH3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)(i)	D		1	AO2 P3.2.4b
2(a)(ii)	friction		1	AO1 P3.2.4b
2(a)(iii)	any **two** from: • the speed / velocity • the radius of the bend • the mass (of the car)	 the radius is insufficient accept curvature of the road size of the bend is insufficient accept distance of car from centre (of bend) accept weight for mass	2	AO1 P3.2.4c
2(b)	the car has a wide base the car has a low centre of mass / gravity	accept any description of a wide base e.g. the wheels are far apart accept wide wheel base do **not** accept long wheel base a large surface area is insufficient wide tyre(s) is insufficient accept any description of low centre of mass e.g. mass is close to the ground a down force is insufficient	1 1	AO2 P3.2
Total			6	

4.5.6.1.2 Speed

Answer 105 · Mark scheme

June 2015 | PH3HP | Original Q2 | Legacy



Answer 106 · Mark scheme

June 2016 | PH1HP | Original Q1 | Legacy

The full source mark scheme begins on page 356. Follow original question 1 in that document.

4.5.6.1.2 Speed

Answer 107 · Mark scheme

June 2016 | PH2HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	starting / stopping the stopwatch **or** timing over the smaller distances	human error is insufficient reaction time is insufficient accept not timing accurately do not accept references to measuring distance incorrectly	1	AO3 2.1
1(b)(i)	before		1	AO3 2.1
1(b)(ii)	increasing	accept accelerating it is not constant is insufficient it is less than after four seconds is insufficient it reaches a constant speed negates	1	AO3 2.1.2b
1(b)(iii)	calculate the gradient of the straight/steepest/constant section	accept gradient of any section after 5.5 seconds/30 cm	1	AO1 2.1.2b
1(b)(iv)	drag (force) increases (as the ball bearing gets faster) (until) drag (force) = weight **or** (until) resultant force is zero	accept frictional/upward force for drag accept upward force = downward force accept till forces are balanced	1 1	AO1 2.1.4b

4.5.6.1.2 Speed

Answer 107 · Mark scheme

1(c)	less than ball bearing increases speed at a greater rate **or** ball bearing has a greater acceleration **or** terminal velocity has not been reached so resultant force must be greater **or** as weight is the same (the drag must be less)	 accept it travels the same distance in less time accept the ball bearing is going faster accept warmer oil has a lower density/viscosity for 1 mark if neither of the two reason marks score	1 1 1	AO3 2.1.4a/b
Total			**9**	

4.5.6.1.2 Speed

Answer 107 · Mark scheme

June 2016 | PH2HP | Original Q1 | Legacy



4.5.6.1.2 Speed

Answer 108 · Mark scheme

June 2016 | PH3HP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	ultrasound is not ionising but X-rays are ionising so X-rays increase the health risk to the (unborn) baby	allow ultrasound does not harm the (unborn) baby accept specific examples of health risks, eg cancer, stunted growth, impaired brain function etc X-rays are dangerous is insufficient	1 1 1	AO1 3.1
3(b)	ultrasound/waves are partially <u>reflected</u> (when they meet a boundary) (between two different media / substances / tissues) the time taken is measured (and is used to determine distances)	must be clear that not all of the wave is reflected 	1 1	AO1 3.1.2b
3(c)	1600 (m/s)	800 (m/s) gains **2** marks 160 000 (m/s) gains **2** marks 0.0016 (m/s) gains **2** marks allow **2** marks for $\frac{0.04}{25 \times 10^{-6}}$ or $\frac{0.08}{50 \times 10^{-6}}$ 80 000 (m/s) gains **1** mark 0.0008 (m/s) gains **1** mark allow **1** mark for $\frac{0.04}{25}$ or $\frac{0.08}{50}$ allow **1** mark for evidence of doubling the distance or halving the time	3	AO2 3.1.2c

Question 3 continues on the next page . . .

4.5.6.1.2 Speed

Answer 108 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(d)(i)	they are absorbed by bone	allow stopped for absorbed X-rays are reflected negates this mark	1	AO1 3.1.1a
	they are transmitted by soft tissue	allow pass through for transmitted allow flesh / muscle / fat accept less (optically) dense material for soft tissue	1	
	(the transmitted) X-rays are detected		1	
3(d)(ii)	short	accept small	1	AO1 3.1.1a
Total			12	

4.5.6.1.2 Speed

Answer 108 · Mark scheme

June 2016 | PH3HP | Original Q3 | Legacy



4.5.6.1.2 Speed

Answer 109 · Mark scheme

June 2016 | PH3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	turning effect	accept force multiplied by perpendicular distance from the line of action of the force to the pivot	1	AO1 3.2.2a
5(a)(ii)	moments are equal (in size) and opposite (in direction)	both parts are required allow clockwise moment = anticlockwise moment	1	AO1 3.2.2c
5(a)(iii)	0.9 (N)	allow **2** marks for F=0.18 ÷ 0.2 provided no subsequent steps allow **1** mark for (anticlockwise moment) = 0.18 (Nm) allow **1** mark for correct substitution i.e. 1.5 × 0.12 = F × 0.20	3	AO2 3.2.2e
5(b)	a longer drumstick lever gives a quieter sound a longer drumstick lever allows a greater range of volumes	a greater force gives a louder sound is insufficient	1 1	AO3 3.2.2e
Total			7	

4.5.6.1.2 Speed

Answer 109 · Mark scheme

June 2016 | PH3HP | Original Q5 | Legacy



4.5.6.1.2 Speed

Answer 110 · Mark scheme

June 2017 | PH1HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	transverse		1	AO1 1.5.1c
1(b)	4.6×10^{14} (Hz)	an answer that rounds to 4.6×10^{14} scores 2 marks allow **1** mark for correct substitution ie $3.0 \times 10^{8} = f \times 6.5 \times 10^{-7}$	3	AO2 1.5.1j
1(c)	10^{-15} to 10^{4}		1	AO1 1.5.1e
Total			5	

4.5.6.1.2 Speed

Answer 110 · Mark scheme

June 2017 | PH1HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.5.6.1.2 Speed

Answer 111 · Mark scheme

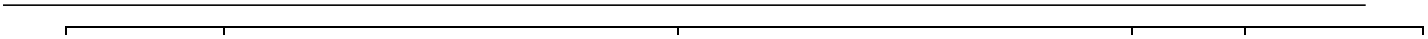
June 2017 | PH1HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	Doppler		1	AO1 1.5.4a
4(b)(i)	A frequency has increased	 accept frequency is higher (compared to the emitted frequency) accept wavelength has decreased reason only scores if A is chosen	1 1	AO2 AO3 1.5.4a
4(b)(ii)	C greater change in frequency	 accept greater change in wavelength reason only scores if C chosen	1 1	AO2 AO3 1.5.4a
Total			5	

4.5.6.1.2 Speed

Answer 111 · Mark scheme

June 2017 | PH1HP | Original Q4 | Legacy



4.5.6.1.2 Speed

Answer 112 · Mark scheme

June 2017 | PH2HP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	The distance the lorry travels during the driver's reaction time.		1	AO1 2.1.3c
4(a)(ii)	the greater the speed (of the lorry) the greater the (thinking) distance **or** they are directly proportional		1	AO1 2.1.3b
4(b)(i)	24 (m)	allow **1** mark for ½ x 12 x 4 an answer of 30 gains **1** mark	2	AO2 2.1.2h
4(b)(ii)	15000 (N) **or** 360 000÷ their **(b)(i)** correctly calculated	allow **1** mark for correct substitution ie 360 (000) = F x 24 or their **(b)(i)** an answer 15 with the unit changed to kN gains **2** marks an answer 15 gains **1** mark 360 ÷ their **b(i)** correctly calculated gains **1** mark	2	AO2 2.2.1b
4(c)(i)	any one from: • height (of the ramp) • speed of the trolley at the bottom (of the ramp) • angle (of the ramp) • start point (on the ramp)	the following are insufficient length of ramp or string same trolley or same ramp	1	AO2 HSW
4(c)(ii)	(measure maximum) distance the weight is lifted from the floor		1	AO3 HSW

4.5.6.1.2 Speed

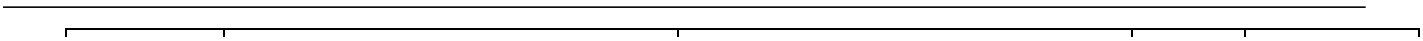
Answer 112 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(c)(iii)	increase accuracy (in measurement of braking distance)	accept results would be more reliable ignore reference to validity	1	AO3 HSW
	by allowing a mean/average to be calculated **or** by allowing anomalous results to be discarded	accept by allowing anomalous results to be identified accept shows results are repeatable reproducible is insufficient	1	
4(c)(iv)	As (braking) force increases (braking) distance decreases	accept weight (lifted) for braking force	1	AO3 HSW
	justification by correct numerical example eg increasing the force from 2 to 8 you can decrease the braking distance from 80 to 20 cm	An answer of (braking) distance is inversely proportional to (braking) force gains **2** marks	1	
Total			**12**	

4.5.6.1.2 Speed

Answer 112 · Mark scheme

June 2017 | PH2HP | Original Q4 | Legacy



4.5.6.1.2 Speed

Answer 113 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)(i)	The direction is changing Because direction is changing the velocity is changing Because velocity is changing the train is accelerating	 accept velocity is speed in a certain direction accept acceleration is rate of change of velocity	1 1 1	AO1 3.2.4a 3.2.4b
8(a)(ii)	Track B has a larger radius allowing a greater speed for the same centripetal force	 accept requiring a lower centripetal force for the same speed	1 1	AO3 AO1 3.2.4c
8(b)(i)	The train can go faster round bends	accept it is less likely to topple ignore references to it will not topple over	1	AO3 3.2.4c
8(b)(ii)	There is no (resultant) moment		1	AO1 3.2.2f
8(c)(i)	**either** When the angle doubles the radius halves. An explanation using numbers quoted from the graph to support this eg at 2 degrees the minimum radius is 3000 m but at 4 degrees it is 1500 m. **or** The product of angle and radius is constant (the product is) 6000		 1 1	 AO2 3.2

4.5.6.1.2 Speed

Answer 113 · Mark scheme

8(c)(ii)	A computer simulation allows for more variables to be tested	accept computer models can control variables more easily accept can generate lots of results in a short time accept does not get damaged in test runs ignore references to accuracy ignore references to cost reduces the likelihood of human error is insufficient	1	AO3 3.2
Total			**10**	

4.5.6.1.2 Speed

Answer 114 · Mark scheme

June 2018 | 8463/1H | Original Q4

Question	Answers	Extra information	Mark	AO/ Spec. Ref
04.1	chemical	in this order only	1	AO1 4.1.1.1
	equal to	allow the same as	1	
04.2	power = $\frac{\text{work done}}{\text{time}}$	allow P = $\frac{W}{t}$	1	AO1 4.1.1.4
04.3		an answer of 360 000 (J) scores **3** marks		AO2 4.1.1.4
	200 = $\frac{W}{1800}$		1	
	W = 200 × 1800		1	
	W = 360 000 (J)		1	
04.4		an answer that rounds to 15.8 (%) scores **2** marks		AO2 4.1.1.1
	11 – 9.5 = 1.5 (m/s)	allow a change in speed between 1.2 and 1.5 (m/s)	1	
	$\left(\frac{1.5}{9.5}\right)$ × 100 = 15.8 (%)	allow an answer consistent with their change in speed	1	
		an answer of 16 (%) scores **2** marks		
04.5	maximum speed is lower		1	AO1 4.1.1.4
	because maximum power output of cyclist is constant	allow maximum force on pedals is constant	1	
	(but) additional work is done (against gravity) **or** gravitational potential energy (of cyclist) is increased	do **not** accept additional work done against friction or air resistance	1	
Total			**11**	

4.5.6.1.2 Speed

Answer 115 · Mark scheme

June 2018 | 8463/1H | Original Q10

Question	Answers	Extra information	Mark	AO/ Spec. Ref
10.1		an answer of 27 600 (kg) scores **3** marks		AO2 4.3.1.1
	$1.2 = \frac{m}{2.3 \times 10^4}$		1	
	$m = 1.2 \times 2.3 \times 10^4$		1	
	m = 27 600 (kg) **or** $m = 2.76 \times 10^4$ (kg)	allow an answer of 28 000 (kg) or 2.8×10^4 (kg)	1	
10.2		allow power output for kinetic energy throughout		AO3 4.1.1.2
	mass of air passing the turbine blades is halved which decreases kinetic energy by a factor of two		1	
	(wind speed is halved) decreasing kinetic energy by a factor of four		1	
	so kinetic energy decreases by a factor of eight		1	
10.3		an answer that rounds to 7.50 (m/s) scores **3** marks		AO2 4.1.1.2
	$388\,000 = 0.5 \times 13\,800 \times v^2$	this mark may be awarded if P is incorrectly / not converted	1	
	$v^2 = \frac{(2 \times 388\,000)}{13\,800}$	this mark may be awarded if P is incorrectly / not converted	1	
	or			
	$v^2 = \frac{388\,000}{(0.5 \times 13\,800)}$			
	or			
	$v^2 = 56.2$			
	v = 7.50 (m/s)	an answer that rounds to 7.50 (m/s) only	1	
Total			**9**	

4.5.6.1.2 Speed

Answer 116 · Mark scheme

June 2018 | 8463/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	P-waves are longitudinal and S-waves are transverse		1	AO1 4.6.1.5
03.2	0.4		1	AO2 4.6.1.2
03.3	wave speed = frequency × wavelength	allow v = f λ	1	AO1 4.6.1.2
03.4	7200 = 0.4 × wavelength wavelength = $\frac{7200}{0.4}$ wavelength = 18 000 (m)	an answer 18 000 scores **3** marks allow up to full marks for ecf using their answer to question **03.2** a method shown as 7200 × 2.5 = 18 000 scores **0** marks	1 1 1	AO2 4.6.1.2
03.5	because S-waves cannot travel through a liquid and S-waves do not travel through the (outer) core	allow some (seismic) waves cannot travel through a liquid and do not go through the core for **1** mark	1 1	AO1 4.6.1.5
03.6	magnetic field around the coil changes **or** the magnetic field (lines) cut by the coil	allow the generator effect	1	4.7.3.1 AO2

4.5.6.1.2 Speed

Answer 116 · Mark scheme

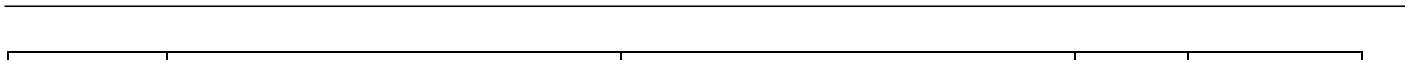
June 2018 | 8463/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	because the magnet changes direction		1	4.7.3.1 AO2
03.8	stationary		1	4.7.3.1 AO2
03.9	any **two** from: • stronger magnetic field • more turns on the coil • turns pushed closer together • spring with a lower spring constant	 allow stronger magnet allow heavier magnet bigger magnet is insufficient bigger coil is insufficient do **not** accept more coils of wire allow less stiff spring allow weaker spring do **not** accept add an iron core	2	4.7.3.1 AO2
Total			**13**	

4.5.6.1.2 Speed

Answer 116 · Mark scheme

June 2018 | 8463/2H | Original Q3



4.5.6.1.2 Speed

Answer 117 · Mark scheme

June 2018 | 8463/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(force of) gravity causes the satellite to accelerate (towards the Earth)	allow satellite is (constantly) accelerating	1	AO1 4.8.1.3
	the acceleration causes a change in direction	acceleration causes a change in speed negates this mark point	1	
	velocity changes because direction changes		1	

4.5.6.1.2 Speed

Answer 117 · Mark scheme

June 2018 | 8463/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2		an answer of 15 scores **5** marks		AO2 4.8.1.3 4.5.6.1.2
	length of orbit taken from graph = 42 100 (km)		1	
	42 100 = 7.73 × time **or** time = $\frac{42\,100}{7.73}$	allow their distance = 7.73 × time	1	
	time (1 orbit) = 5446(s)	allow a value consistent with their distance	1	
	number of orbits = $(\frac{24 \times 3600}{5446})$ = 15.86	allow $(\frac{24}{1.51})$ = 15.86 allow a value consistent with their distance	1	
	number of orbits = 15	allow a value consistent with their distance	1	
		an answer of 16 scores **4** marks		
	or			
	length of orbit taken from graph = 42 100 (km) (1)			
	7.73 = $\frac{\text{distance}}{24 \times 3600}$ (1)			
	distance = 667 872 (km) (1)			
	number of orbits =($\frac{667\,872}{42\,100}$) = 15.86 (1)	allow a value consistent with their two distances		
	number of orbits = 15 (1)	allow a value consistent with their two distances up to full marks can be awarded for a method calculating velocity in km/h and time in hours		

4.5.6.1.2 Speed

Answer 117 · Mark scheme

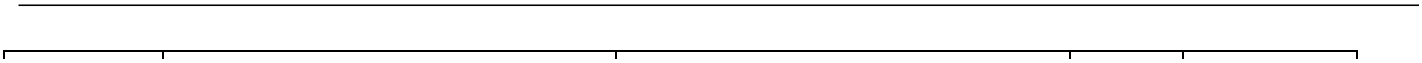
June 2018 | 8463/2H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	the predicted data is very close to the actual data		1	AO3 4.8.1.3
08.4	supported the prediction (made by Bode) so provides evidence that the equation is true / correct / works / accurate	allow predicted and actual values are very close allow proves for provides evidence	1 1	AO3 4.8.1.3
Total			11	

4.5.6.1.2 Speed

Answer 117 · Mark scheme

June 2018 | 8463/2H | Original Q8



4.5.6.1.2 Speed

Answer 118 · Mark scheme

June 2019 | 8463/1H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3.1	$41 = \frac{9.8 \times h}{0.12}$ $h = \frac{41 \times 0.12}{9.8}$ h = 0.50 (m)	an answer of 0.50 scores **3** marks allow a correct answer that rounds to 0.50 for **3** marks	1 1 1	4.1.1.2 AO2
3.2	kinetic energy = 0.5 × mass × (speed)^2 ***or*** $E_k = ½ mv^2$		1	4.1.1.2 AO1
3.3	$270 = ½ \times m \times 3^2$ $m = \frac{270}{(½ \times 3^2)}$ **or** $m = \frac{270}{4.5}$ m = 60 (kg)	an answer of 60 (kg) scores **3** marks	1 1 1	4.1.1.2 AO2

3.4	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear.		3–4	WS3.5 4.1.1.2 AO3
	Level 1: Relevant features are identified and differences noted.		1–2	
	No relevant content		0	
	Indicative content • males have a greater muscle power than females for most of their lives • males have a greater muscle power than females above 9/10 years old • males have a lower muscle power than females below 9/10 years old • there is a similar pattern for males and females as age increases • males have a peak muscle power at 25 years old whereas females have a peak muscle power at 20/21 years old • at 9/10 years old males have the same muscle power as females • peak muscle power for males (47 W/kg) is greater than peak muscle power for females (37 W/kg) • the rate of increase of muscle power is greater for males than females (between 5 and 25 years old) • the rate of decrease of muscle power is greater for males than females. Ignore comments relating to strength			
3.5	any **1** from: • maximum height reached is a better indicator of maximum muscle power • maximum / peak muscle power was being investigated, not mean / average muscle power • volunteer may not use maximum effort on the first try • performance may improve with practise • performance may get worse with tiredness	allow maximum time in the air for maximum height reached / jumped	1	WS3.7 4.1.1.4 AO3
Total			**12**	

4.5.6.1.2 Speed

Answer 119 · Mark scheme

June 2019 | 8463/1H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4.1	electric car journey will take a (much) longer time (because) battery will need recharging **or** (because) the car will need to stop for 40 minutes	allow diesel car journey will take a shorter time allow diesel car will not need to be refuelled	1 1	4.1.3 AO3
4.2	energy stored in diesel = 45 × 51 = 2295 (MJ) energy stored in batteries = 0.95 × 280 = 266 (MJ) (so) the diesel stores more energy than the battery (and the diesel car has a higher range)	 this mark is dependent on correct calculations of energy stored	1 1 1	4.1.3 1AO1 1AO2 1AO3
4.3	any **2** from: • recharging is a continuous process • fewer cells needed in the car • more cars can be charged at the same time	 allow cars do not need to stop to recharge allow shorter journey times allow don't have to wait for battery to recharge allow longer time between recharges allow the range of the electric car is increased allow smaller battery needed in the car allow do not need to find a charging point allow fewer charging stations needed ignore it is quicker ignore cost of charging ignore methods of electricity generation	2	4.1.3 AO1

4.5.6.1.2 Speed

Answer 119 · Mark scheme

June 2019 | 8463/1H | Original Q4

4.4	when cars are plugged in the energy from car batteries could be transferred back to the National Grid	 allow mains supply for National Grid allow energy from car batteries could be used to power household appliances	1 1	4.1.3 AO1
Total			**9**	

4.5.6.1.2 Speed

Answer 120 · Mark scheme

June 2019 | 8463/1H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1		an answer of 2.5 (m) scores **3** marks		4.1.1.2 AO2
	1470 = 60 × 9.8 × h	this mark may be awarded if E_p is incorrectly/not converted	1	
	$h = \frac{1470}{60 \times 9.8}$ **or** $h = \frac{1470}{588}$	this mark may be awarded if E_p is incorrectly/not converted	1	
	h = 2.5 (m)	this answer only	1	
7.2	(work done against) air resistance **or** (work done against) friction (between zip line and pulley)		1	4.1.1.1 AO1
	causes thermal energy to be transferred to surroundings	ignore sound energy	1	
7.3	different people have different surface areas	allow streamlining allow body position body size is insufficient	1	4.1.1.1 4.1.1.2 AO1
	so would be affected by air resistance differently **OR** initial speed may not be zero (1) which would add to the total energy (of the system) (1)	allow people have different masses / weights (1) so people have different terminal velocities (1) reference to mass changing the kinetic energy or gravitational potential energy negates both these marks	1	
Total			**7**	

4.5.6.1.2 Speed

Answer 121 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.1	metre rule	allow metre ruler allow tape measure do not accept ruler do not accept metre stick	1	AO1/2 4.6.1.2 RPA8
2.2	(wave) speed = frequency × wavelength	allow v = f λ	1	AO1/1 4.6.1.2 RPA8
2.3	 80cm = 0.8m v = 55 × 0.8 v = 44 (m/s)	an answer of 44 (m/s) scores **3** marks this mark may be awarded if wavelength is incorrectly or not converted allow correct calculation using an incorrectly or not converted wavelength an answer of 4400 (m/s) scores **2** marks	 1 1 1	AO2/1 4.6.1.2 RPA8
2.4	move the (wooden) bridge to the right OR change the mass/weight (on the string) scores **1** mark add more masses/weights (to the string) scores both marks	 dependent on 1st mp being scored	1 1	AO2/2 4.6.1.2 RPA8

4.5.6.1.2 Speed

Answer 121 · Mark scheme

June 2019 | 8463/2H | Original Q2

2.5	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO3/3a 4.6.1.2 RPA8
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content add or take away masses from the string (ignore any stated values) adjust frequency using the signal generator and/or move the wooden bridge observe a steady / stationary pattern measure the wavelength calculate wave speed from frequency and wavelength a Level 1 answer should include a way of changing tension a complete Level 2 answer would include either changing frequency and/or moving the bridge		
Total		**11**	

4.5.6.1.2 Speed

Answer 122 · Mark scheme

June 2019 | 8463/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5.1	wavelength	this answer only	1	AO1 4.8.2 iso
5.2	(extremely) hot and dense	ignore very small	1	AO1/1 4.8.2 iso
5.3	(directly) proportional	allow a correct description of direct proportionality ignore positive correlation	1	AO3/2b 4.8.2
5.4	6×10^{24}		1	AO2/2 4.8.2 WS4.4
5.5	the furthest galaxies are moving the fastest (this suggests) the universe is expanding (from a very small region)		1 1	AO1/1 4.8.2
5.6	expanding at (an ever) greater rate	allow expanding faster	1	AO3/1a 4.8.2
5.7	any **one** from: • detects false claims • detects inaccurate data • detects bias • verifies new data • provides a consensus (of opinion)	 allow provides credibility allow detects mistakes allow removes bias allow checks validity ignore shows data is accurate ignore proves a theory	1	AO1/1 4.8.2 WS 1.6
5.8	wavelength (seems to have) decreased frequency (seems to have) increased		1 1	AO2/1 4.8.2
Total			**10**	

4.5.6.1.2 Speed

Answer 123 · Mark scheme

June 2019 | 8463/2H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8.1	longer arrow pointing vertically downwards	one arrow only	1	AO2/1 4.5.1.4 4.5.6.1.5
	labelled weight	allow (force of) gravity	1	AO1/1 4.5.6.1.5
8.2	initially air resistance is less than weight / gravity so the skydiver accelerates	allow drag for air resistance allow increased velocity / speed for accelerates	1	AO3/1a AO1/1 AO2/1 4.5.6.1.4
	acceleration causes the air resistance to increase	acceleration **or** increased velocity / speed is not required here if given in the first mark point	1	4.5.6.1.5 4.5.6.2.1
	resultant force decreases to zero	allow air resistance becomes equal to weight / gravity	1	
	so the skydiver falls at terminal velocity	allow constant velocity/speed for terminal velocity ignore any mention of subsequent motion and use of parachute	1	
8.3		an answer of 50 (m/s) scores **3** marks		AO2 4.5.6.1.4
	distance at 7s = 200 (m) distance at 12s = 450 (m)	**both** distances required	1	
	speed = $\frac{450 - 200}{12 - 7}$ **or** $\frac{250}{5}$	allow correct use of their two distances divided by 5	1	
	50 (m/s)	allow an answer consistent with their two distances	1	

4.5.6.1.2 Speed

Answer 123 · Mark scheme

June 2019 | 8463/2H | Original Q8

8.4	The higher the altitude the less dense the air so the air resistance on the skydiver (falling from 39000m) was less (at the same speed) so the skydiver was able to accelerate for longer before reaching (a higher) terminal velocity **or** so the skydiver was able to accelerate for longer before air resistance = weight / gravity	 allow constant velocity/speed for terminal velocity	1 1 1	AO1/1 4.5.5.2 AO1/1 AO2/1
Total			**12**	

4.5.6.1.2 Speed

Answer 124 · Mark scheme

November 2020 | 8463/1H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	Length of sled Time for sled to pass light gate		1 1	AO2 4.1.1.2
06.2	E_p = 8330 (J) 8330 = m × 9.8 × 17.0 $m = \frac{8330}{9.8 \times 17.0}$ m = 50.0 (kg)	 allow a correct substitution using an incorrectly/not converted value of E_p allow a correct rearrangement using an incorrectly/not converted value of E_p allow a correct calculation using an incorrectly/not converted value of E_p	1 1 1 1	AO2 4.1.1.2
06.3	½ mv^2 = mgh **or** decrease in E_p = increase in E_k masses cancel on both sides of the equation **or** v^2 = 2gh (final) speed only depends on vertical height (and gravitational field strength) variations will be due to air resistance/friction **or** different initial speed		1 1 1 1	AO1 4.1.1.2
Total			**10**	

4.5.6.1.2 Speed

Answer 125 · Mark scheme

November 2020 | 8463/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(force of) gravity fusion	do **not** allow weight	1 1	AO1 4.8.1.1
02.2	distance = speed × time **or** s = vt	allow a correct re-arrangement do **not** allow d = st	1	AO1 4.5.6.1.2
02.3	$1.5 \times 10^{11} = 3.0 \times 10^{8} \times t$ $t = \frac{1.5 \times 10^{11}}{3.0 \times 10^{8}}$ t = 500 (s)		1 1 1	AO2 4.5.6.1.2

02.4	**Level 3**: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		5–6	AO1 4.8.1.2
	Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.		3–4	
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1–2	
	No relevant content		0	
	Indicative content: • fusion (processes in stars) produce new elements • cloud of gas / hydrogen **and** dust **OR** nebula • pulled together by gravity • causing increasing temperature (to start the fusion process) • (to become a) protostar • hydrogen nuclei fuse to form helium nuclei • and the star becomes main sequence • hydrogen begins to run out • helium nuclei fuse to make heavier elements • up to iron • the star expands (to become a) • red super giant • (the star collapses rapidly) and explodes • called a supernova • creating elements heavier than iron • and distributing them throughout the universe • leaving behind a neutron star • or a black hole.			
02.5	Temperature		1	AO1 4.6.3.2
Total			**13**	

4.5.6.1.2 Speed

Answer 126 · Mark scheme

November 2020 | 8463/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	320 MHz = 3.2×10^8 Hz	allow 320 000 000	1	AO2
	$3.0 \times 10^8 = 3.2 \times 10^8 \times \lambda$	this mark may be awarded if frequency is incorrectly/not converted	1	AO2
	$\lambda = \frac{3.0 \times 10^8}{3.2 \times 10^8}$	this mark may be awarded if frequency is incorrectly/not converted	1	AO2
	wavelength = 0.9375	allow correct calculation using an incorrectly/not converted frequency allow an answer that rounds to 0.94	1	AO2
	metres **or** m		1	AO1 4.6.1.2
06.2	(alternating) current <u>induced</u> (in the electrical circuit)	allow <u>electrons</u> vibrate / oscillate (in the electrical circuit)	1	AO1 4.6.2.3
	with the same frequency as the radio wave		1	
06.3	Any **two** from: • (radio waves are) transverse	allow sound waves are longitudinal allow a description of transverse/longitudinal waves	2	AO1 4.6.1.1 4.6.1.2
	• (radio waves) travel at a higher speed • (radio waves) don't need a medium • (radio waves are) electromagnetic	allow (only) radio waves travel through a vacuum allow sound waves are mechanical		
06.4	accelerating	allow speeding up	1	AO3 4.5.6.1.4

4.5.6.1.2 Speed

Answer 126 · Mark scheme

November 2020 | 8463/2H | Original Q6

06.5	appropriate tangent drawn correct reading from graph for change in distance and change in time (eg 5.6 (m) and 20 (s)) gradient of tangent shown (eg 5.6/20) 0.28 (m/s)	 allow correct reading from their tangent for change in distance and change in time allow correct gradient from their tangent this answer only allow 0.25 to 0.30 (m/s) if the tangent is appropriate allow 2.8 / 20 = 0.14 (m/s) for **1** mark	1 1 1 1	AO2 4.5.6.1.4
06.6	$0.52^2 - 0.12^2 = 2 \times 0.04 \times s$ $s = \frac{0.52^2 - 0.12^2}{2 \times 0.04}$ s = 3.2 (m) 0.48 = F x 3.2 $F = \frac{0.48}{3.2}$ F = 0.15 (N) **OR**	 this mark may be awarded if the displacement is incorrectly calculated this mark may be awarded if the displacement is incorrectly calculated allow a correctly calculated F using an incorrectly calculated displacement	1 1 1 1 1 1	AO2 4.5.2 4.5.6.1.5

4.5.6.1.2 Speed

Answer 126 · Mark scheme

November 2020 | 8463/2H | Original Q6

	Alternative method 1 $t = \frac{0.52 - 0.12}{0.04}$ (1) t = 10 (s) (1) s = 0.32 × 10 = 3.2 (m) (1) 0.48 = F x 3.2 (1) $F = \frac{0.48}{3.2}$ (1) F = 0.15 (N) (1) **OR** Alternative method 2 0.48 = (0.5 x m x 0.52^2) – (0.5 x m x 0.12^2) (1) 0.48 = 0.1352m – 0.0072m (1) 0.48 = 0.128m (1) m = 3.75 (1) F = 3.75 x 0.040 (1) F = 0.15 (N) (1)	allow a correctly calculated displacement from an incorrectly calculated t this mark may be awarded if the displacement is incorrectly calculated this mark may be awarded if the displacement is incorrectly calculated allow a correctly calculated F from incorrectly calculated values for displacement and / or t allow their calculated m allow correctly calculated F using an incorrectly calculated m		

4.5.6.1.2 Speed

Answer 126 · Mark scheme

November 2020 | 8463/2H | Original Q6

06.7	there is a maximum forward force (provided by the motor) as the speed of the car increases air resistance increases until air resistance is equal in size to forward force so the car can no longer accelerate	allow driving force for forward force - throughout the car has a maximum acceleration is insufficient allow friction / drag for air resistance - throughout allow (until) the resultant force is zero allow forces are in equilibrium / balanced allow the car travels at terminal velocity	1 1 1 1	AO1 4.5.6.1.5
Total			**24**	

4.5.6.1.2 Speed

Answer 127 · Mark scheme

November 2021 | 8463/1H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	the total energy of the racing track and the car is constant.		1	AO1 4.1.2.1
08.2	$E_p = 0.040 \times 9.8 \times 0.90$	allow a correct substitution of an incorrectly/not converted value of h	1	AO2 4.1.1.1 4.1.1.2
	$E_p = 0.3528$ (J)	this answer only	1	
	$0.3528 = 0.5 \times 0.040 \times v^2$	allow a correct substitution of a calculated E_p	1	
	$v^2 = \frac{0.3528}{0.5 \times 0.040}$	allow a correct rearrangement using a calculated E_p	1	
	$v = 4.2$ (m/s)	allow an answer consistent with their calculated E_p	1	
08.3	more than 0.20 J		1	AO3 4.1.1.1
	(because) the car needs to be moving at the top of the loop **or** (because) the car needs to be moving to complete the loop **or** not all E_k at **B** will be transferred to E_p at **C**	this mark is dependent on scoring the first mark allow energy dissipated to the surroundings	1	
Total			**8**	

4.5.6.1.2 Speed

Answer 128 · Mark scheme

November 2021 | 8463/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO/ Spec. Ref
01.1	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.		3–4	AO1 4.5.6.3.3 4.5.6.3.4 4.1.1.2
	Level 1: Point are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.		1–2	
	No relevant content		0	
	Indicative content Factors • poor condition of tyres • poor road surface • wet or icy road • poor/worn brakes Explanation • because of decreased friction Factors • increased mass of car/passengers Explanation • increases kinetic energy of car • more work needs to be done to stop car • increases momentum of the car Factor • road slopes downhill Explanation • (a component of) gravity opposes the braking force • resultant (braking) force is reduced allow answers in terms of reducing braking distance throughout A single factor with no related explanation is insufficient to score a mark			

Answer 128 · Mark scheme

01.2	resultant force = mass × acceleration		1	AO1 4.5.6.2.2
01.3	7200 = 1600 × *a* $a = \frac{7200}{1600}$ *a* = 4.5 (m/s^2)	ignore negatives throughout	1 1 1	AO2 4.5.6.2.2
01.4	15 (m) 38 (m) = 53 (m)	two correct values identified allow the correct addition of a misread braking distance and /or a misread thinking distance taken from the graph	1 1	AO3 4.5.6.3.1
01.5	$p = \frac{F}{A}$		1	AO1 4.5.5.1.1
01.6	120 000 = $\frac{60}{A}$ $A = \frac{60}{120\,000}$ *A* = 0.0005 *A* = 5 (.0) × 10^{-4} m^2	allow an answer given to 2 sig figs from an incorrect calculation using the given data	1 1 1 1 1	AO2 AO2 AO2 AO2 AO1 4.5.5.1.1
Total			**16**	

4.5.6.1.2 Speed

Answer 129 · Mark scheme

November 2021 | 8463/2H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	gravitational force inwards and forces as a result of fusion reactions outwards are in equilibrium / balanced	allow fusion energy for fusion reactions outwards allow radiation pressure for fusion reactions outwards dependant on scoring 1st mark point allow for **1** mark forces are in equilibrium	1 1	AO1 4.8.1.1
03.2	(the star will) expand to become a red giant (the star will) collapse to become a white dwarf (the star will) cool to become a black dwarf	the answers must be in the correct sequence to score all **3** marks allowed outer layers ejected for collapsed if no other marks score, allow red giant, white dwarf, black dwarf in the correct order for **1** mark	1 1 1	AO1 4.8.1.2
03.3	**A** it is (moving away from Earth) the slowest or it is the closest (to the Earth)	 reason only scores if A is chosen	1 1	AO3 4.8.2
Total			**7**	

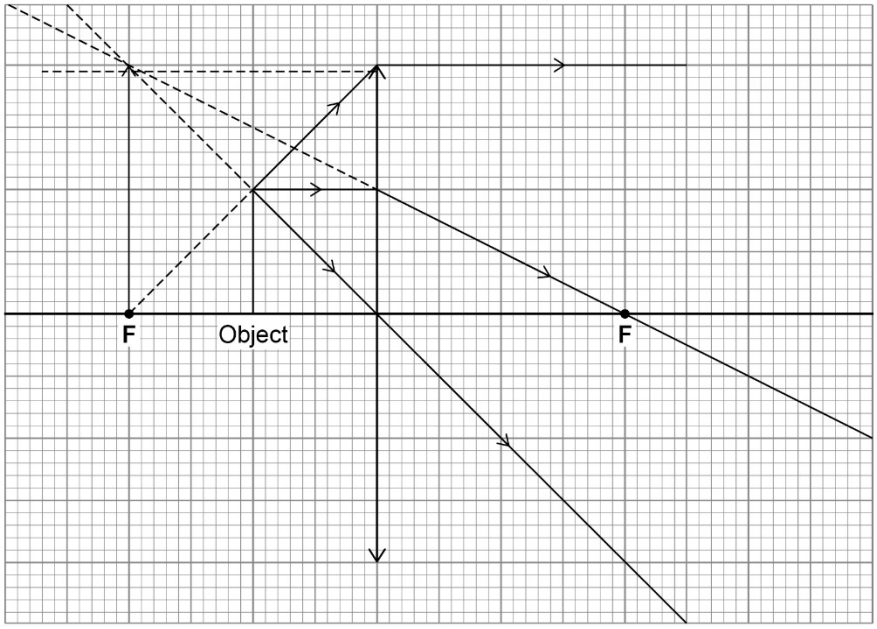
4.5.6.1.2 Speed

Answer 130 · Mark scheme

November 2021 | 8463/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO/ Spec. Ref
04.1	**both** answers correct virtual diminished	answers may be in either order allow a description of diminished (eg smaller / reduced)	1	AO3 4.6.2.5
04.2	any **two** correct lines drawn from the top of the object, passing through the lens and traced backwards image drawn in the correct position and with the correct orientation	allow construction lines that are not dashed allow 1 mark for **two** correct lines drawn from the top of the object, passing through the lens BUT not traced backwards mark only scores if first two marks score	2 1	AO2 4.6.2.5



Answer 130 · Mark scheme

November 2021 | 8463/2H | Original Q4

04.3	(increasing the object distance) decreases the image distance more rapidly at small (object) distances / more gradually at larger (object) distances	do **not** accept inversely proportional	1	AO3 4.6.2.5
04.4	$\frac{(2.2 - 1.4)}{2}$ uncertainty = (±) 0.4 (cm)	 allow $\frac{1.9 + 1.7 + 2.2 + 1.4}{4} = 1.8$ (1) (2.2 – 1.8 =) (±) 0.4 (cm) (1)	1 1	AO3 4.6.2.5
04.5	only red is transmitted by the filter red is absorbed by the (blue) object (so) no light is reflected by the (blue) object		1 1 1	AO1 4.6.2.6
Total			**10**	

4.5.6.1.2 Speed

Answer 131 · Mark scheme

November 2021 | 8463/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **one** from: • (sun) tan • energy efficient lamps	allow • (invisible) security coding • detecting forged bank notes • kill microbes • attract insects • sterilise (surgical) equipment • cause the body to produce vitamin D • increasing the growth rate of plants • water purification	1	AO1 4.6.2.4
05.2	3×10^{-7} m		1	AO1 4.6.2.1
05.3	$3.0 \times 10^{8} = \text{frequency} \times 3 \times 10^{-7}$ $\text{frequency} = \frac{3.0 \times 10^{8}}{3 \times 10^{-7}}$ frequency = 1×10^{15} (Hz)	allow ecf from question **05.2**	1 1 1	AO2 4.6.1.2
05.4	**Wave** / **Name** Wave E → Infrared Wave F → Visible light Wave G → X-rays all three lines correct for **1** mark		1	AO3 4.6.2.1

4.5.6.1.2 Speed

Answer 131 · Mark scheme

05.5	in a transverse wave, the oscillations / vibrations are perpendicular to the direction of energy transfer in a longitudinal wave, the oscillations / vibrations are parallel to the direction of energy transfer	allow direction of wave travel for direction of energy transfer	1 1	AO1 4.6.1.1

Total			**8**

4.5.6.1.2 Speed

Answer 132 · Mark scheme

November 2021 | 8463/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	to reduce the effect of random errors	allow gives a more accurate mean ignore reference to anomalous results ignore measurements are more accurate	1	AO1 4.6.1.2
06.2	$\frac{(8.4+7.8+8.1)}{3} = 8.1$ (s)		1	AO2 4.6.1.2
	$\frac{8.1}{10} = 0.81$ (s)		1	
	frequency = $\frac{1}{0.81}$	allow a correct substitution of an incorrectly calculated value for time	1	
	frequency = 1.2345…	this mark may be awarded if the time is incorrectly calculated	1	
	frequency = 1.2 (Hz)	allow a calculated value correctly rounded to 2 sig figs	1	
06.3	measure the distance travelled by a wave using a metre rule	allow measure the length of the (ripple) tank using a metre rule	1	AO1 4.6.1.2
	measure the time taken (for the wave to travel the measured distance) with a timer / stopwatch		1	
	divide the distance by the time	dependant on scoring the first two mark points	1	
Total			**9**	

4.5.6.1.2 Speed

Answer 133 · Mark scheme

November 2021 | 8463/2H | Original Q7

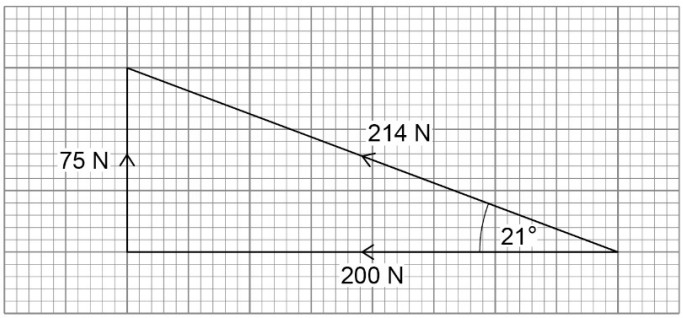
Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	friction		1	AO1 4.5.1.2
07.2	(area of rectangle =) 108 (m) (area of triangle =) 54 (m) (total area / distance =) 162 (m)	 allow a correctly calculated total area / distance from an incorrectly calculated area of rectangle and / or triangle	1 1 1	AO2 4.5.6.1.5
07.3	(the force on the pedal) causes a moment about the pedal axle which causes a force on the chain (which causes a moment about the rear axle)	 allow gear B for chain	1 1	AO1 4.5.4
07.4	$2.4^2 (- 0^2) = 2 \times a \times 18$ $a = \frac{2.4 \times 2.4}{36}$ $a = 0.16$ (m/s^2) <u>alternative method</u> t = 18 / 1.2 t = 15 (s) (1) a = 2.4 / 15 (1) $a = 0.16$ (m/s^2) (1)	 this mark may be awarded if the time is incorrectly calculated allow a correctly calculated acceleration from an incorrectly calculated time	1 1 1	AO2 4.5.6.1.5

4.5.6.1.2 Speed

Answer 133 · Mark scheme

November 2021 | 8463/2H | Original Q7

07.5	horizontal (200N) **and** vertical (75N) forces drawn to the same scale		1	AO2 4.5.1.4
	resultant force drawn in the correct direction	shown by an arrow head from bottom right to top left	1	
	resultant force with a value in the range 212 to 218 (N)	allow a calculated value of 213.6 **or** 214 (N)	1	
	direction in the range 20–22 (degrees from the horizontal)	allow 68–70 (degrees from the vertical) allow a bearing in the range 290–292 to gain full marks a vector diagram must have been drawn	1	
				

Total			**13**

4.5.6.1.2 Speed

Answer 134 · Mark scheme

June 2022 | 8463/1H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	$E_e = 0.5 \times 50 \times 0.12^2$		1	AO2 4.1.1.2
	$E_e = 0.36$ (J)		1	
	$0.36 = 0.5 \times 0.020 \times v^2$	allow a correct substitution of their calculated value of E_e	1	
	$v^2 = \frac{0.36}{0.5 \times 0.020}$ **or** $v^2 = 36$	allow a correct rearrangement of their calculated value of E_e	1	
	speed = 6.0	allow an answer consistent with their calculated value of E_e	1	
	m/s **or** metres/second		1	
		Alternative approach: ($F = ke$) ($F = 50 \times 0.12$) (maximum) $F = 6.0$ (N) (1) ($F = ma$) ($6.0 = 0.020 \times a$) (maximum) $a = 300$ (m/s^2) (1) mean $a = 150$ (m/s^2) (1) ($v^2 - u^2 = 2as$) $v^2 = 2 \times 150 \times 0.12$ (1) **or** $v^2 = 36$ $v = 6.0$ (1) m/s (1) **or** metres/second		

4.5.6.1.2 Speed

Answer 134 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	kinetic		1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	increasing the extension of the spring **or** more elastic potential energy **or** increase the angle of release (to the horizontal by a small amount)	allow other factors that would increase the horizontal distance travelled eg a tail-wind ignore factors without a change specified e.g. extension unqualified would not score ignore changing the spring or changes to the toy aeroplane	1	AO2 4.1.1.1

Total Question 10		**8**

4.5.6.1.2 Speed

Answer 135 · Mark scheme

June 2022 | 8463/2HR | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	any **two** from: • capacity of the battery • speed • mass / weight • uphill / downhill • stopping at traffic lights • condition of the road • (air) temperature • (incorrect) tyre pressure • streamlining of the car	allow energy/charge stored in battery allow efficiency of battery ignore size of battery allow terrain ignore 'the road' only ignore 'weather' only allow efficiency of engine allow anything that would use charge from the battery **or** anything that will reduce the energy stored	2	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	acceleration = change in velocity/time (taken) **or** $a = \frac{\Delta v}{t}$	allow any correct rearrangement allow $a = \frac{v - u}{t}$ do **not** accept $a = \frac{v}{t}$	1	AO1 4.5.6.1.5

4.5.6.1.2 Speed

Answer 135 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$20 = \frac{28}{t}$ $t = \frac{28}{20}$ 1.4 (s)		1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	v^2 (- 0^2) = 2 × 10 × 605 v^2 = 12 100 v = 110 (m/s)		1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	work done = force × distance **or** $W = Fs$	allow any correct rearrangement	1	AO1 4.5.2

4.5.6.1.2 Speed

Answer 135 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	*s* = 7500 (m)		1	AO2 4.5.2
	W = 4000 × 7500	allow correct substitution using incorrectly / not converted value of s	1	
	W = 30 000 000 (J)	allow correct calculation using incorrectly / not converted value of s	1	

Total Question 1		13

4.5.6.1.2 Speed

Answer 136 · Mark scheme

June 2022 | 8463/2HR | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	any **two** from: • wet / icy road conditions • poor condition of brakes • poor condition of tyres • increased mass of car • negative gradient of the road	ignore weather allow weight for mass allow going downhill	2	AO1 4.5.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	distance = speed × time (so) longer reaction time = longer distance		1 1	AO1 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	mean reaction time increases after drinking alcohol the change in reaction time is not the same for all people after drinking alcohol		1 1	AO3 4.5.6.3.3

4.5.6.1.2 Speed

Answer 136 · Mark scheme

June 2022 | 8463/2HR | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	distance = 1500 (m)		1	AO2 4.5.6.1.2
	$1500 = 20 \times t$	allow a correct substitution using an incorrectly / not converted value of distance	1	
	$t = \frac{1500}{20}$	allow a correct rearrangement using an incorrectly / not converted value of distance	1	
	75 (s)	allow a correctly calculated value using an incorrectly / not converted value of distance	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	velocity is a vector and speed is a scalar	allow velocity includes direction (speed does not)	1	AO3 4.5.6.1.2
	road is not straight	allow driver may change lanes	1	
	therefore direction changes so the velocity changes		1	

Total Question 3		**13**

4.5.6.1.2 Speed

Answer 137 · Mark scheme

June 2023 | 8463/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	7.1 (cm) 497 (m)	allow 7.0 to 7.3 (cm) allow 70 × their incorrect measurement of displacement	1 1	AO2 4.5.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	0 (N)		1	AO2 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	constant velocity	allow constant speed (in a straight line) do **not** accept stationary allow constant acceleration if a **mathematical error** in 02.2 gives a non-zero value for resultant force	1	AO1 4.5.6.2.1

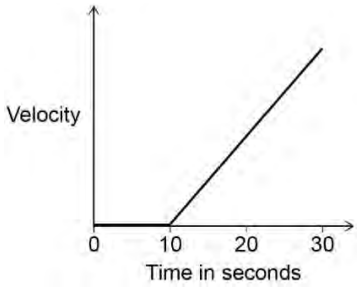
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	any **one** from: • tension • normal contact (force) • upthrust	allow lift, thrust and water resistance allow normal reaction (force) ignore drag	1	AO1 4.5.1.2

4.5.6.1.2 Speed

Answer 137 · Mark scheme

June 2023 | 8463/2H | Original Q2

Question	Answers		Mark	AO / Spec. Ref.
02.5	horizontal line drawn to 10s along the *x*-axis		1	AO3 4.5.6.1.4
	line with a positive gradient starting from 10 s	allow an upward curving line with increasing gradient starting from 10 s	1	



Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	line of best fit drawn and extrapolated to 10 km	do **not** accept a straight line	1	AO2 4.5.5.2
	28 (kPa)	allow 26 to 32 (kPa) allow a value correctly extrapolated from their line allow 2 marks for a correct mathematically extrapolated value	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	the average density of the air above the aeroplane decreases		1	AO3 4.5.5.2

Total Question 2	10

4.5.6.1.2 Speed

Answer 138 · Mark scheme

June 2023 | 8463/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the total amount of energy (of the bumper car and barrier) remains constant. **or** total momentum (of bumper car and barrier) before collision equals total momentum (of bumper car and barrier) after collision **or** the resultant external force acting (on the system) is zero	allow there are no external forces (acting on the system)	1	AO1 4.5.7.2 4.1.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	the force of the car on the barrier is equal to the force of the barrier on the car and in the opposite direction		1	AO1 4.5.6.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	$F = \frac{700}{0.28}$ F = 2 500 (N)		1 1	AO2 4.5.7.3

4.5.6.1.2 Speed

Answer 138 · Mark scheme

June 2023 | 8463/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	increases the time taken for the collision to occur	allow increases contact time do **not** accept slows down time	1	AO1 4.5.7.3
	(so) the rate of change of momentum decreases	allow reduces acceleration / deceleration	1	
	reducing the force (on the people)	reduces impact is insufficient	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	$2.5^2 - u^2 = 2 \times 2.0 \times 1.5$		1	AO2 4.5.6.1.5
	$u^2 = 2.5^2 - (2 \times 2.0 \times 1.5)$		1	
	$u = 0.50$ (m/s)	allow 0.5 (m/s)	1	

Total Question 5	10

4.5.6.1.2 Speed

Answer 139 · Mark scheme

June 2023 | 8463/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	satellite	allow moon	1	AO1 4.8.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	12.5 cm = 0.125 m		1	AO2 4.6.1.2
	$3 \times 10^8 = f \times 0.125$	this mark may be awarded for an incorrectly / not converted value for wavelength	1	
	$f = \frac{3 \times 10^8}{0.125}$	this mark may be awarded for an incorrectly / not converted value for wavelength	1	
	$f = 2\,400\,000\,000$ (Hz)	this mark may be awarded for an incorrectly / not converted value for wavelength	1	
	$f = 2.4 \times 10^9$ (Hz)	this mark may be awarded for an incorrectly calculated value for frequency in standard form using the given data	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	gravitational force causes the Hubble Space Telescope to accelerate towards the Earth		1	AO1 4.5.1.1 4.5.6.1.3 4.8.1.3
	this changes the direction of motion (but not the speed)		1	
	so changes the velocity of the Hubble Space Telescope	if no other marks awarded, allow 1 mark for gravitational force maintains circular orbit	1	

4.5.6.1.2 Speed

Answer 139 · Mark scheme

June 2023 | 8463/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	galaxy A has the greater red shift (so) A is travelling (away from us) faster (than B) (because) A is further away (from us than B)	if no other marks awarded, allow 1 mark for galaxy A and galaxy B are moving away from us	1 1 1	AO3 4.8.2

Total Question 6	12

4.5.6.1.2 Speed

Answer 140 · Mark scheme

June 2024 | 8463/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	0 (N) the child isn't accelerating (vertically) **or** upwards forces are equal to the downwards forces	 MP2 dependent on MP1 allow forces are balanced	1 1	AO2 4.5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	work done = force × distance **or** $W = F \times s$		1	AO1 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$35 = F \times 2.8$ $F = \frac{35}{2.8}$ $F = 12.5$ (N)	 allow 13 (N)	1 1 1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	the resistive force has decreased so the resultant force increases	allow friction (between the wheels and the floor) has decreased	1 1	AO3 4.5.1.4 4.5.6.2.1 4.5.6.2.2

4.5.6.1.2 Speed

Answer 140 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	moment = force × distance **or** $M = F \times d$		1	AO1 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	7.5 cm = 0.075 m $M = 2.0 \times 0.075$ $M = 0.15$ (Nm)	 allow a correct substitution of an incorrectly / not converted value of d allow an answer consistent with an incorrectly / not converted value of d	1 1 1	AO2 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	gear B rotates in the opposite direction (to gear A) **or** gear B rotates clockwise **or** gear B rotates faster than gear A (because) gear A exerts a force on gear B **or** (because) gear A causes a moment about the pivot of gear B		1 1	AO2 4.5.4

Total Question 2	14

4.5.6.1.2 Speed

Answer 141 · Mark scheme

June 2024 | 8463/2H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	planets dwarf planets moons **or** natural satellites	 allow asteroids / meteors / meteoroids / meteorites allow comets	1 1 1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	Betelgeuse		1	AO3 4.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	1.1×10^{17} m		1	AO2 4.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	both show red-shift so both are moving away from us **or** the wavelength of the (absorption) lines has increased so both are moving away from us A shows a greater red-shift (than B) so A is travelling faster (than B)		1 1 1	AO3 4.8.2

4.5.6.1.2 Speed

Answer 141 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$s = 3.6 \times 10^{17}$ (m)		1	AO2 4.5.6.1.2
	$3.6 \times 10^{17} = 3.0 \times 10^{8} \times t$	allow a correct substitution of an incorrectly / not converted value for *s*	1	
	$\frac{3.6 \times 10^{17}}{3.0 \times 10^{8}} = t$	allow a correct re-arrangement using an incorrectly / not converted value for *s*	1	
	$t = 1.2 \times 10^{9}$ (s) **or** $t = 1\ 200\ 000\ 000$ (s)	allow a correct calculation using an incorrectly / not converted value for *s*	1	

Question	Answers	Mark	AO / Spec. Ref.
03.6	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.8.1.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content • fusion occurs at high temperatures • fusion produces new elements • hydrogen nuclei fuse to form helium nuclei • hydrogen (in the core) begins to run out • helium nuclei fuse to make heavier elements • up to iron • some massive stars become supernovae • creating elements heavier than iron		

Total Question 3	16

4.5.6.1.2 Speed

Answer 142 · Mark scheme

June 2024 | 8463/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	the height of the (column of) water above the submarine increases	allow volume / mass for height	1	AO1 4.5.5.1.2
	which increases the force / weight (of the water) acting on the submarine so pressure increases	allow $p = \rho gh$ and ρ and g remain constant so pressure increases	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	p = 110 000 000 Pa		1	AO2 4.5.5.1.2
	110 000 000 = 1026 × 9.8 × Δh	allow a correct substitution of an incorrectly / not converted value for p	1	
	$\Delta h = \frac{110\,000\,000}{1026 \times 9.8}$	allow a correct re-arrangement using an incorrectly / not converted value for p	1	
	Δh = 10 940 (m)	allow a correct calculation from using an incorrectly / not converted value for p allow 11 000 (m) if correct working shown	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	P-waves are longitudinal and S-waves are transverse		1	AO1 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	D only P-waves can travel through liquids	 allow only P-waves can travel through the outer core allow S waves cannot travel through liquids allow S waves cannot travel through the outer core MP2 dependent on MP1	1 1	AO3 4.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	$4500 = 3.6 \times \lambda$ $\lambda = \frac{4500}{3.6}$ $\lambda = 1250$ (m)	allow a correct substitution of an incorrectly / not converted value for v allow a correct re-arrangement using an incorrectly / not converted value for v allow 1300 (m) only allow an answer consistent with a correctly converted value for v	1 1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	the distance is (directly) proportional to the time between the two waves arriving (at the seismometer)	allow they are (directly) proportional allow a greater distance means a greater time for **1** mark allow there is a positive correlation for **1** mark	2	AO3 4.5.6.1.2

Total Question 4	14

4.5.6.1.2 Speed

Answer 143 · Mark scheme

June 2024 | 8463/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	tension		1	AO2 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	(combined) mass of trolley and mass hanger	allow mass / weight of trolley / hanger	1	AO1 4.5.6.2.2 RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3		allow speed for velocity throughout		AO3 4.5.6.1.5 4.5.6.1.2 4.5.6.2.2 RPA7
	divide distance travelled by time taken to give (average / mean) velocity		1	
	double mean velocity (to give maximum velocity)		1	
	divide change in velocity by time taken (to give acceleration)	allow divide maximum velocity by time (to give acceleration) allow use of $v^2 = u^2 + 2as$ allow correct use of $s = ut + \frac{1}{2}at^2$	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(range =) 0.06 (m/s^2) **or** (mean =) 1.36 (m/s^2)		1	AO3 4.5.6.2.2 RPA7
	uncertainty = ±0.03 (m/s^2)		1	

4.5.6.1.2 Speed

Answer 143 · Mark scheme

June 2024 | 8463/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	a component of the weight of the trolley acts parallel to runway (so) resultant force increases so acceleration increases	allow work is done (by raising the trolley) so the trolley gains gravitational potential energy (1) gravitational potential energy is transferred to kinetic energy increasing the final velocity and the acceleration (1)	1 1	AO3 4.5.6.2.2

Total Question 5	9

4.5.6.1.2 Speed

Answer 144 · Mark scheme

June 2024 | 8463/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	$(\frac{1}{2} \times 56 \times 220) = 6160$ $(56 \times 380) = 21280$ $(6160 + 21280) = 27\,440$ (m)	 allow a correctly calculated total distance from an incorrectly calculated area of the rectangle and / or the triangle	1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	the gradient is less after 720 s so the deceleration is smaller so the braking force is smaller	allow the gradient is less after (velocity decreases to) 20 m/s	1 1 1	AO3 4.5.6.1.5 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	correct section of line identified attempt to calculate a gradient using values from the correct section of the graph eg gradient $= \frac{(-)36}{120}$ correct calculation using their correct values eg $a = (-)0.3$ (m/s^2)	judge by values used allow use of correct values obtained from the section of the graph after 720 s allow a correct calculation using correct values obtained from the section of the graph after 720 s if no other marks scored, an answer that rounds to 0.16 (m/s^2) scores 1 mark	1 1 1	AO2 4.5.6.1.5

4.5.6.1.2 Speed

Answer 144 · Mark scheme

June 2024 | 8463/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	(–)270 000 = 240 000 × a		1	AO2 4.5.6.1.5
	$a = \frac{(-)270\,000}{240\,000}$		1	
	a = (–) 1.125 (m/s^2)	the equation $F = ma$ must have been used to score subsequent marks	1	
	0 = 60^2 + (2 × (–1.125) × s)	allow a correct substitution using their value of deceleration	1	
	$s = \frac{3600}{2.25}$	allow a correct re-arrangement using their value of deceleration	1	
	s = 1600 (m)	allow a correct calculation using their value of deceleration	1	
	OR			
	$E_k = \frac{1}{2} \times 240\,000 \times 60^2$ (1)			
	= 432 000 000 (1)			
	Δ E_k = work done (1)			
		the equation $E_k = \frac{1}{2}mv^2$ must have been used to score subsequent marks		
	432 000 000 = 270 000 × s (1)	allow a correct substitution using their value of E_k		
	$s = \frac{432\,000\,000}{270\,000}$ (1)	allow a correct re-arrangement using their value of E_k		
	s = 1600 (m) (1)	allow a correct calculation using their value of E_k		

07.4 cont.	**OR** $p = 240\,000 \times 60\ (= 14\,400\,000)$ (1) $270\,000 = \frac{14\,400\,000}{t}$ (1) $t = 53.333\ldots$(s) (1) mean speed $= \frac{60}{2} = 30$ (1) $s = 30 \times 53.333\ldots$ (1) $s = 1600$ (m) (1)	allow $t = 53$ (s) the equation $F = \frac{\text{change in momentum}}{\text{time taken}}$ must have been used to score subsequent marks allow a correct substitution using their value of t allow a correct calculation using their value of t		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	stopping distance includes both braking distance and thinking distance alcohol increases driver's reaction time which will increase the thinking distance so stopping distance increases		1 1 1	AO1 4.5.6.3.1 4.5.6.3.2

Total Question 7	**18**

4.5.6.1.2 Speed

Answer 145 · Mark scheme

June 2025 | 8463/1H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	renewable: (an energy resource that is) replenished *(*as it is used*)*	allow replaced for replenished ignore has an infinite supply ignore not running out ignore sustainable	1	AO1 4.1.3
	non-renewable: (an energy resource that is) finite	allow limited supply ignore running out ignore won't last forever	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$1030 = \frac{824\,000}{V}$		1	AO2 4.3.1.1
	$V = \frac{824\,000}{1030}$		1	
	$V = 800\ (m^3)$		1	

4.5.6.1.2 Speed

Answer 145 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	any **two** from: • at very low flow speeds there is no power output • tidal power output is (always) greater than wind power output for the same flow speeds (above 0.25 m/s) • a change in flow speed makes a bigger difference to tidal power output than wind power output • there is a non-linear relationship between flow speed and power output	allow wind power needs a higher flow speed to get the same power output (as tidal power) ignore reference to exponential relationships do **not** accept flow speed of tidal is less than flow speed of wind ignore comments about reliability or efficiency	2	AO3 4.1.3

4.5.6.1.2 Speed

Answer 145 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
01.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.1.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • wind turbine is much larger than the tidal turbine • wind turbine causes more visual pollution than the tidal turbine • tidal turbine is hidden from view (as it is under water) • tidal turbine is less likely to cause noise pollution (as it is under water) • wind turbine is likely to make more noise • wind turbine needs more raw materials (for construction) • more wind turbines needed for same power output (at the same flow speed) • wind turbine will harm birds, whereas tidal turbine will not • tidal turbine may harm fish, whereas wind turbine will not		

Total Question 1	12

4.5.6.1.2 Speed

Answer 146 · Mark scheme

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	$E_e = 0.5 \times 64 \times 0.075^2$		1	AO2 4.1.1.1
	$E_e = 0.18$ (J)	the equation $E_e = 0.5ke^2$ must have been used to score subsequent calculation marks	1	4.1.1.2
	$0.18 = 0.5 \times 0.052 \times v^2$	allow a correct substitution using their value of E_e	1	
	$v^2 = \frac{0.18}{0.5 \times 0.052}$	allow a correct rearrangement using their value of E_e	1	
	$v = 2.631\ldots$ (m/s)	allow a correct calculation using their value of E_e	1	
	$v = 2.6$ (m/s)	allow an answer given to 2 sf using **all** the data in the question alternative approach: ($F = ke$) ($F = 64 \times 0.075$) (maximum) $F = 4.8$ (N) (1) ($F = ma$) ($4.8 = 0.052 \times a$) (maximum) $a = 92.3$ (m/s^2) (1) (mean) $a = 46.2$ (m/s^2) (1) ($v^2 - u^2 = 2as$) $v^2 = 2 \times 46.2 \times 0.075$ (1) **or** $v^2 = 6.923$ $v = 2.631\ldots$ (1) $v = 2.6$ (m/s) (1)	1	

4.5.6.1.2 Speed

Answer 146 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2		ignore comments about energy dissipation allow E_k for kinetic energy allow E_p for gravitational potential energy		AO1 4.1.1.1
	kinetic energy decreases moving from **A** to **B**	allow kinetic energy is transferred to gravitational potential energy while moving from **A** to **B** for MP1 and MP2	1	
	(and) gravitational potential energy increases moving from **A** to **B**		1	
	(then) gravitational potential energy decreases from **B** to **C** and kinetic energy increases	allow gravitational potential energy is transferred to kinetic energy while moving from **B** to **C**	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	length of the toy car		1	AO2 4.1.1.2
	time for toy car to pass the light gate		1	

Total Question 10	11

4.5.6.1.2 Speed

Answer 147 · Mark scheme

June 2025 | 8463/2H | Original Q1

Question 1

Question	Answers	Mark	AO / Spec. Ref.
01.1	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account	4–6	AO1 4.6.1.1 4.6.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear	1–3	
	No relevant content	0	
	Indicative content **Differences** • sound waves are mechanical whereas visible light waves are electromagnetic waves • sound waves require a medium to travel through whereas visible light waves can travel through a vacuum • sound waves are longitudinal whereas visible light waves are transverse • sound waves travel slower (in air) than visible light waves • sound waves travel faster in solids than in air whereas visible light waves travel slower in solids than in air • sound waves have longer wavelengths than visible light • sound waves have a lower frequency than visible light waves **Similarities** • both types of waves can be reflected • both types of waves can be refracted • both types of waves can be diffracted • both types of wave transfer energy		

4.5.6.1.2 Speed

Answer 147 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	speed = $\frac{\text{distance}}{\text{time}}$		1	AO1 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$330 = \frac{13\,200}{t}$ **or** $13\,200 = 330 \times t$ $t = \frac{13\,200}{330}$ 40 (s)		1 1 1	AO2 4.5.6.1.2

Total Question 1	10

4.5.6.1.2 Speed

Answer 148 · Mark scheme

June 2025 | 8463/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	convex	allow converging	1	AO1 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	(the parallel) rays converging rays meeting/crossing at the principal focus		1 1	AO2 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	0.60 μm = 0.6 × 10^{-6} m $3.0 \times 10^{8} = f \times 0.6 \times 10^{-6}$ $f = \frac{3.0 \times 10^{8}}{0.6 \times 10^{-6}}$ $f = 5.0 \times 10^{14}$ (Hz)	allow 0.60 μm = 0.000 000 6 m all subsequent marks may be awarded if wavelength is incorrectly / not converted	1 1 1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	wavelength		1	AO1 4.8.2

4.5.6.1.2 Speed

Answer 148 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	distant galaxies are moving away from our galaxy		1	AO1 4.8.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	the distance to this galaxy is greater than any previously observed galaxies		1	AO3 4.8.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	a gravitational / centripetal / resultant force acts on the satellite		1	AO1 4.8.1.3
	(so) the satellite accelerates (towards the centre of the orbit)	do **not** accept acceleration causes a change in speed	1	
	(so) the direction changes (which changes the velocity)		1	

Total Question 4	13

4.5.6.1.2 Speed

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

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Kathleen Tattersall: *Director General*

4.5.6.1.2 Speed

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column.

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

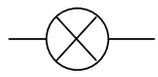
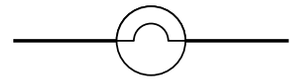
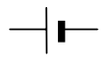
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.5.6.1.2 Speed

3451/F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct 	accept  accept any standard of drawing providing circuit would work	1
	circuit symbol for a cell correct 		1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.5.6.1.2 Speed

3451/F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time	accept fuel available all the time	1
	wind generator can only produce when the wind is strong enough	accept it's not always windy	1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.5.6.1.2 Speed

3451/F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement	accept motion / force do **not** accept energy	1
	direction		1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.5.6.1.2 Speed

3451/F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

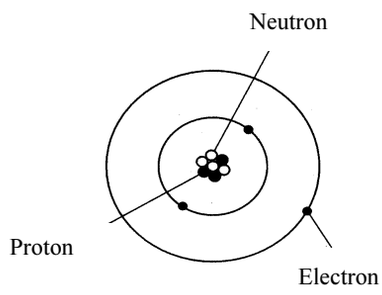
4.5.6.1.2 Speed

3451/F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

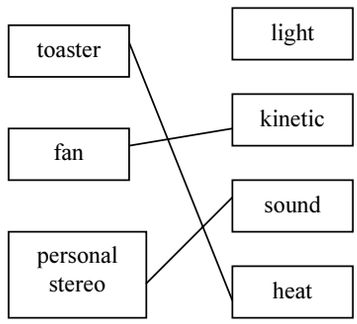
4.5.6.1.2 Speed

3451/F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.5.6.1.2 Speed

3451/F Q7

question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

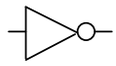
4.5.6.1.2 Speed

3451/F Q8

question	answers	extra information	mark
(a)(i)	point where the rays cross	do not credit if ambiguous	1
(ii)	converging (lens)	do **not** accept convex	1
(b)(i)	point where the rays appear to diverge from	this should appear to be within 10mm in front of the back of the arrows on the approximate centre line need not be accurately constructed using a ruler	1
(ii)	diverging (lens)	do **not** accept concave	1
(c)	converging film smaller than nearer to	accept any clear indication of the correct response e.g. ticking, ringing, writing in after a mistake	1 1 1 1
(d)(i)	(image) bigger than object / enlarge	accept just 'made bigger'	1
(ii)	it / real image can be put on a screen **or** real image on the opposite side of the lens to the object	accept 'not an imaginary or virtual image' assume 'it' refers to a real image do **not** credit 'it can be seen'	1
(e)	**either** (the converging lens is) thick in the middle thin(ner) at the edge **or** (both) sides bend outwards (1) in the middle (1) **or** one side bends in the middle (1) more than the other side bends inwards (in the middle) (1)	thickest in the middle gains **2** marks convex gains **2** marks suitable diagrams gains **2** marks	1 1
total			12

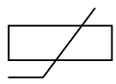
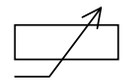
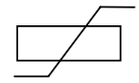
4.5.6.1.2 Speed

3451/F Q9

question	answers	extra information	mark
(a)(i)	off off on	all correct	1
(ii)	AND (gate)	accept and (gate)	1
(iii)	on on on	all correct	1
(iv)	OR (gate)	accept or (gate)	1
(b)(i)	1 0 **or** 0 1 0 1 1 0	do **not** credit on / off responses	1
(ii)		accept mirror image accept  accept with either or both parts shaded accept line through as shading	1
(c)		accept off for 0 and on for 1 throughout	
	0 0	both correct	1
	0 1	both correct	1
	1 1	both correct	1
	1 1	both correct	1

4.5.6.1.2 Speed

3451/F Q9 continued

(d)(i)		accept mirror image **or** inverted do **not** credit  **or**  or similar	1
(ii)	resistance decreases / increases / changes current (through it) increases / decreases / changes **or** temperature changes / increases / decreases (1) resistance changes / decreases / increases (1) (NTC thermistor) both marks independent but must be compatible to score **2** marks accept 'voltage across it decreases' for **2** marks but only if it is made clear that this refers to a thermistor in series		1 1
total			13

4.5.6.1.2 Speed

3451/F Q10

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.5.6.1.2 Speed

3451/F Q11

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.5.6.1.2 Speed

3451/F Q13

question	answers	extra information	mark
(a)	silver is a (good) reflector of heat (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

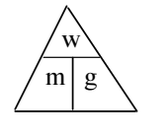
4.5.6.1.2 Speed

3451/F Q14

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.5.6.1.2 Speed

3451/F Q15

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

4.5.6.1.2 Speed

3451/F Q16

question	answers	extra information	mark
(a)(i)	upright with the contacts at the bottom and still in place and unbent	no need for labels but incorrect label(s) cancel the mark accept a freehand drawing no need for details such as correct dimensions	1
	one blob of mercury touching <u>both</u> contacts	do **not** award mark if contacts bent to touch	1
(b)(i)	(X is a) battery	do **not** credit cell accept (set of) cells accept power supply do **not** accept power pack	1
	(Y is a) LED	**or** light emitting diode	1
(ii)	longer (time)	do **not** accept 'slower time'	1
(iii)	any **two** from: current less (so) rate of flow of charge less **or** less coulombs per second (so) discharge is slower	 do **not** accept current slower accept capacitor has charge for longer **or** charge lasts longer **or** (so total of) electrons take longer to travel round circuit	2
(c)	4200	translation correct (= 4000) but percentage addition incorrect gains **1** mark translation incorrect but 5% addition is correct gains **1** mark accept 422.1 **or** 42.2 **or** 6.3 for **1** mark	2
	ohms **or** Ω	4.2 kilohms **or** 4.2 kΩ gains all **3** marks	1
total			10

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(a)	point at which its mass (seems to) act **or** point at which gravity (seems to) act	accept …its weight acts accept correct statements if the intent is clear e.g. … if suspended, the centre of gravity will be directly under the point of suspension e.g. … (if the object is symmetrical), the centre of gravity is on the **or** an axis (of symmetry) do **not** credit just 'it is a point'	1
(b)	**Quality of written communication** *The answer to this question requires good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **five** from: clamp (steel) rod (horizontally) hang plastic / sheet by rod through (one) hole hang plumb line from rod mark ends of plumb line on the sheet and use the ruler to draw a straight line repeat with other hole centre of mass is where the lines cross check by balancing at this point	*maximum of **4** marks if ideas not well expressed* **no** marks if method quite unworkable maximum of **3** marks if no 'repeat with other hole'	5
(c)(i)	(turning) effect **or** moment force distance	all three correct accept weight accept length	1
(ii)	17.6 Nm **or** newton metre(s)	allow 44 × 0.4 **or** 0.4 × 44 for **1** mark do **not** accept N/m **or** N/cm 1760 Ncm gains all **3** marks	2 1
total			10

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Science: Double Award Co-ordinated

3462

Paper 3F

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Kathleen Tattersall: *Director General*

4.5.6.1.2 Speed

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column.

4.5.6.1.2 Speed

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

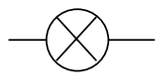
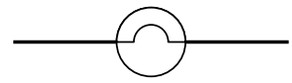
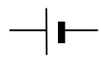
3.10 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.5.6.1.2 Speed

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct 	accept  accept any standard of drawing providing circuit would work	1
	circuit symbol for a cell correct 		1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.5.6.1.2 Speed

3462/3F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time wind generator can only produce when the wind is strong enough	accept fuel available all the time accept it's not always windy	1 1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.5.6.1.2 Speed

3462/3F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement direction	accept motion / force do **not** accept energy	1 1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.5.6.1.2 Speed

3462/3F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

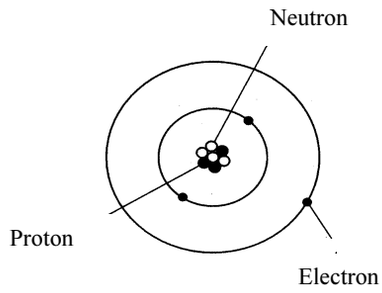
4.5.6.1.2 Speed

3462/3F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

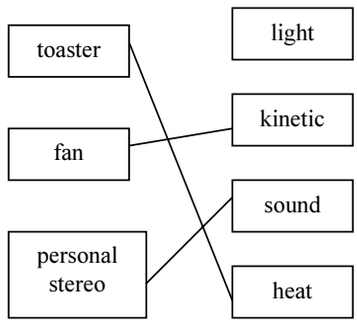
4.5.6.1.2 Speed

3462/3F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

4.5.6.1.2 Speed

3462/3F Q8

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.5.6.1.2 Speed

3462/3F Q9

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.5.6.1.2 Speed

3462/3F Q10

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)	silver is a (good) reflector of heat (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

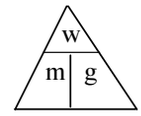
4.5.6.1.2 Speed

3462/3F Q12

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.5.6.1.2 Speed

3462/3F Q13

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.5.6.1.2 Speed

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4.5.6.1.2 Speed

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

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- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.5.6.1.2 Speed

GCSE Physics
Foundation Tier 3451/F

3451F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.5.6.1.2 Speed

3451F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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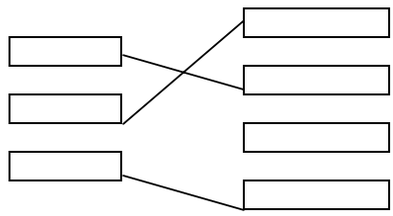
4.5.6.1.2 Speed

3451F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.5.6.1.2 Speed

3451F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.5.6.1.2 Speed

3451F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is solid outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.5.6.1.2 Speed

3451F Q6

	answers	extra information	mark
(a)	converging image object image object shorter		1 1 1 1 1 1
(b)(i)	(Earth's) gravity	accept centripetal accept minor misspellings, however, do **not** credit any response which could be 'centrifugal'	1
(ii)	to(wards) (the centre of the) Earth	allow inwards do **not** accept downwards	1
(c)(i)	**either** friction (force) **or** centripetal force between the tyres / wheels and (the surface of) the road	 allow grip allow on the tyres / wheels **or** towards the centre of the bend / arc / circle	 1 1
(ii)	mass **or** speed **or** momentum radius / diameter	allow weight allow velocity do **not** credit 'curvature' or 'circumference'	1 1
(d)	centripetal	accept minor misspellings (see above)	1
total			13

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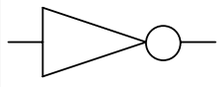
4.5.6.1.2 Speed

3451F Q7

	answers	extra information	mark
(a)(i)	two switches in series **and** circuit complete	ignore small imperfections	1
(ii)	two switches in parallel **and** circuit complete	ignore small imperfections	1
(iii)	one switch in parallel with the cell / lamp (but **not** both)	ignore small imperfections	1
(iv)	(i) AND (ii) OR (iii) NOT	accept 'and' accept 'or' accept 'not'	1 1 1
(b)(i)	when it is light the sensor sends on / high / 1 signal to the gate off / low / 0 sent to the lamp **or** when it is dark the sensor sends off / low / 0 signal to the gate (1) on / high / 1 sent to the lamp (1)		1 1
(ii)	any suitable application	e.g. to switch a security light on (and off) e.g. to switch a light on when it is dark do **not** credit just '… to switch a light on / off'	1
(c)(i)		accept shading-in of either or both parts end connections are not required accept any orientation	1
(ii)	1 0 **or** 0 1 0 1 1 0	all correct	1
(iii)	truth (table)		1
total			12

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4.5.6.1.2 Speed

3451F Q8

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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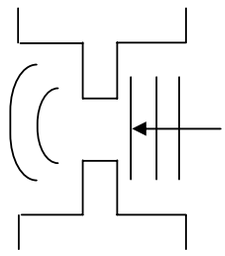
4.5.6.1.2 Speed

3451F Q9

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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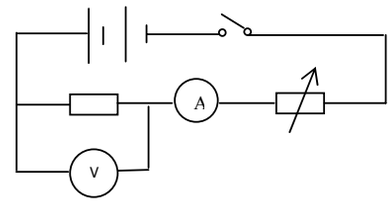
4.5.6.1.2 Speed

3451F Q10

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.5.6.1.2 Speed

3451F Q11

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

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4.5.6.1.2 Speed

3451F Q12

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration increases	accept velocity / speed increases more rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for correct use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between shuttle and Earth) plus correct orbital speed (makes shuttle move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the centripetal force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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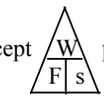
4.5.6.1.2 Speed

3451F Q13

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.5.6.1.2 Speed

3451F Q14

	answers	extra information	mark
(a)(i)	current		1
(ii)	resistance decreases	 accept 'the flow of electrons / current (through it) increases' for **1** mark do **not** credit just '… it will get warmer'	1 1
(b)	input sensor → controlled by the processor processor → detects changes in the environment output device → decides what action is needed	all pairs correct one pair correct for **1** mark	2
(c)(i)	potential divider	accept voltage divider	1
(ii)	4 (volts)	$6 \times \frac{30}{45}$ for **1** mark	2
(iii)	across the new resistor…(will) increase across R_2 … (will) decrease	 N.B. independent marks	1 1
total			10

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4.5.6.1.2 Speed

3451F Q15

	answers	extra information	mark
(a)	relay (normally open) (switch)	each mark is independent	1
	… switch on a (larger) current (in another circuit) **or** switch on a higher voltage circuit	do **not** accept switch on another circuit **or** smaller / equal current	1
	light emitting diode / LED	do **not** credit LDR	1
	… in one / direct / certain direction **or** from left to right	**or** when the cathode is connected to the negative terminal / side **or** when the left-hand side is connected to the positive terminal / side do **not** credit just '… is big enough' do **not** accept 'positive direction'	1
	AND gate	accept 'and' gate	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs	do **not** accept numerical values unless expanded	1
(b)	**Quality of written communication**	If in a sensible order which clearly indicates advantages or disadvantages, including answers in the form of a table **or** as bullet points Q ✓ Q X	1
	any **three** from: • advantage of mobile phones	e.g. more convenient for service engineers e.g. calls can be received away from base	3
	• drawback of mobile phones	e.g. privacy can be more easily invaded e.g. drivers can be distracted e.g. microwaves / radio waves can / may cause damage to the brain	
	• benefit of the Internet	e.g. access to educational material	
	• drawback of the Internet	e.g. some material is salacious e.g. spam (on external e-mail)	
		these are examples candidates may be credited for a variety of responses	
total			10

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4.5.6.1.2 Speed

3451F Q16

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u>	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark	max 2
	C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	
total			5

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GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Science: Double Award
Specification B (Co-ordinated)
3462/3F

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.5.6.1.2 Speed

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4.5.6.1.2 Speed

SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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4.5.6.1.2 Speed

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.5.6.1.2 Speed

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.5.6.1.2 Speed

3462/3F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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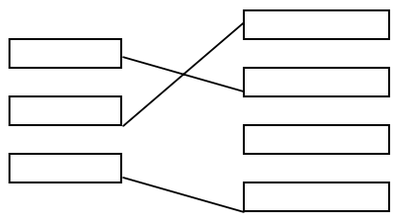
4.5.6.1.2 Speed

3462/3F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.5.6.1.2 Speed

3462/3F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.5.6.1.2 Speed

3462/3F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.5.6.1.2 Speed

3462/3F Q6

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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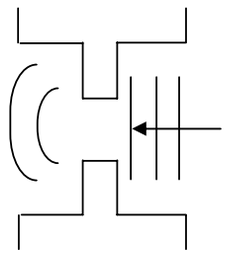
4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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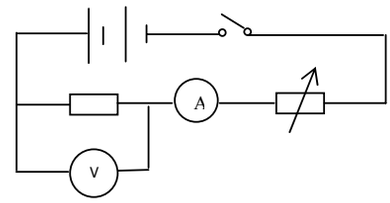
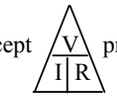
4.5.6.1.2 Speed

3462/3F Q8

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.5.6.1.2 Speed

3462/3F Q9

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) ($1.8 \times \frac{1}{2}$ or 1.8×30) i.e. adding the correct 2 power values	2
total			9

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4.5.6.1.2 Speed

3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration increases	accept velocity / speed increases more rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for correct use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between shuttle and Earth) plus correct orbital speed (makes shuttle move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the centripetal force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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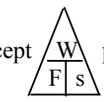
4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.5.6.1.2 Speed

3462/3F Q12

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle deflected / repelled / repulsed by the (positive) nucleus C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	max 2
total			5

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Version 1.0: *27092005*

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.5.6.1.2 Speed

Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3451/F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.5.6.1.2 Speed

3451/F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	X-rays do not go through lead	references to gamma rays are incorrect accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect	1
	Quality of written communication	award for a sensible sequence of **two** points	1
total			8

4.5.6.1.2 Speed

3451/F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

3451/F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.5.6.1.2 Speed

3451/F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

4.5.6.1.2 Speed

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest half-life	accept the others have longer half-lives	1
total			7

4.5.6.1.2 Speed

3451/F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

4.5.6.1.2 Speed

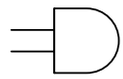
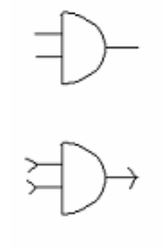
3451/F Q9

question	answers	extra information	mark
(a)	capacitor LDR relay (normally open)	accept condenser **or** light dependent resistor accept 'ldr', 'Ldr' etc. do **not** accept 'relay normally closed'	1 1 1
(b)(i)	battery	accept '(battery of) cells' do **not** accept 'battery / cell'	1
(ii)	LED	**or** light emitting diode accept 'led' or 'Led' do **not** accept just 'diode'	1
(iii)	B will light (but C will not)	accept '(only) B will work' accept 'one is on the other is off' do **not** accept 'C is on and B is off'	1
(iv)	any **one** from: B is connected the right way round (and C is not) a (light emitting) diode only allows (a significant) current to flow in one direction B's anode is connected to the positive side of the supply B's cathode is connected to the negative terminal	N.B. the candidate's answer to part (b)(iii) may include this mark but do **not** credit if the response to part (b)(iii) is incorrect or there is any other contradiction if (iv) is completely consistent with (iii) which is wrong, allow **1** mark	1
(c)(i)	first input / second input / output 0 / 0 / **0** 1 / 0 / **0** 0 / 1 / **0** 1 / 1 / **1**	**all** correct allow: OFF NO OFF NO OFF NO ON YES	1
(ii)	truth (table)		1

cont…

4.5.6.1.2 Speed

3451/F Q9 cont…

(iii)		a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do **not** give the mark if there is any ambiguity or contradiction allow 	1
(d)	light sensor	**or** light dependent resistor **or** LDR accept 'ldr', Ldr' etc allow solar cell, photo cell	1
	NOT gate	accept 'Not gate' **or** 'not gate' if both correct but in the wrong order credit with **1** mark	1
total			12

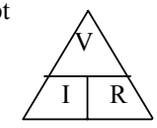
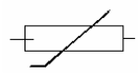
4.5.6.1.2 Speed

3451/F Q10

question	answers	extra information	mark
(a)(i)	rays continued to meet on the right hand side of the lens and beyond	must be straight lines from the right hand side of the lens ignore details through the lens allow if no arrows	1
	meet exactly on the axis	negate mark if contradictory arrow(s) added do not need to go beyond the focus for this mark	1
(ii)	(principal) focus	**or** focal (point)	1
(iii)	converging	**or** convex	1
(b)(i)	**A**		1
(ii)	rays seem to come from this point	**or** words to this effect **or** shows this on the diagram	1
(iii)	diverging	**or** concave	1
(c)	film	accept any unambiguous method of showing the correct response	1
	smaller than		1
	further away from		1
(d)	any **three** from: • real image can be put on a screen • virtual image cannot be put on a screen / film • virtual image is imaginary • real image is formed where (real) rays cross / converge • virtual image is where virtual / imaginary rays (seem to) come from • virtual image formed where virtual rays intersect / cross	allow film allow real image has light travelling through it **or** virtual image is where rays seem to come from	3
total			13

4.5.6.1.2 Speed

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow **1** mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of **P** is more than 20 Ω		1
	a smaller current goes through P / A_2 (than 20 Ω)	dependent on getting 1st mark correct accept converse	1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or 	accept correct circuit symbol allow phonetic spelling	1
	resistance goes down (as temperature of thermistor goes up)	do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1
total			10

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.5.6.1.2 Speed

3451/F Q13

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.5.6.1.2 Speed

3451/F Q14

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

4.5.6.1.2 Speed

3451/F Q14 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined	do **not** accept night time / poor vision N.B. specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only	3
total			13

4.5.6.1.2 Speed

3451/F Q15

question	answers	extra information	mark
(a)(i)	arrow from centre of the ball **and** at right angles to the string **and** in the correct direction	arrow should point to the student's belt accept free-hand 'straight' line do **not** accept curved line	1
(ii)	increase increase increase	accept 'be stronger / bigger' accept 'be stronger / bigger' accept 'be stronger / bigger'	1 1 1
(b)	speed velocity direction	all **three** correct any two correct for **1** mark otherwise **0** marks	2
(c)(i)	centripetal	accept 'centripedal' and other minor misspellings do **not** accept anything which could be 'centrifugal'	1
(ii)	gravity	accept 'weight' accept 'force of attraction due to mass(es) (of the Moon and the Earth)'	1
(iii)	electron(s)		1
(iv)	electrostatic	accept 'electrical' do **not** accept just 'centripetal'	1
total			10

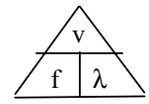
4.5.6.1.2 Speed

3451/F Q16

question	answers	extra information	mark
(a)(i)	**X** at the centre of the lifebelt	measuring from the centre of **X**, allow 2 mm tolerance in any direction	1
(ii)	any **two** from: below the point of suspension at the centre (of the lifebelt) (because) the lifebelt / it is symmetrical	if X is on vertical line below the hanger (but not at centre) can gain the first point only accept '(vertically) below **Y**' accept 'in the middle' **or** (because) the mass / weight is evenly distributed	2
(b)	Nm **or** newton metre(s) 750	accept Newton metre(s) do **not** accept any ambiguity in the symbol ie NM, nM or nm (moment) = force × (perpendicular) distance (between line of action and pivot) **or** (moment) = 500 × 1.5 gains **1** mark	1 2
(c)	**Quality of written communication**: any **three** connected points from: low(er) <u>centre of mass / gravity</u> (more) <u>stable</u> less likely to fall over the <u>turning effect / moment</u> (of the weight of case) is less so the pull on her arm is less	for **2** of the underlined terms used in the correct context **or** <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground **or** less <u>unstable</u> accept 'less likely to overturn' do **not** accept 'will not fall over' **or** so less effort is needed to hold the case ignore references to pulling the case	1 3
total			10

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(a)	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing **Quality of written communication**	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark all emboldened terms in candidate's answer used correctly	2 1
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

Version 1.0: *27092005*

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B (Co-ordinated)

Mark Scheme

2005 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

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Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3462/ 3F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.5.6.1.2 Speed

3462/3F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	**Quality of written communication**	award for a sensible sequence of **two** points	1
	X-rays do not go through lead	accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect references to gamma rays are incorrect	1
total			8

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

4.5.6.1.2 Speed

3462/3F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest <u>half-life</u>	accept the others have longer <u>half-lives</u>	1
total			7

4.5.6.1.2 Speed

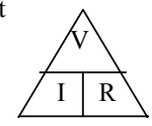
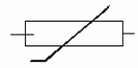
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

4.5.6.1.2 Speed

3462/3F Q9

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$ $A_4 = 0.5$	ignore any units allow **1** mark for $A_1 = A_4 \neq 0.5$	1 1
(ii)	the resistance of **P** is more than 20 Ω a smaller current goes through P / A_2 (than 20 Ω)	 dependent on getting 1st mark correct accept converse	1 1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or  resistance goes down (as temperature of thermistor goes up)	accept correct circuit symbol allow phonetic spelling do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1 1
total			10

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q10

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q12

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

4.5.6.1.2 Speed

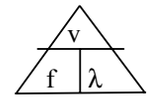
3462/3F Q12 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined	do **not** accept night time / poor vision NB specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only	3
total			13

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q13

question	answers	extra information	mark
(a)	**Quality of written communication**	all emboldened terms in candidate's answer used correctly	1
	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark	2
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2006 examination - June series

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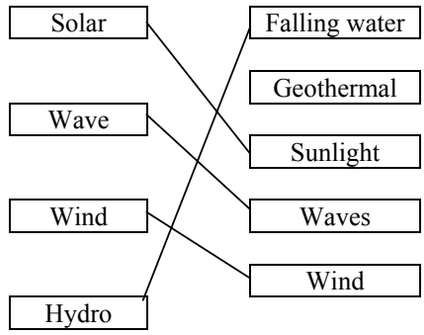
Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.5.6.1.2 Speed

3451/F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW and time in hours or seconds	2
total			5

4.5.6.1.2 Speed

3451/F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.5.6.1.2 Speed

3451/F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

4.5.6.1.2 Speed

3451/F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3451/F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

4.5.6.1.2 Speed

3451/F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3451/F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.5.6.1.2 Speed

3451/F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.5.6.1.2 Speed

3451/F Q10

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>thermistor(s)
LDR(s)
switch(es)
LED(s)
buzzer(s)
motor(s)</td><td>1 mark each
or light dependent resistor(s)
or light emitting diode(s)</td><td>6</td></tr>
<tr><td>(b)(i)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td>both correct</td><td>1</td></tr>
<tr><td>(iii)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(c)(i)</td><td></td><td>do not credit any attempt which could equally well be a poorly drawn attempt at the symbol for a cell</td><td>1</td></tr>
<tr><td>(ii)</td><td>charge

increases</td><td>accept ‘electrons’
accept ‘energy
or gets bigger/larger</td><td>1

1</td></tr>
<tr><td>total</td><td></td><td></td><td>12</td></tr>
</table>

3451/F Q11

question	answers	extra information	mark
(a)(i)	A		1
(ii)	B		1
(iii)	mass is larger	credit if the response is clear by some other means e.g. it is ringed	1
	wire is shorter	credit if the response is clear by some other means e.g. it is ringed	1
(b)	moment		1
	distance		1
(c)(i)	1		1
(ii)	5		1
(iii)	any **two** from • remove slotted mass(es) • slide (slotted) masses / weights nearer pivot • slide forcemeter away from the pivot • slide rod to the left	 **or** ….. to the left **or** ….. to the right **or** …. so that the slotted masses side is shorter **or** …. so that the forcemeter side is longer	2
(d)	centre of the rectangle	accept *2*mm tolerance any direction	1
	centre of the circle	accept *2*mm tolerance any direction	1
	on centre line and 10mm above base	accept *2*mm tolerance any direction	1
total			13

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp		1
		accept for **1** mark only the filament lamp does not obey Ohm's law	
total			9

4.5.6.1.2 Speed

3451/F Q13

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

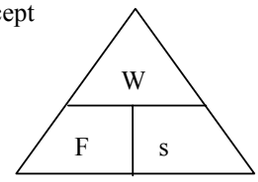
4.5.6.1.2 Speed

3451/F Q14

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

4.5.6.1.2 Speed

3451/F Q15

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time increases / is longer **or** thinking distance increases	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it increases	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1

Continued

4.5.6.1.2 Speed

Physics B – AQA GCSE Mark Scheme, 2006 June series

3451/F Q15

question	answers	extra information	mark
(ii) **E**	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.5.6.1.2 Speed

3451/F Q16

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(a)	both rays brought to a focus at F on the right	do **not** have to be continued beyond F	1
	lines have been drawn **accurately** with a ruler	only credit if 1st mark credited do **not** credit if contradictory arrow(s) added	1
(b)	rays seem to come from a focus at G on the left and continued to the right of the lens	this mark is for the current idea of divergence	1
	lines have been drawn **accurately** with a ruler	only credit if 1st mark credited do **not** credit if contradictory arrow(s) added	1
(c)	…lens… …image… …object… …image… ...object… …lens…	lens as 1st and 6th words (1) image and object in the correct order 2nd and 3rd words (1) image and object in correct order 4th and 5th words (1)	max 3
(d)(i)	correct statement about real image real rays intersect / cross to form a real image **or** a real image can be formed on a screen **or** real image is (always) on the opposite side (of the lens) **or** real image is (always) upside down (to the object)	may be credited from a correct diagram	1
	correct statement about virtual / imaginary image virtual / imaginary rays intersect / cross to form a virtual image **or** a virtual / imaginary image cannot **or** virtual / imaginary image is (always) on the same side (of the lens) **or** virtual / imaginary image is (always) same way up (as the object)	may be credited from a correct diagram	1

Continued

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(ii)	**either** image needs to fall on / affect the film **or** image needs to fall on / affect the light sensors / charged coupled devices (CCDs) (in a digital camera / mobile phone) **or** image needs to cause a chemical reaction (in / on the film)		1
total			10

4.5.6.1.2 Speed

3451/F Q18

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>AND (gate)

OR (gate)

NOT (gate)

LED or light emitting diode</td><td>accept ‘and’

accept ‘or’

accept ‘not’ or invert gate

accept ‘led’</td><td>1

1

1

1</td></tr>
<tr><td>(b)(i)</td><td>NOT (gate) and AND (gate)</td><td>both in either order or ‘(the) gates’

any additions lose the mark</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Switch for fire</th><th>Tilt switch</th><th>Signal to relay</th></tr><tr><td>0</td><td>0</td><td>…0…</td></tr><tr><td>0</td><td>1</td><td>…0…</td></tr><tr><td>1</td><td>0</td><td>…1…</td></tr><tr><td>1</td><td>1</td><td>…0…</td></tr></table></td><td>all correct

allow off or no
off no
on yes
off no</td><td>1</td></tr>
<tr><td>(iii)</td><td>(relay) acts as / is a switch

either
small current from the electronic / control circuit / system (1)

large current through the output / (electric) fire (1)

or

full current through electronic control system (1)

may damage components / lead to overheating / electric shock (1)

QoWC for correct use of the scientific term ‘current’</td><td>accept implication that it works as a switch e.g. ‘turns on fire’

or ‘small current through the coil (of the relay)’

do not accept small current is turned into a large current

annotate Q✓ Q×

if answer in terms of voltage isolation / voltage/ p.d. accept QoWC mark for correct use</td><td>1

1

1

1</td></tr>
<tr><td>total</td><td></td><td></td><td>10</td></tr>
</table>

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B

Mark Scheme

2006 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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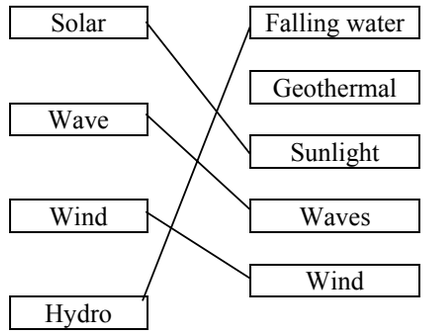
Double Award (Co-ordinated)
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.5.6.1.2 Speed

3462/3F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW and time in hours or seconds	2
total			5

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.5.6.1.2 Speed

3462/3F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3462/3F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3462/3F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.5.6.1.2 Speed

3462/3F Q10

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q10

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp	accept for **1** mark only the filament lamp does not obey Ohm's law	1
total			9

4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

4.5.6.1.2 Speed

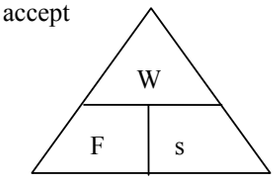
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q12

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

4.5.6.1.2 Speed

3462/3F Q13

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time <u>increases</u> / is <u>longer</u> **or** thinking distance <u>increases</u>	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it <u>increases</u>	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q14

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

4.5.6.1.2 Speed

PMT

AQA

GCSE

Science A / Physics

PH1HP

Mark scheme

4405/4403
June 2015

Version/Stage: 1.0 Final

4.5.6.1.2 Speed

PMT

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Further copies of this mark scheme are available from aqa.org.uk

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Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.5.6.1.2 Speed

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.1 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.2 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **2a** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)	chemical kinetic sound	correct order only	1 1 1	AO1 P1.2.1a
1(b)	37.5% or 0.375	an answer rounded to 0.38 or 38% scores both marks an answer of 0.375 with a unit gains **1** mark an answer of 0.375% gains **1** mark an answer of 37.5 with or without a unit gains **1** mark allow **1** mark for an answer 3/8 3/8 with a unit scores 0	2	AO2 P1.2.1d
Total			**5**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP – JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2 (a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.		6	AO2 AO3 P1.2 HSW	E

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	There is a relevant statement about an energy saving method	There is at least one clear comparison of energy saving methods and their cost effectiveness with an appropriate calculation	There is a comparison of energy saving methods and their cost effectiveness with appropriate calculations. Comparison to include further detail.

examples of physics points made in the response	extra information
examples of relevant statements • energy efficient boiler saves the most (energy / money) per year • loft insulation costs the least to install • double-glazing costs the most to install **examples of statements that include cost effectiveness** • loft insulation is the most cost effective in the long term • double-glazing is the least cost effective • loft insulation has the shortest payback time • double-glazing has the longest payback time • payback time calculated for any method **examples of further detail** • for cost effectiveness install in the following order: loft, cavity wall, boiler, double-glazing • for reducing energy use install in the following order: boiler, loft, cavity wall, double glazing • don't install double-glazing for insulation purposes • double-glazing won't pay for itself in your lifetime • justified choice of best / worst method	payback times: energy efficient boiler: 6.25 years loft insulation: 2 years double glazing: 100 years cavity wall insulation: 2.86 years

Question 2 continued . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.
2(b)(i)	how effective a material is as an insulator	accept 'heat' for energy accept how effective a material is at keeping energy in accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy transfer	1	AO1 P1.1.4a
2(b)(ii)	(the U-value) decreases		1	AO1 P1.1.4b
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)(i)	0.5 °C		1	AO3 P1.1
3(a)(ii)	data is continuous **or** both variables are continuous **or** independent variable is continuous **or** time is continuous	accept results / measurements for data accept data is not categoric one variable is continuous is insufficient air temperature is continuous is insufficient	1	AO3 P1.1
3(b)(i)	20.5 (°C)		1	AO2 P1.1
3(b)(ii)	60 (minutes)	accept 1 hour	1	AO2 P1.1
3(c)(i)	so a comparison can be made **or** outside temperature is a control variable	accept: (outside) temperature would affect energy required (to maintain temperature of the house) **or** (outside) temperature would affect internal temperature (of the house) **or** heat loss will be faster on a cold day outside temperature will affect the results is insufficient fair test is insufficient	1	AO3 P1.1

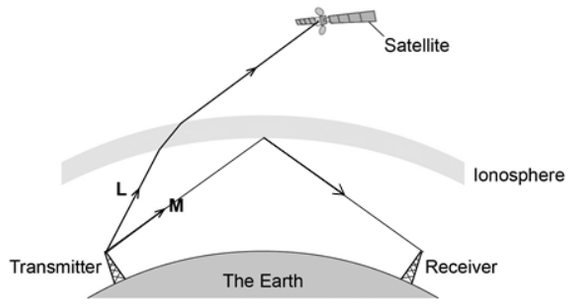
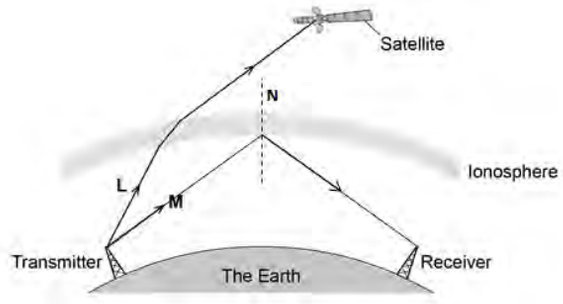
Question 3 continues on the next page . . .

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(c)(ii)	the cost is equal to the number of kWh x the cost per kWh calculation 0.8 / 8.0 = 0.1 or 10%	accept (heating) bill depends on (number of) kWh used accept energy for kWh allow 7.2 / 8.0 = 0.9 or 90%	1 1	AO3 AO2 P1.1
3(c)(iii)	heating is on for more / less time (than anticipated) because some days it is cooler / warmer (than anticipated)	 accept other sensible suggestions an answer giving two sensible situations gains **2** marks possible examples: • some houses have different amounts of insulation • there are different styles of house temperature (inside / outside) is always changing is insufficient	1 1	AO3 P1.1
Total			**9**	

PMT

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP – JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)(i)	microwave		1	AO1 P1.5.1k
4(a)(ii)	refraction		1	AO1 P1.5.1g
4(b)(i)	wave M continues as a straight line to the ionosphere and shown reflected correctly reflected wave shown as a straight line reaching the top of the receiver  	accept reflection at or within the ionosphere if more than 2 rays shown 1 mark maximum ignore arrows	1 1	AO2 P1.5.2b
4(b)(ii)	normal drawn at point where their **M** meets the ionosphere  		1	AO1 P1.5.2a

Question 4 continues on the next page. . .

Question 4 continued…

Question	Answers	Extra information	Mark	AO / Spec. ref.
4(c)	any **two** from: • transverse • same speed (through air) • can be reflected • can be refracted • can be diffracted • can be absorbed • transfer energy • can travel through a vacuum • can be polarised • show interference	accept speed of light **or** 3 x 10^8 m/s an answer travel at the same speed though a vacuum scores **2** marks travel in straight lines is insufficient	2	AO1 P1.5.1a,bc, d,g
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(a)(i)	infrared (radiation)	accept IR (radiation)	1	AO1 P1.1.1b
5(a)(ii)	(heated) water turns to steam steam turns a turbine turbine turns a generator	ignore reference to fossil fuels do **not** accept water evaporates to steam accept turbine connected to a generator	1 1 1	AO1 P1.4.1a
5(b)(i)	(so the molten salts) can store large amounts of energy	accept there is a small temperature change for a large energy transfer accept heat for energy	1	AO2 P1.1.4d
5(b)(ii)	16 (hours)	an answer that rounds to 16 gains **2** marks eg 15.71 allow **1** mark for a correct substitution ie 2 200 000 = 140 000 x t	3	AO2 AO1 P1.3.1c
5(b)(iii)	the number of daylight hours varies the (mean) power (received from the Sun per square metre) varies	less sunlight is insufficient accept an answer in terms of maximum possible electrical output only possible during Summer for **1** mark	1 1	AO2 AO3 P1.4

Question 5 continues on the next page . . .

Question 5 continued . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(c)(i)	non-renewable power stations have higher Capacity Factors than renewable power stations		1	AO1 AO3 P1.4
	fuel (for non-renewable power stations) is always available	reference to non-renewable power stations operating all the time is insufficient non-renewable energy sources are reliable is insufficient	1	
	(most) renewable energy sources are unpredictable / unreliable	accept (most) renewable energy sources depend on the weather	1	
5(c)(ii)	the (proportion of) time that solar storage power stations can generate electricity is greater (than for other renewable energy sources)		1	AO1 P1.4
Total			**14**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO/Spec ref.
6(a)	Doppler (effect)		1	AO1 P1.5.4a
6(b)	(reflected microwaves) wavelength decreased (reflected microwaves) frequency increased (reflected microwaves) have same speed		1 1 1	AO1 P1.5.4a P1.5.1d
Total			4	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
7(a)	4200	allow **2** marks for correct substitution ie 6930 = 0.330 x c x 5.0 answers of 1050 **or** 840 **or** correctly calculated answer from correct substitution of incorrect temperature change **or** identification of temperature change ie 5 ˚C gain **1** mark	3	AO2 AO1 P1.1.4d
	J/kg˚C	accept J/kg K	1	
7(b)	(in a metal) free electrons	to gain full credit the answer must be in terms of free electrons	1	AO1 P1.1.3a
	gain kinetic energy	accept move faster	1	
	(free electrons) transfer energy to other electrons / ions / atoms	do **not** accept particles	1	
	by collision		1	
		allow a maximum of **2** marks for answers in terms of atoms / ions / particles • gaining kinetic energy or vibrating faster / more • transferring energy by collisions		
7(c)	(air) particles spread out		1	AO1 P1.1.3a
	(which causes the) air to become less dense / expand	do **not** accept particles become less dense	1	
	(so the) warm air rises	do **not** accept heat rises particles rise is insufficient	1	
7(d)	large surface area	ignore references to type of metal or external conditions	1	AO1 P1.1.3c
	black / dark (colour)		1	
Total			**13**	

4.5.6.1.2 Speed

AQA

GCSE

Science A / Physics

PH1HP

Mark scheme

4405/4403
June 2016

Version 1.0: Final Mark Scheme

4.5.6.1.2 Speed

PMT

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.5.6.1.2 Speed

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **2(b)** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	frequency		1	AO1 1.5.3b
1(b)	echo(es)		1	AO1 1.5.3c
1(c)	spreading (out) equal to	changing direction is insufficient moving apart is insufficient bending is insufficient accept: similar to same (order of magnitude) as slightly smaller than slightly larger than	1 1	AO1 1.5.1g
1(d)	340 (m/s)	allow **1** mark for correct substitution ie 25 000 x 0.0136 provided no subsequent step **or** allow **1** mark for a correct calculation showing an incorrect value from conversion to hertz x 0.0136 an answer of 0.34 gains **1** mark	2	AO2 1.5.1j
1(e)	(a wave where the) oscillations are parallel to the direction of energy transfer causing (areas of) compression and rarefaction	both marking points may appear as labels on a diagram accept vibrations for oscillations accept in same direction as for parallel to allow direction of wave (motion) for direction of energy transfer accept correct description in terms of particles mechanical wave is insufficient needs a medium to travel through is insufficient	 1 1	AO1 1.5.1b
Total			**8**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	any **one** from: • high cost of installing overhead power lines or underground cables or pylons • high cost as (very) long cables needed • amount of electricity required is too low	allow not enough (surplus) electricity would be generated	1	AO1 1.4.1e

Question 2 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(b)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.		6	3 AO1 2 AO2 1 AO3 1.4.1b

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	at least **one** advantage **or one** disadvantage of either method	at least **one** advantage **and one** disadvantage is stated for **one** method **and** a different advantage **or** disadvantage is stated for the other method	clear comparison of advantages **and** disadvantages of **each** method

examples of physics points made in the response	extra information
Advantages of both methods:	
• both renewable sources of energy	
• both have no fuel (cost)	accept carbon neutral
• both have very small (allow 'no') running costs	accept no greenhouse gases
• no carbon dioxide produced	accept doesn't contribute to global warming
Advantages of wind:	
• higher average power output	produces more energy is insufficient
Advantages of hydroelectric:	
• constant / reliable power (output)	
• lower (installation) cost	
Disadvantages of wind:	
• higher (installation) cost	
• variable / unreliable power output	
• (may) kill birds / bats	
Disadvantages of hydroelectric:	
• lower power output	
• (may) kill fish or (may) damage habitats	
• more difficult to set up (within river)	
Disadvantages of both methods	
• (may be) noisy	
• visual pollution	ignore payback time unless no other relevant points made ignore time to build for both

Total			7

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	a proportion / percentage of the energy is wasted	allow heat for energy allow some energy is wasted	1	AO2 1.2.1b 1.2.1c
	(wasted) energy is transferred to surroundings **or** energy is needed to heat pan (before food is heated)		1	
3(b)	(fins have a) large(r) surface area	accept fins increase the surface area	1	AO1 1.1.1c 1.1.1e 1.1.3c
	(black metal surface is a) good / better absorber of infrared radiation	allow 'heat' or 'energy' for infrared radiation ignore good emitter of infrared radiation not a good reflector is insufficient	1	
3(c)	the higher the temperature (of the saucepan) the greater the rate at which infrared radiation is emitted	accept converse answer allow the higher the temperature the more infrared radiation is emitted allow there is a positive correlation	1	AO2 1.1.1b
Total			**5**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	**use of infrared:** remote controls fibre optic (communications) **use of microwaves:** mobile/cell phones satellite (communications/TV) wi-fi Bluetooth	 accept mobiles accept phone signals	1 1	AO1 1.5.1k
4(a)(ii)	any **two** from • same speed **or** travel at the speed of light (in a vacuum) • transverse • transfer energy (from one place to another) • can be reflected • can be refracted • can be diffracted • can be absorbed / transmitted • can travel through a vacuum/space • can be polarised	 accept a full description of a transverse wave travels in straight lines is insufficient	2	AO1 1.5.1c 1.5.1d 1.5.1e 1.5.1g
4(b)(i)	Cosmic Microwave Background (Radiation)	accept CMBR	1	AO1 1.5.4d
4(b)(ii)	 the Big Bang (theory) predicted the existence of CMBR **or** only the Big Bang (theory) supports the existence of CMBR	allow microwave radiation for CMBR throughout allow it supports / proves the Big Bang (theory) accept CMBR disproved other theories, eg steady state	 1	AO1 1.5.4e
Total			**6**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	no particles (in a vacuum) (so) no / reduced conduction and no / reduced convection	 both energy transfer methods needed for the mark	1 1	AO1 1.1.3a
5(b)(i)	78 (°C)	allow **2** marks for correct temperature change ie 22 ˚C allow **1** mark for correct substitution ie 46 200 = 0.5 x 4200 x θ **or** $\frac{46200}{0.5\times4200}=\theta$	3	AO2 1.1.4d
5(b)(ii)	6.4 (W)	allow **2** marks for an answer that rounds to 6.4 allow **1** mark for correct substitution ie 46 200 = P x 7200 an answer of 23 000 or 23 100 or 385 gains 1 mark	2	AO2 1.3.1c
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	any **two** from: • cost per kWh is lower (than all other energy resources) • infrastructure for nuclear power already exists • more reliable (than renewable energy resources)	allow it is cheaper ignore fuel cost ignore energy released per kg of nuclear fuel accept cost of setting up renewable energy resources is high accept many renewable power stations would be needed to replace one nuclear power station accept (France in 2011 already had a) surplus of nuclear energy, so less need to develop more renewable capacity for increased demand in the future accept France benefits economically from selling electricity accept (nuclear) fuel is readily available ignore destruction of habitats for renewables	2	AO1 AO2 1.4
6(b)	any **two** from: • non-renewable • high decommissioning costs • produces radioactive / nuclear waste • long start-up time • nuclear accidents have widespread implications	allow nuclear fuel is running out accept high commissioning costs allow waste has a long half-life allow for nuclear accident a named nuclear accident eg Fukushima, Chernobyl ignore visual pollution	2	AO1 1.4.1f

Question 6 continues on the next page . . .

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(c)	0.48 (kW)	allow **1** mark for correct substitution ie 0.15 = P / 3.2 an answer of 480 W gains **2** marks an answer of 48 or 480 scores **1** mark	2	AO2 1.2.1d
6(d)	the higher the efficiency, the higher the cost (per m^2 to manufacture)	accept a specific numerical example	1	AO2 AO3 1.4.1c
	more electricity could be generated for the same (manufacturing) cost using lower efficiency solar panels **or** (reducing the cost) allows more solar panels to be bought	accept a specific numerical example	1	
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	surface area **or** duration of experiment	accept shape of beaker size of beaker is insufficient	1	AO3 1.1.3b
7(b)	any **two** from: • takes readings automatically • takes readings more frequently • reduces / no instrument reading error • higher resolution • don't need to remove probe to take reading • more accurate	ignore easier **or** takes readings for you ignore human error allow better resolution	2	AO3 1.1.3
7(c)(i)	0.07 (°C/s)	allow **1** mark for obtaining a temperature drop of 7(ºC) allow **1** mark for an answer between 0.068 and 0.069 (°C/s)	2	AO2 1.1.3d
7(c)(ii)	rate of temperature change is greater at the start **or** rate of temperature change decreases	accept rate of evaporation is greater at the start allow rate of evaporation decreases allow temperature decreases faster at the start	1	AO3 1.1.3b

Question 7 continues on the next page . . .

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(c)(iii)	A lower temperature decrease (over 200 seconds)	reason only scores if A is chosen accept lower gradient	 1	AO3 1.1.3b
7(c)(iv)	no effect (as rate of evaporation is unchanged)	allow larger temperature change (per second as mass of liquid is lower)	1	AO3 1.1.3b
7(d)	particles with more energy leave the (surface of the) liquid (which) reduces the average (kinetic) energy (of the remaining particles)	accept particles with higher speeds allow reference to the total energy of the liquid reducing	1 1 1	AO1 1.1.3b
Total			**11**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1HP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	any **two** factors: • surface area (of mug in contact with cup warmer) • thickness of mug • temperature of heater / coffee • power of the heater	 accept temperature difference (between heater and coffee) accept power of the laptop ignore efficiency of the heater	2	AO3 1.1.3c
8(b)	 atoms (gain kinetic energy and) vibrate faster / more energy is passed on from atom to atom by collision	allow particles / molecules for atoms allow bigger / faster vibrations do not accept start to vibrate accept vibrations for energy an answer in terms of free electrons scores zero	 1 1	AO1 1.1.3a
8(c)	 the particles spread out (so) coffee becomes less dense (so) the heated coffee rises (and) cooler / denser coffee falls	allow fluid / liquid / water for coffee throughout answer allow particles move further apart allow (coffee) expands particles rise is insufficient particles fall is insufficient	 1 1 1 1	AO1 1.1.3a
Total			8	

4.5.6.1.2 Speed

Answer 116 · Examiner comments

June 2018 | 8463/2H | Original Q3

Question 3 (Standard demand)

03.1 Just over 50% of the students scored this mark

03.2 Only 30% of students were able to use the information in Figure 3 to calculate the frequency of the wave.

03.3 Just over 75% of the students were able to write the correct equation.

03.4 Nearly 70% of the students who could recall the equation calculated the wavelength correctly.

03.5 This is a topic new to this specification. 19% of the students knew that S-waves do not travel through a liquid and could relate this to the Earth having a liquid (outer) core.

03.6 23% of the students scored the mark, generally for simply stating ‘generator effect’.

Answer 116 · Examiner comments

June 2018 | 8463/2H | Original Q3

03.7 37% of students realised that this was to do with the movement of the magnet.

03.8 This was well answered with just over 76% of students choosing the correct answer.

03.9 Just over half of the students scored zero. Answers such as ‘bigger magnet’ or ‘more coils’ were too vague to gain credit.

4.5.6.1.2 Speed

Answer 117 · Examiner comments — June 2018 | 8463/2H | Original Q8

Question 8 (Standard/high and High demand)

08.1 Just over half the students wrote answers that were worthy of some credit but often only gained a single mark, which was usually for a match to the third marking point. It was very unusual to see acceleration mentioned. Frequent incorrect answers were in terms of variations in the radius of the satellite's orbit, despite it being shown as circular in Figure 14. Other students commented on the physical geography of the Earth having an effect on the orbit or the velocity being affected by the Earth's magnetic field. A few students stated that the satellite was falling on the right hand side and getting faster as a result.

08.2 Over 50% of the students completed this calculation correctly to score all five marks. A further 10% of the students scored four marks because they rounded the number of orbits to 16. Some of students incorrectly used 300 km as the length of the orbit.

08.3 This part was generally well answered with just over 70% of students scoring this mark.

08.4 About 50% of the answers matched one of the marking points but few students scored both marks. Some students expressed the view that the predicted and actual values for the radius of Uranus' orbit were too different to support the prediction. Many answers referred to Uranus or the Solar System rather than Bode's prediction or equation.

Answer 121 · Examiner comments — June 2019 | 8463/2H | Original Q2

Question 2 (Standard demand)

02.1 Most of the students did suggest using a piece of apparatus that was, recognisably, one that could be thought of as having been designed to measure a length. Many, however, failed to describe it with sufficient clarity to be given the mark. The most common answers that did not gain a mark were 'ruler' and 'metre stick'. A minority of the students opted for pieces of equipment from Figure 4, such as 'signal generator'. Only 57% of the students gave a correct answer.

02.2 Just over 81% of the students knew this equation.

4.5.6.1.2 Speed

Answer 121 · Examiner comments June 2019 | 8463/2H | Original Q2

02.3 Some students failed to convert 80 cm to 0.8 m but they were usually able to substitute values into the correct equation and calculate the answer. There were a number of students who used 50 Hz in their calculation despite 55 Hz appearing in the stem of this part question and in Figure 4. There were only a few answers that involved the use of an incorrect value for wavelength.

02.4 Nearly 80% of the students scored at least one mark with half of these scoring both marks. Moving the bridge was a more popular correct answer than changing mass. Some students gave both movement of the bridge and changing the mass but contradicted themselves by, for example, moving the bridge to the right and decreasing mass. References to shortening the string suggested that the students understood what was required but did not describe how to adjust the apparatus to change the length. Similarly, some answers mentioned changing tension but gave no indication of how this could be achieved.

02.5 The majority of the students were able to describe how to vary the tension in the string by changing the masses. Most were able to continue to describe measuring the wavelength and some then described how to calculate wave speed. The aspect that was missing, from all but a few of the answers, was a description of how to obtain a new wave pattern on the string, by moving the bridge or adjusting the frequency.

Answer 122 · Examiner comments June 2019 | 8463/2H | Original Q5

Question 5 (Standard and standard/high demand)

05.1 Half of the students were able to answer this correctly. Distance, amount, speed and frequency were common incorrect answers.

05.2 Around 18% of the students scored this mark. The life cycle of stars was often confused with the Big Bang theory. Other incorrect answers gave one but not both of the required pieces of information, usually the ‘dense’ idea which was sometimes linked to small, but rarely the ‘hot’ idea.

05.3 ‘Further away is faster’ was a common incomplete answer; a large number of correct responses had directly proportional rather than just proportional. If this phrase were not used, very few could describe directly proportional correctly. A significant number of responses just said positive correlation or linear relationships. 36% of the students scored this mark.

05.4 Approximately 47% of the students scored this mark.

4.5.6.1.2 Speed

Answer 122 · Examiner comments June 2019 | 8463/2H | Original Q5

05.5 This was not well answered; there seemed to be a lot of confusion over the graph, with some students appearing to be under the impression that it charted the speed of one particular galaxy over time as it moved away from its original location at the position of the Earth. The response 'directly proportional' required for **05.3** occurred frequently.

05.6 Many answers had 'expanding' but very few qualified this with 'faster' or 'at an increasing rate'. Quite a number of answers wrote about gravity getting less or running out. A fifth of the students scored this mark.

05.7 The reason for peer review was understood with around 72% of the students scoring this mark. Correct answers mainly addressed the bias and finding mistakes ideas. Incorrect responses included comments about proving the theory and there were vague statements about accuracy, repeatability and reliability.

05.8 Nearly half of the students scored both marks. Where students did not score both marks, it was often because they had not appreciated that the speed of light would be the same so if one factor increased, the other decreased. The inability to express answers coherently was evident in responses that referred to longer frequency or faster frequency or compressed waves.

4.5.6.1.2 Speed

Answer 123 · Examiner comments

June 2019 | 8463/2H | Original Q8

Question 8 (Standard and standard/high and high demand)

08.1 Just over 63% of the students scored both marks with approximately further 30% scoring one mark. Those scoring only one mark often did so because they incorrectly had the downward force equal in size to air resistance. A few students did not score the first mark as they drew two incorrect sideways arrows as well as the correct downwards arrow.

08.2 Just over half of the students scored the final two marks showing an understanding that balanced forces result in terminal velocity. Many students gave answers in terms of the resultant force being zero. Many of the students did not score the second marking point because they failed to explicitly link increasing air resistance to acceleration. A number of students used the term upthrust for the upward acting force and appeared to think the air resistance was caused by moving sideways through the air during the descent. Many stated the incorrect idea that there was a much larger value for gravity closer to the Earth's surface than at the height of the plane. A noticeable number did not refer to the forces involved in the motion despite being asked for this in the question and many then went on to explain what would happen once a parachute was opened.

08.3 About 82% of the students scored full marks on this question. A few of the students did not appreciate that they should calculate the gradient and incorrectly calculated speeds at individual points on the graph.

08.4 Only around 40% of the students scored any marks on this question. Few of the students described the lower density of the air correctly, with most simply stating there were fewer particles. Very few related the lower air resistance to being able to accelerate longer before reaching terminal velocity. The majority of the students simply stated that the skydiver would accelerate for longer because they were falling from a greater height, which was not creditworthy.

4.5.6.1.2 Speed

Answer 124 · Examiner comments

November 2020 | 8463/1H | Original Q6

Question 6 (Standard/High demand)

06.1 This question proved more challenging than expected with only 30% of students identifying two measurements and 51% of students identifying one.

06.2 73% of students scored all 4 marks for this question. A common mistake was not to convert the energy into J. This meant that the mass of the boy was much lower than the expected value (0.05 kg). Weaker students then rearranged the equation incorrectly to get a more believable answer, a common response was 20 kg ((17 x 9.8) / 8.33). Another common calculation error was to divide 8330 by 9.8 then multiply by 17.0 resulting in a mass of 1445 kg, which apparently didn't strike students as being a high value for the mass of a boy.

06.3 Very few students scored 3 or 4 marks for this question. Since the acceleration down the slide is unlikely to be uniform due to the changing gradient this question could not be answered by consideration of equations of uniform acceleration, therefore an approach using energy transfers was the only appropriate answer. A discussion involving terminal velocity didn't score as the slide height is not sufficiently high for terminal velocity to be reached. The first marking point was the most likely to be scored by students. 25% of students scored 1 mark, while 67% of students scored zero.

4.5.6.1.2 Speed

Answer 125 · Examiner comments — November 2020 | 8463/2H | Original Q2

Question 2 (Standard demand)

02.1 The most common error was to give 'fission' as the answer in the second space.

02.2 Just under 70% of students were able to recall this equation.

02.3 This calculation was generally well done. There were errors made with the standard form and in the rearranging of the equation.

02.4 The lifecycle of stars was well known. However many students limited the mark they scored by not giving any relevant detail beyond the stages the star goes through.

02.5 About 50% of students correctly identified the property of the star.

Answer 126 · Examiner comments — November 2020 | 8463/2H | Original Q6

Question 6 (Standard and standard/high and high demand)

06.1 The majority of the students were able to convert MHz to Hz correctly. A large number of the students did not know the unit of wavelength with the symbol 'λ' being a common incorrect answer.

06.2 Only 3% of students were able to write a complete answer to this question. Many of the students described the final movement of the car rather than what happens in the electrical circuit. A significant number of the students thought that absorbing radio waves would result in sound being produced. Some of the students realised that there would be a current in the aerial but used terms such as 'produce a current' and 'produce an electrical signal' which were insufficient for credit to be awarded.

06.3 The most frequent correct answer was to state that radio waves are transverse and sound waves are longitudinal. Another popular correct answer was the idea of radio waves being able to travel through a vacuum / space. Comparisons of wavelength / frequency did not gain any marks due to the overlapping range of wavelength and frequency of radio waves and sound waves.

06.4 83% of students correctly described the motion of the car during the first 30 seconds.

06.5 The majority of the students knew how to calculate velocity from a straight line graph but failed to realise the significance of the curved line. Those few students that drew an appropriate tangent to the line at 20s generally went on to score all four marks.

06.6 Whilst 25% of the students gained all six marks for this calculation, a significant number of the remaining students gained partial credit for clearly showing the working out, part of which was correct.

06.7 There were very few complete and correct answers to this question. A significant number of the students correctly referred to air resistance increasing with speed but then went on to state that air resistance becomes equal to speed. It was common for answers to be in terms of real cars, the effect of speed on braking distances or the likely increase in accidents.

4.5.6.1.2 Speed

Answer 127 · Examiner comments — November 2021 | 8463/1H | Original Q8

Question 8
This question was well attempted, with the multistep calculation in **08.2** discriminating well between students. Many students calculated the change in gravitational potential energy but couldn't take the next step in the calculation, so scored 2 marks only.

Answer 128 · Examiner comments — November 2021 | 8463/2H | Original Q1

Question 1 (Common Question)
Part **01.1** asked students to explain factors and not simply list them. However, this is what many of the students did. Another common error was to explain factors affecting thinking distance rather than as asked, braking distance. The required equations were well known and the calculation required to answer **01.3** was often given correctly. Reading values from a graph proved difficult with only about half of the students answering **01.4** correctly.Less than 50% of the students scored full marks in part **01.6**. Generally only those students completing the calculation correctly scored the unit mark. However many of the students did score the mark for correctly giving a calculated incorrect numerical answer in standard form.

Answer 129 · Examiner comments — November 2021 | 8463/2H | Original Q3

Question 3
This question was poorly answered. Few of the students knew which forces act during the main sequence stage or what happens to a star after the main sequence ends. To gain full marks it was not sufficient to simply state the names of the subsequent stages correctly. A significant number of the students gave answers that referred to both stars of the same size and mass of the Sun (the required answer) and to stars much larger than the Sun. These answers scored no marks as the

Answer 129 · Examiner comments — November 2021 | 8463/2H | Original Q3

students had produced a list without indicating which of the options presented was correct. In part **03.3** the correct choice (option A) needed to be accompanied by a comparative reason to score both marks. Simply stating something like 'it has a low speed' was insufficient.

Answer 130 · Examiner comments — November 2021 | 8463/2H | Original Q4

Question 4
Few of the students showed knowledge of lenses, were able to describe a trend in detail, the meaning of uncertainty in measurements or why objects appear different colours. In part **04.1** few students could describe the image shown. Answers such as 'not real' and 'fake image' are not acceptable for the term 'virtual'. In **04.2** the ray diagram was not completed well by most students. Some of the students drew a correct diagram for a concave lens, however, this did not answer the question asked so did not gain credit.

4.5.6.1.2 Speed

Answer 131 · Examiner comments — November 2021 | 8463/2H | Original Q5

Question 5

Although a number of correct uses were given for ultraviolet a number of the students appeared to confuse UV with ultrasound. The meaning of the prefix ‘nano’ was not well known. However the students that knew the correct equation for part **05.3** (about 35% did not) did go on to use the value chosen in **05.2** to calculate a correct answer. Only about half of the students could use the data presented in Table 1 to correctly answer part **05.4.** Most of the students scored no marks for part **05.5**, with many either simply giving an example of each type of wave, or failing to link the direction of oscillation to either direction of energy transfer or direction of wave travel.

Answer 132 · Examiner comments — November 2021 | 8463/2H | Original Q6

Question 6

Although it was frequently seen, an answer only in terms of removing anomalous results was insufficient. The reason being that the question asked not only the advantage of repeating but also taking a mean. Very few of the students gave a precise answer in terms of reducing the effect of random errors. The calculation produced a full range of marks with most of the students scoring 2 or less. For part **06.3** there were a number of very good answers covering all three marking points. However, most of the students failed to answer the question asked as they simply described a way that the teacher could have measured the wavelength.

Answer 133 · Examiner comments — November 2021 | 8463/2H | Original Q7

Question 7

In part **07.1**, few students could name a force. Most of the students gave answers such as ‘energy’, momentum’ and ‘speed’. Once again reading a correct value from a graph proved difficult and prevented many of the students from scoring full marks. Despite part **07.3** using both the word ‘force’ and the word ‘moment’ few of the answers used either word and so scored no marks. Clear working out in part **07.4** allowed some students to gain some credit even when the final answer was wrong. An approach that was often seen was to first calculate time and then acceleration. However, those doing this tended to use the final velocity, instead of the average velocity. The final part produced few totally correct answers. Common errors included: showing the wrong direction, or not indicating the direction, of the resultant force; inaccurate scale drawing; no indication of what angle was being given; and giving a calculated answer with no vector diagram attempted.

4.5.6.1.2 Speed

Answer 137 · Examiner comments

02.1

58% of students calculated the displacement correctly. Those who did not gain the mark simply measured the route taken by the aircraft and scaled that distance up, showing that many students do not appreciate the difference between displacement and distance.

02.2

82% of students successfully calculated the resultant force to be zero.

02.3

Having successfully calculated the resultant force to be zero, few students stated that the plane was moving at a constant speed. Many said it was stationary or accelerating, not appreciating the lack of resultant force.

02.4

Students did not appear to understand the concept of a contact force, often quoting gravity as one. In addition, they gave forces already quoted in the question as answers.

02.5

This was successfully done by the majority of students, with 64% correctly linking distance and velocity and drawing correct graphs.

02.6

The minority attempted to draw a smooth curve and extrapolate this to the 10km line. Those who did generally used the graph correctly, with 44% of students gaining both marks. A number of students misread the scale on the graph and quoted incorrect values from their line. It was common to see a straight line, which often allowed the award of 1 mark for a correct reading of the value.

02.7

84% of students knew that as the height of the aeroplane above the ground increased, the average density of the air decreased.

4.5.6.1.2 Speed

Answer 138 · Examiner comments June 2023 | 8463/2H | Original Q5

05.1

41% of students were awarded this mark. There were a lot of good answers in terms of both conservation of energy and momentum. Answers in terms of no external forces were also credited. Some answers were too vague to score or were answered outside of the context of the question, for example, in terms of a Chemistry approach.

05.2

30% of students answered the question correctly. Those who did not, tended to just state Newton's 3rd Law, rather than stating how it applied in this context.

05.3

96% of students scored both mars for calculating the force.

05.4

10% of students were given all three marks for this explanation. Most responses were creditworthy. Reducing force was the most common 1 mark awarded. Many students also gained the first marking point, about increasing the time for the collision to occur.

Answer 138 · Examiner comments June 2023 | 8463/2H | Original Q5

05.5

Students find it difficult to use this equation of motion. This was where not showing the substitution of the data in the equation had the biggest impact. Many students were unable to rearrange the equation with some dividing the two expressions instead of subtracting them. 68% gained all 3 marks, recognising that they had to square root their value to obtain the velocity.

4.5.6.1.2 Speed

Answer 139 · Examiner comments June 2023 | 8463/2H | Original Q6

06.1

88% of students scored this mark. The vast majority of responses seen said ‘satellite’, with a small number giving the alternative ‘moon’.

06.2

61% of students were able to achieve full marks for this calculation. Those that did not, didn't convert the wavelength into metres, or converted incorrectly. Most students were able to give their answer in standard form.

06.3

Many students only scored the compensation mark and it was rare to see answers where acceleration towards Earth was included. Few students linked a change in direction to a change in velocity, with some describing the converse.

06.4

6% of students gained full marks for this explanation. students scored a mark for the 2nd or 3rd marking point, and it was unusual to have to consider the award of the compensation mark. A significant number of students thought that galaxies A and B were emitting radiation with a greater wavelength than that emitted by the Sun.

Answer 140 · Examiner comments June 2024 | 8463/2H | Original Q2

02.1

79% of students scored the first mark, with a minority citing 9.8 N / gravity for the resultant vertical force. Many quoted Newton’s laws as an explanation; very few students said, ‘the child isn’t accelerating‘ and a number stated that the forces were equal but failed to explain that the forces were in opposite directions.

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4.5.6.1.2 Speed

Answer 140 · Examiner comments

June 2024 | 8463/2H | Original Q2

02.2
99.6% of students wrote down the correct equation for work done.

02.3
95% of students scored all 3 marks for this calculation of force. There were some errors rearranging.

02.4
84% of students gained the first mark point for explaining why the speed of the baby walker increased as the baby moved onto the hard floor, but few referred to the resultant force. A significant number of students thought there was no friction on the hard floor. Some responses were in terms of energy rather than forces.

02.5
99.7% of students wrote down the correct equation for the moment of a force.

02.6
75% of students scored all 3 marks for the calculation of the moment; 24% did not convert 7.5cm to 0.075m or converted incorrectly.

02.7
This question related to interaction of two gears. When marks were gained, this was primarily for the first mark point. Some expressed ideas for the second mark point and but rarely in the correct terms, sometimes referring to momentum, rather than moments. There were a number of responses in terms of energy transfers. 10% of students scored both marks, 73% scored 1 mark.

4.5.6.1.2 Speed

Answer 141 · Examiner comments

June 2024 | 8463/2H | Original Q3

03.1
Generally, well answered with 50% of students gaining all 3 marks for naming types of object that make up our solar system, and 35% getting 2 marks. Many students did not make the distinction between artificial and natural satellites. A number listed different stages in the life cycle of stars.

03.2
94% of students chose the star mostly likely to become a black hole. A common incorrect answer was Cynus A, the star with the lowest mass.

03.3
56% of students were able to convert gigametres to metres.

03.4
This is always a difficult topic for students. Many students recognised that galaxy A is travelling faster. A large number of students didn't clearly state the light spectra were showing red-shift or that the galaxies were moving away from us, so were unable to achieve the first and / or the second mark points. Students who stated the light spectra were showing red-shift often went on to achieve all 3 marks (17%).

03.5
63% of students scored all 4 marks for this calculation of time. The most common error was not converting the distance to metres. Some students got confused dividing numbers in standard form, ending up with an incorrect power.

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Answer 141 · Examiner comments

June 2024 | 8463/2H | Original Q3

03.6
23% of the students were able to give a complete account of how all the elements larger than hydrogen formed and achieve level 2. 24% gave partial accounts that missed out a stage and a 25% gave only a beginning, a middle or an end. The remainder mentioned the lives of stars without mentioning fusion or the processes at all, or clearly had no idea what a star was or described chemical bonding of gas molecules. 47% of the students gained 1 or 2 marks in this question but those who achieved level 2 showed a good understanding beyond recall, suggesting that this topic has been well established in the teaching and is one that many students have a passion for.

4.5.6.1.2 Speed

Answer 142 · Examiner comments June 2024 | 8463/2H | Original Q4

04.1
This question asked students to explain the effect of increasing depth on the pressure on a submarine. A common error was repeating the question stem “as depth increases” rather than referring to increasing height (volume or mass) of water above the submarine.

04.2
Quite a well answered question with over 72% of students gaining all 4 marks for calculating the depth of the Mariana Trench. Another 20% did not convert the pressure, or converted incorrectly.

04.3
75% of students knew what types of waves P and S-waves are.

04.4
68% of students selected the position where only P-waves are detected following an earthquake. However, the reasons often referred to “it was in a straight line” or “it was below the earthquake”. A number of students just referred to the core without specifying the inner or outer core. Others confused which layers are liquid and which are solid, even though this information was given in the diagram.

04.5
95% of students gained at least 2 marks in this calculation of wavelength. Converting was sometimes unclear, often being done at the end rather than the beginning of the working, preventing students gaining all 3 marks. .

04.6
This question was about the relationship between the distance an earthquake is from a seismometer, and the time difference between P and S-waves arriving at it. 15% of students gained both marks and 30% gained 1 mark. Those who didn’t score had misunderstood the question stem. A small number had identified that greater distance meant a greater time difference, but then called this inversely proportional.

Answer 143 · Examiner comments June 2024 | 8463/2H | Original Q5

05.1
Only 25% of students were able to name the force acting through the string. There are a significant number of students on higher tier who are unable to distinguish between forces and types of energy.

05.2
29% of students gained this mark by identifying a control variable. There is a misconception that ‘keeping things the same’ equates to a control variable. The idea that you would, for example, change the string or the bench in the middle of an investigation is not creditworthy.

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4.5.6.1.2 Speed

Answer 143 · Examiner comments June 2024 | 8463/2H | Original Q5

05.3
Very few students (0.94%) scored full marks for a description of how to calculate acceleration with the given data. Very few appreciated the necessity to use the maximum velocity in the calculation and did not gain the second mark point as a result. Many students merely quote two formulae, often simply using symbols and not quoting the correct subject of the formula. Describing a calculation, rather than performing one, appears to be a skill that few students have practised.

05.4
This uncertainty calculation was generally well done, and those students who knew the difference between range, mean and uncertainty found the question straightforward. 62% gained both marks. However, it was clear that many students were unsure of the meaning of these terms and were therefore unable to calculate an uncertainty successfully.

05.5
This was a demanding question, requiring an explanation of how the raising of the runway affected the acceleration of the trolley. Very few students (0.3%) scored the full 2 marks. Many were able to appreciate the idea of acceleration increasing because of an increased resultant force, but virtually none could link this to the correct component of the weight. Those who adopted the energy approach in their answer similarly found the question challenging and failed to give a complete response relating work done to the energy transfer causing the increase in final velocity and hence acceleration.

Answer 144 · Examiner comments June 2024 | 8463/2H | Original Q7

07.1
Most students appreciated the idea of using the area under the graph to calculate the distance travelled with 55% scoring full marks. Some, however, tried to calculate the area under the whole graph rather than limiting their calculation to the first 600 s. Common mistakes were seen in those who could not read the scale on the axes correctly, or who tried to calculate the areas of incorrect triangles or rectangles.

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4.5.6.1.2 Speed

Answer 144 · Examiner comments

June 2024 | 8463/2H | Original Q7

07.2
A minority of students gained the first mark point for interpreting the velocity-time graph. Weaker responses referred to acceleration, or a slower deceleration, or stated that the rate of deceleration was slower. Only 49% gained marks on this question.

07.3
Students needed to determine the maximum deceleration from the velocity – time graph. Many incorrectly used the whole of the final section of the graph, calculating 2 gradients and adding them together, or used the section from 720s to 960 s. A minority calculated the average deceleration and were awarded a compensation mark. Most gradients were calculated with the correct values, but a small number read the velocity as 58 m/s or the time as 700 s or 1000 s. 41% scored all 3 marks.

07.4
30% of students scored full marks on this multi-step calculation of distance. These students tended to use the preferred method, or the first alternative method, given on the mark scheme. 45% scored 3 marks, usually because they used the final velocity instead of the mean velocity in distance = speed × time, so could not access the final 3 marks.

07.5
77% of students scored at least one mark in this question about how alcohol affects stopping distance. There was references to time being slowed down, and confusion between distance and time. 15% scored all 3 marks.

4.5.6.1.2 Speed

Answer 146 · Examiner comments June 2025 | 8463/1H | Original Q10

10.1

Many students were successful with this multi-step calculation question. Nearly 60% of the students scored 6 marks, while almost 10 % scored 5 marks. A significant number of students tried to answer the question using equations from paper 2, which was creditworthy, but virtually no students arrived at the correct answer using this method. Some students scored the significant figures mark by completing an incorrect calculation using all the data provided in the question. The most common mistake was not squaring the extension in the elastic potential energy equation. Ensuring that students substitute first before rearranging is a good way of scoring method marks in calculations, even if the final answer is incorrect.

10.2

Students who stated the names of energy stores didn't score any marks unless they stated how the amount of energy changed or stated that kinetic energy was transferred to gravitational potential energy, for example. Mention of elastic potential energy from the spring in Q10.1 was ignored for this question. E_k and *KE* were acceptable abbreviations for kinetic energy; E_p and *GPE* were acceptable abbreviations for gravitational potential energy. Just over 60 % of the students scored 3 marks, while just over 10% scored 2 marks and just fewer than 10 % scored 1 mark.

10.3

Only about 25 % of the students scored 2 marks for identifying the correct measurements needed to determine the speed of the car at the end of the track. Nearly 75% of the students scored 1 mark. The most common incorrect choice was the length of the track.

4.5.6.1.2 Speed

Answer 146 · Examiner comments

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.6.1.2 Speed

Answer 147 · Examiner comments June 2025 | 8463/2H | Original Q1

1.1

Almost all responses gained marks, with the majority being awarded 2 or 3 marks.

The most common differences were for a comparison of speed, transverse and longitudinal, and whether each type of wave could travel through a vacuum.

Students struggled giving a completely correct definition of transverse and longitudinal, but this wasn't needed if they had already stated whether each was transverse or longitudinal. Some did get these the wrong way round, but they knew the terms.

A few quoted the speeds of each type of wave correctly. Again, this wasn't required if they had given the correct comparison of speed.

Whilst a lot of students knew that light was an electromagnetic wave, very few knew that sound was mechanical. Stating that sound is not an electromagnetic wave or that light is was enough to be counted as a comparison.

Approximately 50 % of the students scored 3 marks or less because they did not identify any similarity and so gave a level 1 response, regardless of giving many differences.

Answer 147 · Examiner comments June 2025 | 8463/2H | Original Q1

The most common similarity given was that both transferred energy; however some students did include the extra similarities of both waves being reflected, refracted, transmitted and absorbed.

Simply stating that light can be seen and sound heard was insufficient.

A number of responses included other information about how each type of wave was detected and how each could be used medically, which was not the focus of the question.

1.2

Almost all of the students identified the correct equation linking distance, speed and time.

1.3

A straightforward substitution, rearrangement and evaluation to calculate the time was completed successfully by almost all of the students. A few examples of incorrect rearrangement resulted in an answer of 0.025. Many students adopted good practice and showed both the substitution and rearrangement stages.

4.5.6.1.2 Speed

Answer 148 · Examiner comments June 2025 | 8463/2H | Original Q4

4.1

This question was answered well. The majority of the students correctly stated 'convex' as the type of lens. 'Converging' was occasionally used.

4.2

Answer 148 · Examiner comments June 2025 | 8463/2H | Original Q4

Almost three quarters of the students scored both marks for completing the ray diagram. However a significant number of the others tried adding objects, images or additional incorrect lines.

4.3

Approximately half of the students failed to convert the wavelength correctly. Some of the students struggled with the rearrangement, but there were also numerous examples of mathematical errors for example 3.0/0.6 = 0.5 or 3.0/6.0 = 5. There was also a notable lack of understanding regarding the use of standard form. Students also need to understand that answers given in standard form are perfectly acceptable.

4.4

Only just over half of the students knew that when radiation is red-shifted there is an increase in wavelength. Incorrect answers such as 'frequency' and 'wave speed' were commonly seen.

4.5

Over 93 % of students knew why radiation from distant galaxies is red-shifted.

4.6

This question tested awareness of what red-shift tells us. Just fewer than 60% of the students gained this mark. Many of the students knew how red-shift related to speed but not the relationship between greatest red-shift and greatest distance away.

4.7

The James Webb Telescope orbits the Sun and those students who read the question carefully answered in terms of the Sun, but sometimes focussed on the different speeds at different points of an elliptical orbit. The majority of the students did not understand the Physics of circular orbits but were able to state that to stay in a circle the direction had to be constantly changing.

4.5.6.1.2 Speed

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GCSE
PHYSICS

8463/1H: Paper 1 (Higher tier)
Report on the Examination

8463
June 2022

Version: 1.0

4.5.6.1.2 Speed

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4.5.6.1.2 Speed

General

Grade 4-5 calculation questions ask for students to recall an equation, before using it in a subsequent calculation. In the 2022 series, students were given an Equations Sheet which had all the equations printed on it. Subsequently, the performance on the more straightforward calculations has improved on previous years.

The multistep calculations targeted at candidates working at grades 8-9, questions **09.1** and **10.1**, were well attempted with many students answering correctly. Of these two questions, students were slightly more successful on question **09.1** with about 55% of students scoring full marks, whereas for question **10.1** approximately 45% of students scored full marks.

Question **02.1** was generally well attempted and students who had carried out the density required practical had an advantage over those who hadn't. For this question, about 35% of students scored 6 marks and approximately 25% of students scored 5 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. Students who have handwriting that is difficult to read may benefit from a scribe or from word processing their answers in exams.

Question 11

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

4.5.6.1.2 Speed

Question 1 (Standard demand)

01.1 About 55% of students scored 2 marks. The unit conversion caused a problem for many students and powers of 10 errors were frequently seen. A correct calculation using an incorrectly or not converted value for power would score 1 mark.

01.2 Students were generally successful at answering this question with approximately 40% scoring 2 marks and about 50% scoring 1 mark. Most students wrote variations of the first and third bullet points in the markscheme. A number of students wrote that the turbines may be broken, which was enough to score a mark for the idea of maintenance.

01.3 'Turbine will rotate faster' was insufficient to score a mark. 'Rotate more smoothly' was not enough to score the 'less friction' mark. Students who stated that 'no energy was wasted' did not score the second marking point. Approximately 35% of students scored 3 marks, 35% of students scored 2 marks and 20% of students scored 1 mark.

01.4 About 30% of students scored 2 marks, while approximately 50% of students scored 1 mark. Many students answered in terms of 'saving energy' which was insufficient. Other students answered in terms of absolute statements which did not score, 'energy efficient appliances waste no energy' for example.

Question 2 (Standard demand)

02.1 Generally very well answered with about 35% of students gaining 6 marks and 25% scoring 5 marks. Students were told that this required practical would appear in the 2022 series via the Advance Information. A number of students quoted the density equation incorrectly, although this was given on the Equations Sheet for the 2022 series. There were extremely few students who didn't attempt the question and less than 1% of students who attempted the question scored zero.

02.2 Approximately 85% of students answered this question correctly. Of the incorrect answers seen, a significant proportion gave the maximum and minimum values the wrong way round. Another common mistake was to write maximum: 2.55 and minimum 0.10, which showed a clear misunderstanding of expressing an uncertainty.

02.3 About 95% of students answered this question correctly.

02.4 Approximately 45% of students scored 2 marks and 40% scored 1 mark. 'In case an error / mistake was made the first time' was insufficient. 'To check the repeatability of the data' was ignored, as this wouldn't improve the accuracy of the data. 'Get rid of anomalies' was assumed to mean 'remove anomalies', but 'stops anomalies from occurring' did not score. Likewise 'stops random errors' did not score.

Question 3 (Standard demand)

03.1 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.2 Nearly 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the equations sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

03.3 Over 99% of students answered this question correctly as they had all the Physics equations on the Equations Sheet for the 2022 series.

03.4 95% of students answered this question correctly. In this series all students were given all the equations on the Equations Sheet. The first mark is for the substitution into the equation as it appears on the Equations Sheet. Some students failed to score any marks by incorrectly rearranging the equation, then substituting into the incorrectly rearranged equation.

Question 4 (Standard/High demand)

04.1 A large number of students found it difficult to identify the independent and dependent variables in the investigation that was described. Control variables appeared often in students' answers. 'Temperature change' seemed to be the most common incorrect answer for the dependent variable. About 50% of students scored 2 marks and approximately 35% of students scored 1 mark.

04.2 65% of students answered correctly. The most common incorrect answer was 87.4 °C.

04.3 About 35% of students answered this question correctly. Common incorrect answers referred to the resolution, or just repeated the question and said 'difficult to read' which was insufficient.

04.4 Approximately 75% of students scored 3 marks and about 10% of students scored 2 marks. Power of 10 errors were common and usually resulted in 2 marks being scored for an incorrectly or not converted value of energy.

04.5 Many students found relating the time for the temperature to decrease to thermal conductivity difficult. About 15% of students scored 2 marks, while 40% scored 1 mark. Answers in terms of good / bad insulators were insufficient to score a mark.

Question 5 (Standard/High demand)

05.1 Approximately 45% of students scored 1 mark, with about 5% of students scored 3 marks. Around 30% of students scored no marks. The first marking point of this explanation was most likely to score, the third marking point was least likely to score.

05.2 About 30% of students scored all 3 marks for this explanation. 10% of students scored 2 marks and 10% scored 1 mark. A lot of student answers were not creditworthy, with mixed up descriptions of ion transfer, electron transfer, proton transfer, protons weighing more than electrons and transfer of electrons increasing the mass of the rod on the balance. As a result about 50% of students scored zero.

05.3 Approximately 60% of students scored the mark. Some students evidently did not know what a zero error was. Answers like 'it means there is no error' being a good example of this. Some answers were insufficient, 'the actual mass of the rod is not required' being not enough to score the mark. 'Weight' was allowed for 'mass' when used correctly as the reading on the balance does depend on the weight of the object. An answer of 'only the change in weight was needed' would have scored the mark.

05.4 Some very good explanations were seen and about 10% of students scored all 3 marks. The first marking point was least likely to score. The third marking point needed to be linked to the second marking point before it could be scored.

Question 6 (Standard/High demand)

06.1 This question discriminated well between students. About 15% scored 4 marks with 20% gaining 3 marks. The first two marking points were most commonly scored. Students who said that 'no energy was lost' as a consequence of the step-up transformer's effect did not score the third marking point.

06.2 Approximately 55% of students scored 2 marks, while 15% of students scored 1 mark. Students who scored no marks usually confused the quantity that was decreased (pd) with the quantity that increased (current). Some student answers lacked technical accuracy referring to energy, power or charge incorrectly.

06.3 Two thirds of students scored 4 marks for this calculation, whereas about 20% of students scored 3 marks. A common mistake was to try to multiply the answer by the number of seconds in a day, which would probably only score the significant figure mark if correct, as the Physics equations were applied incorrectly.
Common mistakes were to round the answer to 1 400 000 000 C, which would score 3 marks if the full s.f. answer was seen, or round the answer to 141, which would score 3 marks for the supporting calculations if seen. A common error was to miscount the number of zeroes, so would only score 3 marks.

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Question 7 (Standard/High demand)

07.1 54% of students could state what an alpha particle consists of. The list principle was applied when students wrote '2 protons and 2 neutrons – a helium atom', which did not score.

07.2 65% of students completed the nuclear equation correctly, scoring 2 marks, whereas 24% scored just 1 mark.

07.3 Students generally made good attempts to answer this question and marking points 1, 2 and 4 were seen most often. To score the 5th marking point students need to make a comparative statement, internal versus external damage. The third marking point was least likely to score, as students rarely referred to dose or the living cells / tissues / organs inside the body. Some students incorrectly thought that ionisation was a process that happened to cells, rather than atoms, so often didn't score the fifth marking point for this reason. Very few students scored 5 marks and the question discriminated well between students of differing ability.

Question 8 (Standard/High demand)

08.1 About 90% of students gave the correct measuring instrument. While it wasn't seen often, an answer of a 'volumetric pipette' was also creditworthy. 'Pipette' was insufficient.

08.2 Around 90% of students correctly identified the hazard in the investigation.

08.3 For this calculation, about 45% of students scored 5 marks and 20% of students scored 4 marks. A common mistake was to calculate *L* using one of the masses given in the question, rather than the change in mass. The resulting numerical answer would score zero as the equation was not being used correctly.

08.4 About 15% of students scored 2 marks for this explanation and 10% of students scored 1 mark. Many students reached incorrect conclusions and many students simply reworded the information given in the question.

08.5 7% of students scored 2 marks and 3% of students scored 1 mark. Many students reached incorrect conclusions and many students reworded the information given in the question without adding to it.

Question 9 (High demand)

09.1 Approximately 55% of students scored 5 marks, but in the 2022 series students were provided with an Equations Sheet with all the equations. A commonly seen answer was 73 500, which scored 4 marks for not converting the height into metres.

09.2 5% scored 2 marks and about 30% scored 1 mark. Many students failed to score a mark by pointing to the 'inaccuracy of the measured mass / height / gravitational field strength', or referring to the measurements as being 'low resolution'. 'Mass may have been greater than 60 kg' or 'time may have been longer / shorter than 1.40 seconds' were other common incorrect answers.

09.3 About 75% of students identified the correct conclusion.

Question 10 (High demand)

10.1 About 45% of students scored 6 marks for this extended calculation, but in the 2022 series students were provided with an Equations Sheet with all the equations. Therefore, students were supported when it came to attempting this question. With an alternative approach using equations from paper 2, students' answers were marked on whichever approach brought them closest to the correct final answer. An answer of 6 m/s with no supporting working did not score full marks as students could achieve this answer by multiplying the spring constant and the extension together, which would give them the maximum force acting on the toy aeroplane.

10.2 About 65% of students scored the mark. The most common incorrect answers seen were gravitational potential or elastic potential.

10.3 Approximately 20% of students scored a mark. Many students failed to score a mark because they gave a factor without a specific change e.g. 'extension of spring', rather than 'increase the extension of the spring'.

Question 11 (High demand)

Due to incorrect Advance Information guidance being issued for this question, and to avoid students being disadvantaged, Question 11 was discounted and all students were awarded full (9) marks.

4.5.6.1.2 Speed

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account of how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.6.1.2 Speed

Questions matter

GCSE

Physics

8463/1H

Report on the examination

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June 2025

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4.5.6.1.2 Speed

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4.5.6.1.2 Speed

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General

Grade 4-5 calculation questions ask for students to recall an equation first before using it in a subsequent calculation, however in the 2025 series, students were provided with all of the equations on the Physics Equations Sheet. Subsequently, the performance on all calculations has improved compared with years when equations have needed to be recalled from memory.

The grade 8-9 multistep calculations, question **09.2** and **10.1**, were well attempted with many students scoring full marks. Question **09.2** had nearly three quarters of the students scoring 6 marks, while question **10.1** had almost 60 % of the students scoring 6 marks.

Question **02.2** was well attempted and students who had carried out the specific heat capacity required practical would have had an advantage over those who had not. For this question, just fewer than 40% of the students scored 5 or 6 marks and a further 46% of the students scored 3 or 4 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. An increasing number of students are using computers to word process their answers for extended response questions, which is helpful for examiners in awarding credit for student responses. However, students must use the question number as printed in the question paper e.g. 04.3 rather than 4(c) to ensure that their work is matched and marked with the corresponding question part.

Many students did not cross out the work they did not want to be marked. This results in the 'list principle' being applied which means if there are two sets of working or answers and they conflict, the student scores zero.

Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

01.1

Common answers which were insufficient included 'running out', 'not running out', 'sustainable', 'not sustainable'. The specification uses the word 'replenished' so words equivalent to this were needed, so 'replaced' or 'more of the energy resource is produced' were just able to score a mark. For non-renewable the idea that the resource is finite, or there is a limited amount was needed to score the mark. It was not enough to just state the exact

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opposite of the renewable energy resources mark point. Just fewer than 20 % of the students scored 2 marks, while just over 50 % of the students scored 1 mark.

01.2

Almost all of the students scored this mark for writing down the equation linking density, mass and volume using the equation sheet provided in this exam series.

01.3

The vast majority of the students scored 3 marks for this grade 4-5 calculation of mass using the density equation.

01.4

This question was poorly answered with fewer than 10 % of the students scoring 2 marks. About 30 % of the students scored 1 mark. Students who said that tidal power output was greater than wind power did not score a mark without reference to a particular flow speed. If wind flow speed was a consistent 2 m/s and tidal flow speed never reached 0.75 m/s the wind turbine's power output would be greater.

01.5

A good range of environmental impacts were described by many students. To score within level 2, students needed to make at least one comparative statement about a factor for both turbines. The simplest way of doing this was to compare relative size.
An answer; 'The wind turbine is larger, but harms birds. The tidal turbine harms fish but does not cause visual pollution' would score 4 marks.
Nearly all of the students scored some marks with nearly 50% scoring 3 or 4 marks.

02.1

Answers such as 'electrical devices near water' were insufficient, as was 'wires in the water'. A low p.d. power supply also is not a hazard, unless water was spilled on it, in which case it would score for the 'spilled water' which in a typical science laboratory is a hazard by itself. Risks by themselves like electrocution, electric shock or burns did not score but were ignored if given with an appropriate hazard. About 75 % of the students scored this mark usually for identifying 'hot water' or the 'heater' as the hazard. While in this experiment it is unlikely that water is at boiling point, 'boiling water' was creditworthy for 'hot water'.

02.2

To score 5 or 6 marks, students needed to be clear how the mass of the water should be determined. There were some very good, straightforward methods seen to calculate specific heat capacity, a graphical approach scored no additional credit. Some students who had more complex methods often became confused with the significance of what the gradient of their graph represented. It was possible for a student to score 6 marks for measuring the energy needed to increase the temperature of a suitable volume of water by just 1°C as the method would work, even if the temperature change is not as large as may be needed to obtain an accurate value.

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02.3

Almost all of the students scored this mark for identifying that the beaker of water needed insulation and/or a lid. Any named insulation was allowed for this question. Aluminium / tin foil was also allowed as it would reduce energy transfer by infrared radiation. Place the beaker on a 'heatproof' mat was also creditworthy as it would decrease energy transfer through the base of the beaker by conduction.

02.4

Nearly three quarters of the students scored 2 marks for this percentage difference calculation. The most common mistake was to calculate the percentage difference between 4200 and 4410 which didn't score marks, unless they had set out the top of the equation correctly, (4410 – 4200) or (4200 – 4410) or calculated the difference of 210. Many students calculated 105 or 1.05, which scored no marks unless the working out was shown.

An answer of 4.76% or working showing a calculation of this figure, rounded to 5% scored no marks.

03.1

An answer of; 'Increase the resistance' without a method to do so was insufficient. 'Use the variable resistor' was just enough to score a mark, given there is a variable resistor in the circuit provided. Just over 60 % of the students scored the mark.

03.2

Almost all of the students chose the correct equation linking *I*, *V* and *R*.

03.3

Just fewer than 90 % of the students scored 4 marks, while a further 7 % of the students scored 3 marks. Reading the value of current from the graph proved difficult for a small minority of the students. A large tolerance was allowed for mark points 2, 3 and 4.

03.4

Most students identified that LEDs only allow charge to flow in one direction. Current in one direction was equivalent to this. Some students incorrectly thought that the ammeter was not capable of measuring a negative current, or thought that the order of the components mattered, or that the switch was open. Just over 20 % of the students scored 2 marks, while almost 30 % of the students scored 1 mark.

04.1

For marking point 1 a link was needed between the type of gas and the effect it has i.e. the greenhouse effect. Students who incorrectly linked carbon dioxide to ozone depletion could not score the first marking point. Most of the students scored at least 1 mark.

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4.5.6.1.2 Speed

04.2

Just fewer than 80 % of the students read the correct value of 8000 kg from the graph. Students who answered incorrectly usually chose the wrong car and wrote 5000 kg or read the maximum value when the electric car had driven 100 000 km.

04.3

Just over 90 % of the students scored the mark for correctly reading where the two lines crossed over on the graph. A large tolerance was allowed as the two lines had similar gradients at the cross-over point.

04.4

A surprising number of the students thought that carbon dioxide exhaled by the passengers of the car was the cause of the additional carbon dioxide being released. Other incorrect ideas involved the breakdown of the battery or the tyres or the catalytic converter. Few students stated that the car/battery needed (re) charging. Even fewer students linked the electricity generated to a type of energy resource and usually just repeated the information given in the question. Only 15 % of the students scored 2 marks, while a further 35% of the students scored 1 mark.

04.5

Just over 70 % of the students chose nuclear and solar as the correct energy resources. The most common incorrect choice was biofuel.

05.1

Just over 80 % of the students scored 2 marks for correctly describing what is meant by an isotope of an element. The number of electrons was ignored as this does not define an isotope.

05.2

Students needed to say light / lighter / small nuclei to demonstrate they understood that it is only lighter nuclei which fuse. The word fuse could have been substituted for other words like ‘join’, or ‘combine’ but ‘collide’ was insufficient. Some students demonstrated an excellent understanding of the fusion process and fusion in stars was accurately described. Fusion on earth where an extra neutron is released was ignored, as the process as stated in the specification was being tested. Just fewer than 20 % of the students scored 3 marks, while nearly 30 % of the students scored 2 marks and approximately 15 % of the students scored 1 mark.

05.3

Most students who scored a mark did so for stating that the reactor walls should not melt. Few students scored the first marking point. Most students were vague and used phrases like the walls need to ‘withstand the high temperatures’ which did not score a mark. Many students confused specific heat capacity with thermal conductivity and thermal insulation. Containing the fusion energy or products was another common insufficient response. Only

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about 4 % of the students scored 2 marks, while approximately 40 % of the students scored 1 mark.

05.4

Just over 30 % of the students scored the mark for the consequence of an uncontrolled chain reaction. 'Explosion' unqualified was insufficient to score the mark.

06.1

Just over 90 % of the students scored 3 marks on this grade 4-5 calculation of temperature increase using the specific heat capacity equation.

06.2

Just over 80 % of the students scored 4 marks for this calculation of charge flow using the equation $E = QV$. About 15 % of the students scored 3 marks as they had either not converted or converted incorrectly the energy into Joules.

06.3

Students found this question difficult with very few scoring marks because of incorrect assumptions about how potential difference, current and resistance are affected by series and parallel circuits. Marking point 2 was dependent on marking point 1 so that students who stated that the current was increased without a valid reason would not score. The third mark was demanding in requiring an understanding of how $P = IV$ related to the circuit being considered. Just over 80% of the students scored no marks.

07.1

Nearly all of the students chose the correct reason for why scientists change the model used to describe the structure of an atom.

07.2

Many students were confused about the distinction between irradiation and radioactive contamination. Many thought that it had to do with being exposed to radiation inside or outside the body, or one causing harm the other not causing harm. Exposure to a radioactive source was insufficient to score the irradiation mark. Without using the word 'exposed' students often did not express their ideas clearly enough. 'Absorbing radiation from a source' would have been another way of gaining credit for this idea. Students were more secure explaining what radioactive contamination meant and often gave examples like 'radioactive dust' or radioactive atoms' being present on or in people / objects. Almost a quarter of the students scored 2 marks, while just over 40 % of the students scored 1 mark.

07.3

About 90 % of the students scored 2 marks for this nuclear equation, while about 5 % of the students scored 1 mark.

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4.5.6.1.2 Speed

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07.4

'4 half-lives' needed to be seen to score the first mark, the number '4' was not sufficient by itself for a mark. The most common mistake was to divide 256 000 by 16 000 to give an answer of 16, which scored no marks. Just over 70 % of the students scored 3 marks.

07.5

More / less active was insufficient as was a description of activity in terms of rate of decay.
Just over 20 % of the students scored 2 marks, while a further 12 % of the students scored 1 mark.

08.1

Just fewer than 90 % of the students scored 4 marks on this calculation of specific latent heat. Students who did not convert or incorrectly converted the mass could score a maximum of 3 marks.

08.2

Most students did not refer to the energy of the particles in terms of kinetic and potential energy, so scoring no marks. Many students thought the kinetic energy of the particles changed which limited them to scoring only the first marking point. Only about 3 % of the students scored 2 or 3 marks, while just over 10 % of the students scored 1 mark.

08.3

Students made good attempts at answering this challenging question about gas pressure. Technical accuracy was important for the second and third marking points, so it needed to be clear that particle collisions with the container walls were more frequent, more often or at a greater rate of collision. More frequent collisions between particles was insufficient for the second mark. The third marking point needed to reference the forces involved in collisions with the container walls, an implied greater force per collision was acceptable, but not a macroscopic force linked to force and area as that was not being tested. Almost half of the students scored 3 or 4 marks, while almost 40 % of the students scored 1 or 2 marks.

09.1

Many of the students did not convert the 70 cm into metres and some students converted the energy unnecessarily. Not converting the height stopped marking point 1 from scoring and converting the energy unnecessarily stopped 1 marking point from being scored too. Some students, despite setting out their calculations correctly, did not use brackets around the denominator and arrived at an answer of 0.0245 or 2.45. Nearly 80 % of the students scored full marks on this question.

09.2

Many students found it easy to score full marks on this multi-step calculation. The most common mistake was not to convert the time which resulted in an answer of 27 and scored 5 marks. Converting the time incorrectly e.g. converting time into 0.5 hours also scored 5 marks. About 90% of the students scored either 5 or 6 marks.

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09.3

Many students understood that the flow rate would increase. This was often correctly linked to either more useful energy transferred or less wasted energy. Some students expressed their ideas in terms of power. Just over 40 % of the students scored 2 marks, while just over 40 % scored 1 mark.

10.1

Many students were successful with this multi-step calculation question. Nearly 60% of the students scored 6 marks, while almost 10 % scored 5 marks. A significant number of students tried to answer the question using equations from paper 2, which was creditworthy, but virtually no students arrived at the correct answer using this method. Some students scored the significant figures mark by completing an incorrect calculation using all the data provided in the question. The most common mistake was not squaring the extension in the elastic potential energy equation. Ensuring that students substitute first before rearranging is a good way of scoring method marks in calculations, even if the final answer is incorrect.

10.2

Students who stated the names of energy stores didn't score any marks unless they stated how the amount of energy changed or stated that kinetic energy was transferred to gravitational potential energy, for example. Mention of elastic potential energy from the spring in Q10.1 was ignored for this question. E_k and *KE* were acceptable abbreviations for kinetic energy; E_p and *GPE* were acceptable abbreviations for gravitational potential energy. Just over 60 % of the students scored 3 marks, while just over 10% scored 2 marks and just fewer than 10 % scored 1 mark.

10.3

Only about 25 % of the students scored 2 marks for identifying the correct measurements needed to determine the speed of the car at the end of the track. Nearly 75% of the students scored 1 mark. The most common incorrect choice was the length of the track.

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