AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.1.3

Gravity

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**33**
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.

4.5.1.3 Gravity

Answer 01 · Mark scheme June 2003 | 3451F | Original Q15 | Legacy

The full source mark scheme begins on page 49. Follow original question 15 in that document.

Answer 02 · Mark scheme June 2003 | 3451F | Original Q17 | Legacy

(ii)	17.6	allow 44 × 0.4 **or** 0.4 × 44 for **1** mark	2
	Nm **or** newton metre(s)	do **not** accept N/m **or** N/cm 1760 Ncm gains all **3** marks	1
total			10

Answer 03 · Mark scheme June 2003 | 3462F3 | Original Q13 | Legacy

The full source mark scheme begins on page 71. Follow original question 13 in that document.

Answer 04 · Mark scheme June 2006 | 3451 | Original Q11 | Legacy

The full source mark scheme begins on page 88. Follow original question 11 in that document.

4.5.1.3 Gravity

Answer 05 · Mark scheme

Question 1

question	answers	extra information	mark
(a)	**B** or bungee cords		1
	C or springs or playground ride		1
		each additional answer loses **1** mark minimum mark zero	
	will go back to original shape/size		1
(b)(i)	newton		1
(ii)	0 – 5 (N) or 5	accept1-5 (N) do **not** accept 4	1
(iii)	16 (cm)		1
(iv)	2.5 (N)	accept answer between 2.4 and 2.6 inclusive	1
total			7

4.5.1.3 Gravity

Answer 05 · Mark scheme

January 2008 | PHY2F | Original Q1 | Legacy

PHY2F

4.5.1.3 Gravity

Answer 06 · Mark scheme

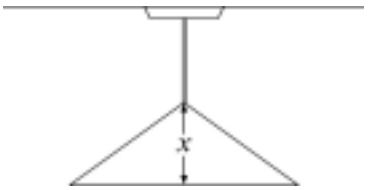
Question 4

	answers	extra information	mark
(a)(i)	0.6 newtons	allow **1** mark for correct substitution accept N do **not** accept n accept Newtons	2 1
(ii)	the same as		1
(b)(i)	changed velocity	accept increased/ decreased for change accept speed for velocity accept change direction accept getting faster/ slower accept start/ stop moving accept correct equation in terms of change in speed or change in velocity	1
(ii)	down(wards)	accept towards the ground accept ↓ do **not** accept south	1
(iii)	increase velocity is increasing **or** it is accelerating	 can only credit second mark if answer is increase accept speed for velocity accept is moving faster accept an answer in terms of resultant force downwards mention of weight/ mass increasing negates second mark	1 1
total			8

4.5.1.3 Gravity

Answer 07 · Mark scheme

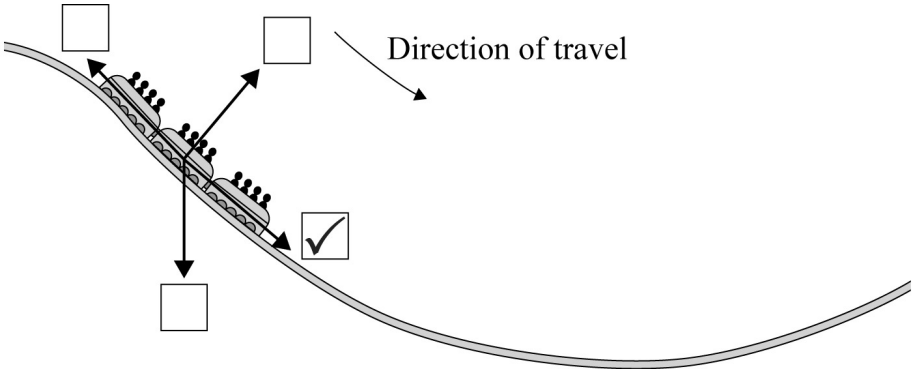
Question 1

question	answers	extra information	mark
(a)	centre of **X** should appear to be on the continued line of the flex and in the body of the lamp as judged by eye	example  	1
(b)	below		1
(c)	(D)→B→F→A→C→(E)	all four correct for **3** marks **or** any two correct for **2** marks **or** just one correct for **1** mark	3
total			5

4.5.1.3 Gravity

Answer 08 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	correct box ticked 		1
7(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
7(c)(i)	30	ignore added units	1
7(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**

4.5.1.3 Gravity

Answer 08 · Mark scheme January 2009 | PHY2F | Original Q7 | Legacy

PHY2F

4.5.1.3 Gravity

Answer 09 · Mark scheme

June 2009 | PHY3F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	centre of **X** at the centre of the concentric circles	judge by eye that the intention is correct	1
1(b)	drawn from any corner to the diagonally opposite corner **or** from the mid-point of any side to the mid-point of the opposite side	judge by eye that the intention is correct if more than one axis of symmetry has been drawn, accept only if both / all are correct	1
1(c)	a turning	accept any unambiguous indication	1
Total			**3**

4.5.1.3 Gravity

Answer 09 · Mark scheme

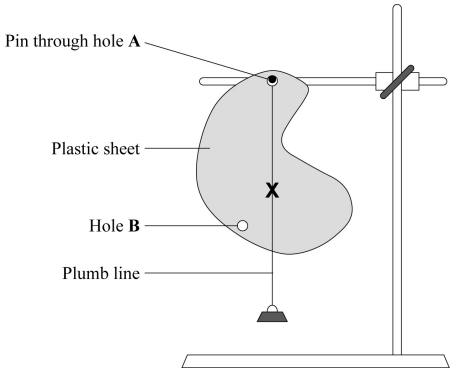
June 2009 | PHY3F | Original Q1 | Legacy

PHY3F

4.5.1.3 Gravity

Answer 10 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)	centre of **X** on the plumb line and between the level of the captions 'plastic sheet' and 'hole **B**'	**example**  	1
2(b)	centre of mass	accept any unambiguous indication	1
2(c)	vertical	accept any unambiguous indication	1
Total			**3**

4.5.1.3 Gravity

Answer 10 · Mark scheme

January 2010 | PHY3F | Original Q2 | Legacy

PHY3F

4.5.1.3 Gravity

Answer 11 · Mark scheme

June 2010 | PHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(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
6(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
6(b)(i)	arrow drawn parallel (to) **and** down (the) slope	accept arrow drawn anywhere on the diagram	1
6(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
6(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**

4.5.1.3 Gravity

Answer 11 · Mark scheme June 2010 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.1.3 Gravity

Answer 12 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	**C**		1
3(b)	moment	accept any unambiguous correct indication	1
3(c)	bigger than	accept any unambiguous correct indication	1
3(d)	120 (Ncm)	allow **1** mark for correct substitution ie 12 × 10	2
Total			**5**

4.5.1.3 Gravity

Answer 12 · Mark scheme January 2011 | PHY3F | Original Q3 | Legacy

PHY3F

4.5.1.3 Gravity

Answer 13 · Mark scheme

June 2011 | PHY3F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	below		1
2(b)	boss nail string	 do **not** allow boss 	1 1 1
2(c)(i)	line from mid-point of either side to the mid-point of the opposite side	intention correct as judged by eye, use of ruler not essential do **not** allow either diagonal	1
2(c)(ii)	**X** in the centre of the rectangle		1
Total			**6**

4.5.1.3 Gravity

Answer 13 · Mark scheme June 2011 | PHY3F | Original Q2 | Legacy

PHY3F

4.5.1.3 Gravity

Answer 14 · Mark scheme

June 2011 | PHY3F | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)(i)	turning effect	accept turning force accept force x distance (accept symbols only if correctly defined) do **not** accept newtons x metres	1
8(a)(ii)	stop apparatus falling over	accept holds the stand in place accept make it safer / stable references to balanced / equilibrium are insufficient	1
8(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
8(a)(iv)	the centre of mass of the ruler is at the axis of rotation		1
8(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**

4.5.1.3 Gravity

Answer 15 · Mark scheme

June 2012 | PH2FP | Original Q8 | Legacy

Question 8

question	answers	extra information	mark
8(a)	750	allow **1** mark for correct substitution, ie 75 x 10 provided no subsequent step shown	2
	newton(s) / N	do **not** accept n	1

8(b)			6
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 2, and apply a 'best-fit' approach to the marking.			
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	There is a brief attempt to explain why the velocity / speed of the parachutist changes. **or** the effect of opening the parachute on velocity/speed is given.	The change in velocity/ speed is clearly explained in terms of force(s) **or** a reasoned argument for the open parachute producing a lower speed.	There is a clear and detailed explanation as to why the parachutist reaches terminal velocity **and** a reasoned argument for the open parachute producing a lower speed

Question 8 continues on the next page . . .

PH2FP

Question 8 continued

question	answers	extra information	mark
8(b) (cont)	**examples of the physics points made in the response to explain first terminal velocity** • on leaving the plane the only force acting is weight (downwards) • as parachutist falls air resistance acts (upwards) • weight greater than air resistance **or** resultant force downwards • (resultant force downwards) so parachutist accelerates • as velocity / speed increases so does air resistance • terminal velocity reached when air resistance = weight **to explain second lower terminal velocity** • opening parachute increases surface area • opening parachute increases air resistance • air resistance is greater than weight • resultant force acts upwards / opposite direction to motion • parachutist decelerates / slows down • the lower velocity means a reduced air resistance air resistance and weight become equal but at a lower (terminal) velocity	accept gravity for weight throughout accept drag / friction for air resistance accept terminal velocity reached when forces are balanced	
8(c)(i)	any **one** from: • mass of the (modelling) clay • material parachute made from • number / length of strings	accept size/shape of clay size/amount/volume/shape of clay accept plasticine for (modelling)clay accept same (plastic) bag	1

Question 8 continues on the next page

PH2FP

Question 8 continued

question	answers	extra information	mark
8(c)(ii)	**C** smallest (area) so falls fastest (so taking least time)	reason only scores if **C** is chosen accept quickest/quicker for fastest if **A** is chosen with the reason given as 'the largest area so falls slowest' this gains **1** mark	1 1
Total			**12**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.5.1.3 Gravity

Answer 16 · Mark scheme June 2014 | PH2FP | Original Q7 | Legacy

7(a)	450	allow **1** mark for correct substitution, ie 18 × 10 × 2.5 provided no subsequent step shown	2	AO2 2.2.1f
7(b)(i)	friction between child ('s clothing) and slide causes electron / charge transfer (between child and slide)	accept friction between two insulators accept child rubs against the slide accept when two insulators rub (together) accept specific reference, eg electrons move onto / off the child / slide reference to positive electrons / protons / positive charge / atoms transfer negates this mark answers in terms of the slide being initially charged score zero	1 1	AO1 2.3.1a
7(b)(ii)	all the charges (on the hair) are the same (polarity) charges / hairs are repelling	accept (all) the charge/hair is negative / positive accept it is positive/negative both parts should be marked together	1 1	AO3 2.3.1d
7(b)(iii)	charge would pass through the metal (to earth)	accept metal is a conductor accept metal is not an insulator accept there is no charge / electron transfer accept the slide is earthed accept metals contain free electrons	1	AO1 2.3.1e
Total			**7**	

4.5.1.3 Gravity

Answer 16 · Mark scheme

June 2014 | PH2FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

Answer 17 · Mark scheme

June 2014 | PH3FP | Original Q2 | Legacy

The full source mark scheme begins on page 108. Follow original question 2 in that document.

Answer 18 · Mark scheme

June 2014 | PH3FP | Original Q4 | Legacy

The full source mark scheme begins on page 108. Follow original question 4 in that document.

4.5.1.3 Gravity

Answer 19 · Mark scheme

June 2018 | 8463/1F | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	$P = \frac{120\,000}{8.0}$ P = 15 000 (W)	an answer of 15 000 (W) scores **2** marks	1 1	AO2 4.1.1.4
09.2	energy is transferred in heating the surroundings friction causes energy to be transferred in non-useful ways		1 1	AO2 4.1.2.1
09.3	the switches are in parallel (so) closing either switch completes the circuit		1 1	AO2 4.2.1.1
09.4	gravitational potential energy = mass × gravitational field strength × height	allow E_p = m g h	1	AO1 4.1.1.2
09.5	E_p = 280 × 9.8 × 14 E_p = 38 416 (J) E_p = 38 000 (J)	an answer of 38 000 scores **3** marks an answer that rounds to 38 000 scores **2** marks	1 1 1	AO2 4.1.1.2
Total			**10**	

4.5.1.3 Gravity

Answer 20 · Mark scheme

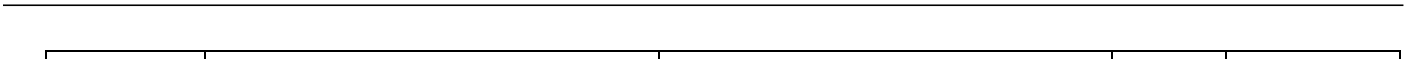
June 2018 | 8463/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	C		1	AO1 4.5.5.1.2
06.2	weight = 2.5 × 9.8 weight = 24.5 (N)	an answer of 24.5 scores **2** marks an answer of 24.5 rounded to 25 scores **2** marks	1 1	AO2 4.5.1.3
06.3	the upthrust is the same as the weight		1	AO1 4.5.5.1.2
06.4	(resultant) force = mass × acceleration	allow F = m a	1	AO1 4.5.6.2.2
06.5	4.0 = 2.5 × a $a = \frac{4.0}{2.5}$ a = 1.6 (m/s^2)	an answer of 1.6 scores **3** marks	1 1 1	AO2 4.5.6.2.2
Total			**8**	

4.5.1.3 Gravity

Answer 20 · Mark scheme

June 2018 | 8463/2F | Original Q6



4.5.1.3 Gravity

Answer 21 · Mark scheme

June 2019 | 8463/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3.1	use a tape measure one person holding the top and another person holding the bottom **or** use a set square to ensure tape measure is vertical **or** take repeat readings and calculate a mean	allow use a metre rule allow use a laser measure allow use a plumb-line to ensure tape measure is vertical	1 1	4.1.1.2 AO3/3a
3.2	$E_p = 45 \times 9.8 \times 2.0$ $E_p = 880$ (J)	an answer of 880 (J) or 882 (J) scores **2** marks	1 1	4.1.1.2 AO2
3.3	any **3** from: • change in vertical height • mass / weight • speed / velocity • air resistance or drag • friction (between zip line and pulley) • gradient / angle (of the zip wire) • length of zip wire	 allow body position allow wind ignore gravitational field strength	3	4.1.1.1 AO1
Total			**7**	

4.5.1.3 Gravity

Answer 22 · Mark scheme

June 2019 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7.1	crate		1	AO1/1 4.5.4
7.2	centre of mass		1	AO1/1 4.5.1.3
7.3	the pointer is vertical	allow unable to see the pointer allow the bar is horizontal	1	AO3/1a 4.5.4
7.4	P		1	AO2/1 4.5.4
7.5	moment (of a force) = force x distance	allow M = F d	1	AO1/1 4.5.4
7.6	 0.15 = W × 0.06 $W = \frac{0.15}{0.06}$ W = 2.5 (N)	an answer 2.5 (N) scores **3** marks	 1 1 1	AO2/1 4.5.4
7.7	weight = mass × gravitational field strength	allow W = m g	1	AO1/1 4.5.1.3
7.8	 2.5 = m × 9.8 m = 2.5 / 9.8 mass rice = 0.215 (kg)	an answer 0.215 or 0.22 (kg) scores **3** marks allow ecf from 07.6 an answer of 0.255 or 0.26 (kg) scores **2** marks	 1 1 1	AO2/1 4.5.1.3
Total			**12**	

4.5.1.3 Gravity

Answer 23 · Mark scheme

November 2020 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the friction is decreased		1	AO1 4.1.2.1
02.2	$E_p = 62.5 \times 9.8 \times 16.0$ $E_p = 9800$ (J)		1 1	AO2 4.1.1.2
02.3	$E_k = 0.5 \times 62.5 \times 12^2$ $E_k = 4500$ (J)		1 1	AO2 4.1.1.2
02.4	Any **two** from: • speed (at bottom of slide) • friction *(*between sled and ground*)* • air resistance	allow mass/weight of rider (and sled) allow surface type	2	AO1 4.1.1.1
Total			**7**	

4.5.1.3 Gravity

Answer 24 · Mark scheme

November 2020 | 8463/2F | Original Q1

Question 1

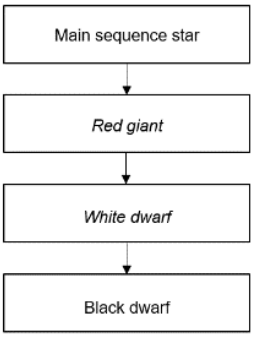
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	B to D		1	AO2 4.5.6.1.2
01.2	metre rule	allow tape measure allow ruler	1	AO1 4.5.6.1.2
01.3	so that each piece falls the same distance	allow to stop them from building up at the bottom	1	AO3 4.5.6.1.2
01.4	$\frac{34 + 37 + 34}{3}$ 35 (s)	allow $\frac{105}{3}$	1 1	AO2 4.5.6.1.2
01.5	cone the (mean) time is the lowest	 reason only scores if correct shape is selected allow it fell the fastest allow it had the most streamlined shape ignore reference to surface area	1 1	AO3 4.5.6.1.2
01.6	Time through air would be less.		1	AO3 4.5.6.1.2
01.7	w = 0.050 × 9.8 w = 0.49 (N)		1 1	AO2 4.5.1.3
01.8	Electrostatic force Magnetic force		1 1	AO1 4.5.1.2
Total			**12**	

4.5.1.3 Gravity

Answer 25 · Mark scheme

November 2021 | 8463/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$g = \frac{750}{2.5}$ g = 300.0 (N/kg)		1 1	AO2 4.5.1.3
06.2	electrostatic		1	AO1 4.5.1.2
06.3	red giant white dwarf	this order only 	1 1	AO1 4.8.1.2
06.4	Z only stars about the same/smaller size/mass as the Sun become Black dwarfs	reason only scores if Z chosen allow converse	1 1	AO3 4.8.1.2
06.5	supernova		1	AO1 4.8.1.2
Total			8	

4.5.1.3 Gravity

Answer 26 · Mark scheme

June 2022 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	tape measure **or** metre rule	allow ruler ignore metre stick	1	AO3 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$E_p = 50 \times 9.8 \times 1.7$ $E_p = 833$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$P = \frac{1800}{1.44}$ $P = 1250$ (W)		1 1	AO2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	stop-clock C		1	AO3 4.1.1.4

4.5.1.3 Gravity

Answer 26 · Mark scheme

June 2022 | 8463/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	$E_k = 0.5 \times 70 \times 2.0^2$ $E_k = 140$ (J)		1 1	AO2 4.1.2.1

Total Question 2		**8**

4.5.1.3 Gravity

Answer 27 · Mark scheme

June 2022 | 8463/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	centre of mass		1	AO1 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	weight is directly proportional to mass		1	AO1 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	reading from balance = 1.1 kg mass = $\frac{1.1}{5}$ = 0.22 kg	 allow correct calculation using incorrectly read value from the balance	1 1	AO2 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	weight = 0.22 × 9.8 2.156 (N)	allow ecf from question **04.3** allow correct answer to 2 or 3 sig figs	1 1	AO2 4.5.1.3

4.5.1.3 Gravity

Answer 27 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	0.015 m		1	AO2 4.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	spring constant = $\frac{6.0}{0.015}$ 400 (N/m)	allow ecf from question **04.5**	1 1	AO2 4.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	returns to its original length/shape	allow returns to 3.5 cm	1	AO3 4.5.3

Total Question 4		**10**

Answer 28 · Mark scheme

June 2023 | 8463/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	other energy resources = 95 (%) hydroelectric = 5 (%)		1 1	AO2 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	E_p = 2 500 000 × 9.8 × 15 E_p = 367 500 000 (J) **or** E_p = 3.675 × 10^8 (J)	 allow 370 000 000 (J) **or** E_p = 3.7 × 10^8 (J)	1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	energy = power × time **or** $E = P \times t$		1	AO1 4.2.4.2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	t = 3600 (s) E = 3000 × 3600 E = 10 800 000 (J) **or** E = 1.08 × 10^7 (J)	 allow a correct substitution using an incorrectly/not converted value for t allow an answer consistent with their incorrectly/not converted value for t allow a correct answer given to 2 s.f.	1 1 1	AO2 4.2.4.2 4.1.1.4

4.5.1.3 Gravity

Answer 28 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	the level of the water in the river varies **or** the amount of rainfall varies		1	AO3 4.1.3
	and is lower in the summer months	allow specified months or range of months eg April to September MP2 dependent on scoring MP1	1	

Total Question 4	10

4.5.1.3 Gravity

Answer 29 · Mark scheme

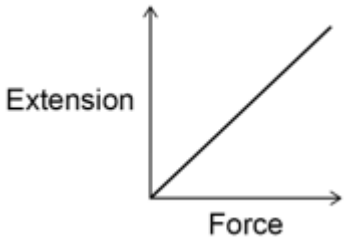
June 2023 | 8463/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	1.5 cm		1	AO1 4.5.3 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	any **one** from: • clamp the stand to the desk • wear safety goggles / glasses • stand up / away from apparatus • limit the total mass used • have masses over the base of the stand		1	AO1 4.5.3 RPA6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$W = 0.050 \times 9.8$ $W = 0.49$ (N)	 do **not** accept 0.50 (N) alone	1 1	AO2 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4			1	AO1 4.5.3 RPA6

4.5.1.3 Gravity

Answer 29 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	$k = \frac{2.0}{0.080}$ k = 25 (N/m)		1 1	AO2 4.5.3 RPA6

Total Question 1	7

4.5.1.3 Gravity

Answer 30 · Mark scheme

June 2024 | 8463/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	stretched length – original length		1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$E_e = 0.5 \times 800 \times 7.5^2$ $E_e = 22\,500$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	kinetic energy = $0.5 \times 240 \times 15^2$ kinetic energy = 27 000 (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$E_p = m \times g \times h$		1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$24\,000 = 240 \times 9.8 \times h$ $h = \frac{24\,000}{(240 \times 9.8)}$ $h = 10.2$ (m)	 allow 10 (m) allow a correct answer given to more than 3 s.f.	1 1 1	AO2 4.1.1.2

4.5.1.3 Gravity

Answer 30 · Mark scheme

June 2024 | 8463/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	energy is transferred to the surroundings work is done against air resistance		1 1	AO1 4.1.2.1

Total Question 3	11

4.5.1.3 Gravity

Answer 31 · Mark scheme

June 2024 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	$W = 25\,000 \times 9.8$ $= 245\,000$ (N)		1 1	AO2 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	$p = \frac{1\,960\,000}{49}$ $= 40\,000$ Pa		1 1 1	AO2 AO2 AO1 4.5.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	B		1	AO1 4.5.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	$a = \frac{1.3 - 0.7}{5.0}$ $= 0.12$ (m/s^2)		1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	$\frac{0.21}{0.84} \times 100$ 25%		1 1	AO2 4.5.3

4.5.1.3 Gravity

Answer 31 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	force (applied to the spring) = spring constant × extension **or** $F = k \times e$		1	AO1 4.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	$336 = k \times 0.21$ $\frac{336}{0.21} = k$ $k = 1600$ (N/m)		1 1 1	AO2 4.5.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	$v^2 - 0 = 2 \times 9.8 \times 0.95$ $v^2 = 18.62$ $v = 4.3150\ldots$ $= 4.3$ (m/s)	 allow $v = \sqrt{(18.62)}$ allow an answer correctly rounded to 2 significant figures from an incorrect calculation which uses the values in the question	1 1 1 1	AO2 4.5.6.1.5

Total Question 7	18

4.5.1.3 Gravity

Answer 32 · Mark scheme

June 2025 | 8463/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	$E_e = 0.5 \times 5.6 \times 0.35^2$ $E_e = 0.343$ (J)	 allow 0.34 (J)	1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$E_p = mgh$		1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	$0.294 = m \times 9.8 \times 0.60$ $m = \frac{0.294}{9.8 \times 0.60}$ $m = 0.050$ (kg)		1 1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	elastic potential energy decreases		1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	kinetic energy decreases		1	AO1 4.1.1.1

4.5.1.3 Gravity

Answer 32 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	gravitational potential energy increases		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	air resistance opposes the motion of the toy energy is transferred to the surroundings		1 1	AO2 4.1.1.1 4.1.2.1

Total Question 6	11

4.5.1.3 Gravity

Answer 33 · Mark scheme

June 2025 | 8463/2F | Original Q2

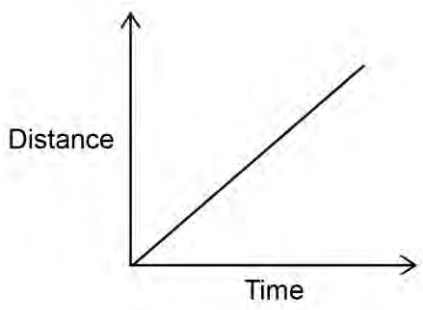
Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	*W* = 75 000 × 9.8 735 000 (N)		1 1	AO2 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	*W* = 850 000 × 80 68 000 000 (J)		1 1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	4 × 850 000 3 400 000 (N)		1 1	AO1 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	frictional force		1	AO1 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5			1	AO1 4.5.6.1.4

4.5.1.3 Gravity

Answer 33 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	25 – 16 = 9 (m/s) $a = \frac{9}{150}$ 0.06 (m/s^2)	subsequent marks may be awarded if an incorrectly calculated change in velocity is used	1 1 1	AO2 4.5.6.1.5

Total Question 2	**11**

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

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Kathleen Tattersall: *Director General*

4.5.1.3 Gravity

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

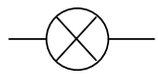
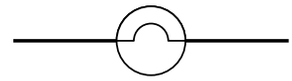
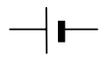
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

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.

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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 direction	accept motion / force do **not** accept energy	1 1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.5.1.3 Gravity

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

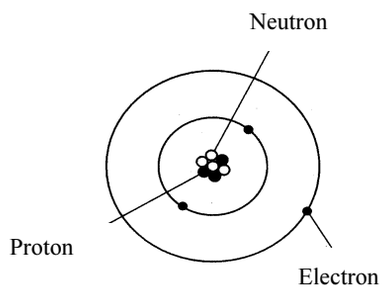
4.5.1.3 Gravity

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

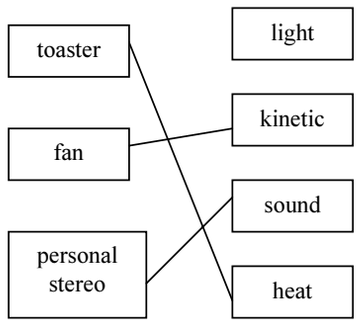
4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

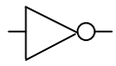
4.5.1.3 Gravity

3451/F Q8

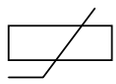
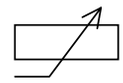
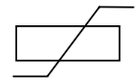
question	answers	extra information	mark
(a)(i)	point where the rays cross	do not credit if ambiguous	1
(ii)	converging (lens)	do **not** accept convex	1
(b)(i)	point where the rays appear to diverge from	this should appear to be within 10mm in front of the back of the arrows on the approximate centre 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

4.5.1.3 Gravity

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

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

3451/F Q13

question	answers	extra information	mark
(a)	silver is a (good) reflector of <u>heat</u> (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

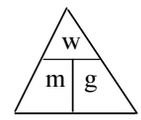
4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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*

4.5.1.3 Gravity

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.

4.5.1.3 Gravity

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.

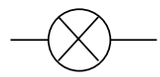
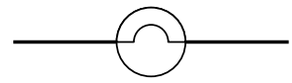
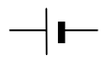
3.10 Unexpected Correct Answers not in the Mark Scheme

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.

4.5.1.3 Gravity

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

4.5.1.3 Gravity

3462/3F 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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

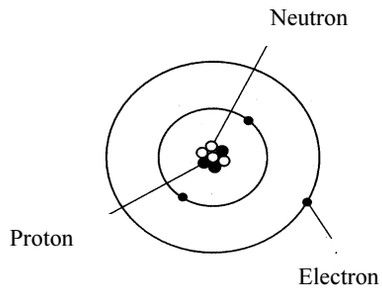
4.5.1.3 Gravity

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

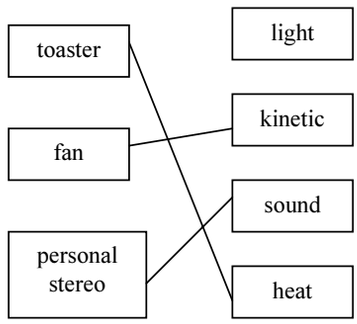
4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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** <u>speed</u> / velocity increases	accept faster <u>and</u> 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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

3462/3F Q11

question	answers	extra information	mark
(a)	silver is a (good) reflector of <u>heat</u> (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

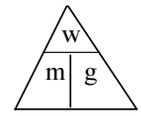
4.5.1.3 Gravity

3462/3F Q12

question	answers	extra information	mark
(a)(i)	any **one** from:		1
	the ground	do **not** accept mobile phones	
	the air		
	radon (gas)		
	building materials		
	buildings		
	rocks / granite		
	food		
	cosmic rays **or** solar rays	accept from outer space accept sun but **not** sunlight	
	X-rays	accept medical uses	
	nuclear weapons testing		
	nuclear power stations / accidents		
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)		answers must be comparative accept converse answers throughout	
	alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas	accept paper for the card	1
	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)	accept aluminium for the metal	1
	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	accept aluminium for the metal accept lead / aluminium for the metal	1
total			6

4.5.1.3 Gravity

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

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2006 examination - June series

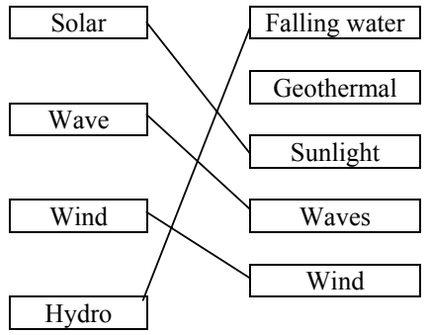
Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. 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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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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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>

4.5.1.3 Gravity

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

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 + • some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components • the other components have a resistance • cells not fully charged **or** cells partially run down • cells have an internal resistance	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 accept voltage for pd do **not** accept using up pd accept a named component / components / wire has a resistance do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	2
(ii)	the diode has a (very) high resistance (in the reverse direction) a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1 1

Continued

4.5.1.3 Gravity

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

4.5.1.3 Gravity

3451/F Q13

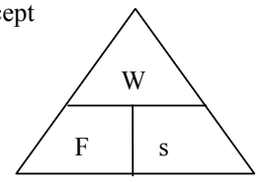
question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** 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

4.5.1.3 Gravity

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

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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

4.5.1.3 Gravity

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>

4.5.1.3 Gravity

GCSE

PHYSICS

PH3FP

Mark scheme

4403

June 2014

Version: 1.0 Final

4.5.1.3 Gravity

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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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 / ; e.g. allow smooth / free movement.

3. Marking points

3.1 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

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

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

3.2 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.

3.3 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 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.

3.6 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 Ignore / Insufficient / Do <u>not</u> allow

Ignore or 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.

Quality of Written Communication and levels marking

In Question 9(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates 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.

4.5.1.3 Gravity

MARK SCHEME – GCSE Physics – PH3FP – June 2014

Question	Answers	Extra information	Mark	AO spec ref
1(a)	transmits absorbs	correct order	1 1	AO1 3.1.1b
1(b)	light	allow ultra violet **or** UV **or** infrared **or** IR **or** gamma	1	AO1 3.1.1b
1(c)	20	allow **1** mark for correct working, ie $\frac{60}{3}$ provided no subsequent step	2	AO2 3.1.1b
1(d)	Killing cancer cells		1	AO1 3.1.1b
Total			**6**	

4.5.1.3 Gravity

Question	Answers	Extra information	Mark	AO spec ref
2(a)	3000	allow **1** mark for correct substitution, ie 600 × 5 provided no subsequent step	2	AO2 3.2.2b
2(b)	anticlockwise moment	must be both words	1	AO1 3.2.2c
2(c)(i)	3400	allow 3.4 kilo (newtons)	1	AO2 3.2.2c
2(c)(ii)	as the distance (of the girl from point A) increases, force F increases	allow gets bigger for increases force is (directly) proportional to distance will negate any correct response	1	AO3 4.5.3
Total			**5**	

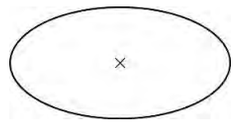
Question	Answers	Extra information	Mark	AO spec ref
3(a)	<table><tr><th></th><th>Digital Camera</th><th>Eye</th></tr><tr><td>Cornea</td><td></td><td>✓</td></tr><tr><td>Lens</td><td>✓</td><td>✓</td></tr><tr><td>Pupil</td><td></td><td>✓</td></tr><tr><td>CCD</td><td>✓</td><td></td></tr></table>	ignore shaded row each correct row = **1** mark	3	AO1 3.1.4a, d
3(b)	long		1	AO1 3.1.4b
3(c)	lens A it is a concave / diverging lens	 this mark is only gained if lens A is stated any reference to lens material or mass of lens negates this mark allow it will focus light onto the retina	1 1	AO1 3.1, 3.1.4b
3(d)	The refractive index of the lens material		1	AO1 3.1.4f
3(e)	4	ignore any signs allow **1** mark for correct substitution, ie $\frac{1}{0.25}$ provided no subsequent step	2	AO2 3.1.4e

Question 3 continues on the next page . . .

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(f)	Cauterising open blood vessels		1	AO1 3.1.5f
3(g)	5	allow **1** mark for correct substitution, ie $\frac{70}{14}$ provided no subsequent step	2	AO2 3.1.3i
Total			**12**	

4.5.1.3 Gravity

Question	Answers	Extra information	Mark	AO spec ref
4(a)	concentrated		1	AO1 3.2.1a
4(b)		judge by eye	1	AO2 3.2.1c
4(c)	C A D	3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO1 3.2.1a
4(d)	Lower the athlete's seating position Move the wheels further apart		1 1	AO2 3.2
Total			**6**	

4.5.1.3 Gravity

Question	Answers	Extra information	Mark	AO spec ref
5(a)	hydraulic		1	AO1 3.2.3
5(b)	9	allow **1** mark for a correct substitution, ie $\frac{1800}{200}$ provided no subsequent step	2	AO2 3.2.3c
5(c)	an environmental		1	AO3 SALoSE
Total			**4**	

Question	Answers	Extra information	Mark	AO spec ref
6(a)(i)	increase		1	AO3 3.3.1a, 4.5.4
6(a)(ii)	A and B and B and C	both required for the mark either order	1	AO3 3.3.1a, 4.5.4
6(a)(iii)	any **two** from: • size of nail **or** nail material • current • (size of) paper clip • length of wire	 allow (same) nail allow (same) cell allow p.d. same amount of electricity is insufficient accept type/thickness of wire	2	AO3 4.1b
6(b)	4 B picks up the same number as C, so this electromagnet would pick up the same number as A **or** direction of current does not affect the strength of the electromagnet	 allow it has got the same number of turns as A	1 1	AO3 3.3.1a, 4.5.4
6(c)	2	allow 1 or 3	1	AO3 3.3.1a, 4.5.4
Total			**7**	

Question	Answers	Extra information	Mark	AO spec ref
7(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
7(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
7(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 7 continues on the next page . . .

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(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 <u>ionising</u> • mutate cells **or** cause mutations **or** increase chances of mutations • turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells • kill cells • 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**	

Question	Answers	Extra information	Mark	AO spec ref
8(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
8(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
8(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
8(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
8(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			**6**	

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 on page 5, and apply a 'best-fit' approach to the marking.		Mark	AO spec ref
9(a)			6	
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO1 3.3.2
No relevant / correct content.	**Either** there is an attempt at a description of the construction of a transformer **or** a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer **and** a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer **and** there is a correct description of how transformers affect the input p.d.	

details of construction:	extra information
a (laminated) core	
core is made from a magnetic material / iron	
2 coils	
the coils are made from an electrical conductor / copper	
the coils are covered in plastic / insulation	
the coils are (usually) on opposite sides	
step-up transformer has more turns on secondary coil than (its) primary (or vice versa)	
step-down transformer has less turns on secondary coil than (its) primary (or vice versa)	
effect on input p.d. :	
step-up transformer, the output p.d. is greater (than the input p.d.)	accept voltage for p.d.
step-down transformer, the output p.d. is lower (than the input p.d.)	

Question 9 continues on the next page . . .

Question 9 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
9(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			7	

4.5.1.3 Gravity

Answer 20 · Examiner comments June 2018 | 8463/2F | Original Q6

Question 6 (Low and Standard demand)

06.1 This was well known with 95% of the students scoring the mark.

06.2 Most of the students showed a substitution before calculating the final correct answer.

06.3 Answers were split almost equally between the three options.

06.4 44% of the students were able to write down this equation correctly. Most of the students that gave a wrong equation simply wrote the three quantities out in the order they were given – 'acceleration = mass x resultant force' was a common wrong answer.

06.5 43% of the students were able to calculate the correct answer to this question.

Answer 22 · Examiner comments June 2019 | 8463/2F | Original Q7

Question 7 (Low and standard demand)

07.1 Just over 80% of the students correctly identified the crate as the object not likely to rotate.

07.2 About 48% of the students scored this mark.

07.3 Answers to this question were poorly expressed, with few students writing that the pointer is behind the hanging arm. The most popular answer to gain credit was the idea that each side of the device was level. The word 'horizontal' was rarely seen.

07.4 Only 46% of the students scored this mark.

07.5 Just under a half of the students could recall this equation.

07.6 57% of the students could manipulate the figures and arrive at the correct answer.

07.7 36% of the students could give the equation correctly.

07.8 95% of students either scored zero or did not attempt the question.

4.5.1.3 Gravity

Answer 26 · Examiner comments

June 2022 | 8463/1F | Original Q2

Question 2 (Low demand)

02.1 About 80% of students answered this question correctly. ‘Metre stick’ was ignored, so if students gave a list eg ‘metre stick or tape measure’ they could still score the mark.

02.2 About 90% of students completed this calculation correctly, scoring 2 marks.

02.3 About 90% of students completed this calculation correctly, scoring 2 marks.

02.4 90% of students identified the correct stop-clock.

02.5 90% of students completed this calculation correctly, scoring 2 marks. The most common mistake was to not square the speed. This would then just score a mark for the substitution, if correct.

4.5.1.3 Gravity

Answer 27 · Examiner comments — June 2022 | 8463/2F | Original Q4

Question 4 (Low demand)

04.1 The correct answer was chosen by approximately 65% of the students.

04.2 The correct answer was chosen by approximately 70% of the students.

04.3 Approximately 80% of the answers were correct. Most errors occurred due to misreading the balance or dividing by a number other than five.

04.4 This was well answered. A significant number of the students gained both marks by correctly using an incorrect answer to part 04.3.

04.5 Just over 60% of the students were able to calculate the extension of the spring correctly.

04.6 Students who did not choose the correct value in part 04.5 were still able to score both marks for this part question. However, many of the students used values different to their choice in part 04.5 or tried a wrong conversion and so scored zero.

Answer 27 · Examiner comments — June 2022 | 8463/2F | Original Q4

04.7 This was generally well answered although some statements were in terms of the movement of the spring, rather than it reverting back to its original length / shape.

Answer 28 · Examiner comments — June 2023 | 8463/1F | Original Q4

Question 4 (Low and Standard Demand)

04.1 93% of students scored 2 marks on this calculation question.

04.2 84% of students scored 2 marks for this calculation question.

04.3 In this exam series students were provided with an equations sheet with all equations given. 95 % of students answered the question correctly.

04.4 A question that discriminated well. 16% of students scored 3 marks, while 63 % of students scored 2 marks for an answer of 180 000, having not converted the time to seconds.

4.5.1.3 Gravity

Answer 28 · Examiner comments June 2023 | 8463/1F | Original Q4

04.5 Some students appeared to confuse the power output of the hydroelectric generator with the power demand of the consumers. 'People use less power in the summer' being seen as a common incorrect answer. Students needed to link rainfall / water level to the summer months to score both marks. Referring to 'hotter months' was insufficient for 'summer months' or named months. Examples of specific changes were creditworthy eg 'less/more water in the river' or 'rainfall may be less/more' for the 1st marking point. Both marking points could be the converse of what appeared in the mark scheme. 30% of students scored 2 marks, while 22% of students scored 1 mark.

Answer 29 · Examiner comments June 2023 | 8463/2F | Original Q1

01.1

76% of students correctly identified the extension of the spring.

01.2

56% of students scored this mark. The most common correct responses were 'wear goggles' or stand up/back from the equipment. Incorrect responses would often describe a dangerous situation rather than a safety precaution to be taken.

01.3

93 % of students scored 2 marks for calculating the weight. It was clear that some students did not have calculators for the exam. This was a major disadvantage.

01.5

92 % of students scored 2 marks and 2.5 % scored 1 mark for this calculation of the spring constant..

4.5.1.3 Gravity

Answer 30 · Examiner comments

June 2024 | 8463/1F | Original Q3

Question 3 (Low / Standard demand)

03.1 53% of students scored a mark for this question showing how the extension of a bungee cord should be calculated.

03.2 90% of students scored both marks for correctly calculating the elastic potential energy.

03.3 90% of students scored both marks for correctly calculating the maximum kinetic energy.

03.4 95% of students chose the correct equation. However, in this exam series students were provided with a Physics Equations Sheet.

03.5 56% of students scored all 3 marks for this standard demand calculation question.
For 3 mark calculations, these general principles apply:
The 1st mark is for the substitution.
The 2nd mark is for the rearrangement.
The 3rd mark is for the answer.
In straightforward calculations, no working needs to be shown, but students should be encouraged to do so just in case the final answer is incorrect.
If the answer is correct, 3 marks can score.

03.6 27% of students scored 2 marks for this question, while 59% scored 1 mark. This question tested understanding of energy dissipation in energy transfers. A lot of students only ticked one box, ignoring the rubric of the question.

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4.5.1.3 Gravity

Answer 31 · Examiner comments June 2024 | 8463/2F | Original Q7

07.1
Only a few students failed to gain 2 marks in this calculation of weight. Some had not substituted correctly, others tried to convert mass to grams.

07.2
58% of students scored all 3 marks for this calculation of pressure. The unit of area being m^2 seemed to confuse some students into squaring 49. Those scoring 2 marks tended to give an incorrect unit.

07.3
61% of students knew that the pressure in a fluid causes a force normal to the surface.

07.4
Students were expected to calculate the change in velocity to find the acceleration. Many did not calculate the change but just used one of the velocities given in the question. 78% scored both marks.

07.5
A percentage calculation which proved to be too difficult for many students. A common answer was 75% instead of 25%.

07.6
Even though all students had access to the Physics Equations Sheet, 3% did not write down any equation. 7% quoted the wrong equation.

07.7
Well answered calculation of spring constant with 77% getting all 3 marks. Some students struggled to rearrange the equation. Some tried to use the elastic potential energy equation.

07.8
24% of students gained all 4 marks for this velocity calculation. Those who didn't usually did not show a full substitution into the equation, and calculated 2*as*, thinking this was the final answer.

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Answer 31 · Examiner comments June 2024 | 8463/2F | Original Q7

08.1 76% of students gave an incorrect value of resolution for the protractor. Answers of 10, 90 and 180 degrees were commonly seen.

4.5.1.3 Gravity

Answer 32 · Examiner comments June 2025 | 8463/1F | Original Q6

06.1
Nearly 90 % of the students scored 2 marks on this calculation of elastic potential energy.

06.2
The vast majority of the students identified the correct equation for gravitational potential energy.

06.3
Just over half of the students scored 3 marks on this calculation of mass using the gravitational potential energy equation.

06.4
About 65 % of the students understood that the elastic potential energy of the spring decreased.

06.5
About 80 % of the students understood that the kinetic energy of the toy decreased.

Answer 32 · Examiner comments June 2025 | 8463/1F | Original Q6

06.6
Just over 60 % of the students understood that the gravitational potential energy of the toy increased.

06.7
Just over 30 % of the students chose two correct reasons for the toy eventually stopping. About 50% of the students scored 1 mark. Many students did not read the instructions for the question and only ticked one box.

4.5.1.3 Gravity

AQA

GCSE
PHYSICS

8463/1F: Paper 1
Report on the Examination

8463
June 2019

Version: 1.0

4.5.1.3 Gravity

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General

Grade 1-3 calculation questions were well answered, where the equation is always given and students will not be required to rearrange the equation. Grade 4-5 calculation questions involving equation recall were answered better this year than in 2018 and students are scoring many of their marks on the paper by answering the subsequent calculation questions correctly. At grade 4-5 students are expected to be able to either rearrange an equation or convert a unit, so it is beneficial for students to be able to quickly identify if the units given in a question are correct for the use in the equation. Question 10.1 was generally well attempted and students who had carried out Required Practical Activity 2 would have had a material advantage over those who hadn't.

Handwriting sometimes makes 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.

Levels of demand

Questions are set at two levels of demand on this paper:

- low demand questions are targeted at students working at grades 1–3
- standard demand questions are targeted at students working at grades 4–5.

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.

Question 1 (Low demand)

01.1 Around 77% of students scored 2 marks. Around 16% of students scored 1 mark.

01.2 Only around 8% of students scored 2 marks. Both evaporation and change of state were common, insufficient answers for the first marking point. Less than half of the students scored 1 mark. The marking points were independent, so if the change of state was incorrect eg melting, the student could still score the second marking point.

01.3 Around 91% of students scored 2 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks.

01.4 Approximately 82% of students scored 3 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks for the calculation. Some students set out their calculation, but then multiplied the two values rather than dividing.

Question 2 (Low demand)

02.1 About 67% of students identified the correct decay equation.

02.2 More than three quarters of the students identified why alpha radiation is dangerous inside the human body.

02.3 Just below three quarters of students scored 2 marks. Most correct answers read the values from the graph as intended (460, 280) and students didn't need the tolerance given in the mark scheme.

02.4 About 60% of students correctly estimated the mass remaining.

02.5 Students found this question difficult, with around 55% of students scoring 2 marks and around 27% of students scoring 1 mark.

Question 3 (Low demand)

03.1 Approximately 45% of students scored 1 mark for identifying a measuring instrument that could be used. About 9% of students scored 2 marks for describing an appropriate way to use it. Pythagoras was insufficient as the triangle described would not give the height of the zip wire.

03.2 Students were often very successful in calculation, with around 91% scoring 2 marks.

03.3 This question gave a good spread of marks. Over a fifth scored 3 marks, almost two fifths scored 2 marks and slightly below a quarter scored 1 mark. Gravitational potential energy or gravitational field strength were insufficient to score a mark.

Question 4 (Low demand)

04.1 Over a third of students answered this question correctly.

04.2 About 14% of students answered this question correctly.

04.3 This question about the alpha particle scattering experiment discriminated well between students. Around 16% of students scored 3 marks, around 45% of students scored 2 marks and around 30% of students scored 1 mark.

04.4 About 77% of students correctly identified what reproducible means. .

Question 5 (Low demand)

05.1 The most common correct answers linked CO_2 to global warming. Around 38% of students scored 2 marks and around 35% scored 1 mark. Common incorrect answers were usually vague and mentioned air pollution without being specific. There were many students who incorrectly linked CO_2 with the ozone layer.

05.2 Over half of the students scored 2 marks and over a third scored 1 mark. Insufficient answers included hydro and water. Answers using specification wording eg the tides were acceptable, as were terms like tidal, etc. Oil was insufficient as this was assumed to be non-renewable oil as opposed to palm oil or other biofuel oils.

05.3 Around 83% of students scored 2 marks for this percentage calculation. An answer of 78 scored 1 mark even if spurious calculations followed.

05.4 About 67% of students scored 2 marks. Quite a large number of misreads from the graph resulting in 0 marks and around 29% of students scored 0 marks.

05.5 Only around 5% of students scored 2 marks whilst half of the students scored 1 mark. Some students failed to make the connection between the time of day and sunrise. Some students talked vaguely about the energy stored by solar panels, confusing them with solar heating panels rather than solar photovoltaic panels.

Question 6 (Low and Standard demand)

06.1 More than half of the students scored 2 marks. To score a mark a comparative statement was needed eg lower, not low mass of power source. A statement using the word 'better' would be insufficient.

06.2 Around 64% of students scored 2 marks. Many students scored 1 mark for truncating and not rounding their answers, an answer of 26.08 would score only 1 mark for the substitution.

06.3 This question discriminated well, with about 16% scoring 2 marks and more than half scoring 1 mark. 'Increases the battery's power output' was insufficient to score a mark. 'Battery lasts longer' was insufficient to score a mark.

06.4 The quantities in the question are given in alphabetical order; there is no need for students to recall the equation in this order. Any correct rearrangement of the equation or use of the correct symbols for quantities was allowed. A mixture of symbols and words would also score the mark. Approximately 70% of students answered this question correctly.

06.5 It was encouraging to see many Foundation tier students successfully rearranging the equation. Around 77% of students scored 3 marks.

Question 7 (Low and Standard demand)

07.1 About 86% of students answered this question correctly.

07.2 Approximately 83% of students answered this question correctly. Students should refer to the Physics specification for the accepted symbols for circuit components. Textbooks and revision guides do not necessarily use the specification symbols. The circles in the component symbol scored a mark even if shown as blobs rather than circles.

07.3 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.4 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.5 About 23% of students answered this question correctly.

07.6 About 38% of students answered this question correctly.

07.7 Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order.

Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference. Approximately 57% of students answered this question correctly.

07.8 The first mark is for the substitution into the correct equation. The second mark is for the correct rearrangement of the correct equation. The third mark is for the correct final answer. About 58% of students scored 3 marks for this question. Grade 4-5 calculation questions require either a unit change or a rearrangement of the equation.

Question 8 (Low and Standard demand)

08.1 Around 63% of students answered this question correctly.

08.2 Around 86% of students answered this question correctly. Some students gave a precaution instead of a risk, which was insufficient.

08.3 Around 62% of students answered this question correctly, demonstrating that students still confuse the terms resolution and range.

08.4 Around 96% of students answered this question correctly.

08.5 Many students failed to substitute correctly into the equation that was printed on the Physics Equations Sheet. Many students multiplied the 3 values given in the question, which scored zero marks. The unit mark was independent, but a large number of students failed to recognise the correct unit from the box. More than a third of students scored 4 marks and around 16% of students scored 3 marks. A quarter of students scored 1 mark for either the correct unit or the correct substitution.

Question 9 (Standard demand)

09.1 About 45% of students correctly identified the meaning of power input.

09.2 Only a quarter of students scored this mark. Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order. Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference.

09.3 Around 13% of students scored 3 marks and about 81% scored zero. Students found this question difficult to answer, presumably due to their inability to recall the correct equation in the preceding question.

09.4 More than half of students answered this correctly. Some students failed to score the mark by writing input for both the denominator and the numerator.

09.5 Students who successfully recalled the equation in **09.4** were likely to score all 3 marks for this question. Only around 15% of students scored zero.

09.6 Many students restated the stem, rather than going the extra stage in the reasoning and linking to efficiency because thermal energy is also transferred by the light bulb. A number of students believed that knowing the rate at which the bulbs emitted visible light was a

safety concern related to the household electrics. Only around 1% of students scored 2 marks, about 16% of students scored 1 mark and around 73% of students scored zero marks.

Question 10 (Standard demand)

10.1 This question produced a good spread of marks. A mean score of 2.1 was achieved by students on the Foundation tier. Students who had experience of a similar practical benefitted from this as they were able to describe a method in sufficient detail to achieve Level 2. To achieve Level 3, a student needed to indicate that several values of number of layers were used, referring to the interval of 8 layers (as the graph showed) or that the experiment should be done with no layers. A control variable was also needed, either the initial temperature of the water, or the volume of water in each experiment. Some students gained no credit by describing different required practical methods. Around 2% of students scored 6 marks, around 15% of students scored 4 marks and about a fifth of students scored 2 marks. Around 10% of students didn't attempt the question.

10.2 Many students stated that it wasn't necessary to use both as it would be confusing. The datalogger would produce too much data was a common insufficient answer. A number of students stated that using a normal thermometer would be more appropriate, scoring zero marks. Less than 1% of students scored 2 marks and less than a fifth of students scored 1 mark.

Question 11 (Standard demand)

11.1 Over two-fifths of students scored 3 marks for this question. It wasn't necessary to give the answer to an appropriate number of significant figures, so answers of 0.502, 0.50 and 0.5 were all creditworthy. Some students calculated the jump height to be unlikely values; students should be encouraged to consider whether it is likely that someone can jump a height of 4.92 m, a commonly seen answer achieved by multiplying the 2 values given (41 × 0.12). Less than half of the students scored zero marks.

11.2 A common incorrect answer was E_k = mass × speed, since these were the quantities given in the question. A number of students also left out the 0.5 value even if they remembered that speed should be squared. Velocity was allowed instead of speed in the equation. Correct symbols were acceptable for the quantities in the equation. About 30% of students answered this question correctly.

11.3 Despite being asked to recall the equation in 11.2, most students simply multiplied or divided the 2 values given in the question (3.0 and 270), scoring 0 marks. Only around 19% of students scored 3 marks.

11.4 Some students commented on muscle mass and strength which were insufficient to score marks. Clear comparisons, including at least one difference and one similarity, were needed to score 4 marks. This question discriminated well between students; around 6% of students scored 4 marks, around 29% of students scored 2 marks and around 13% of students scored zero.

4.5.1.3 Gravity

11.5 Some students failed to score a mark because they simply restated the question, 'the scientist wanted the highest muscle power reading' without adding any value. The answer either needed to refer to the effect of repetition on performance (improvement or worsening) or that it was the maximum (or peak) muscle power that the scientist was investigating. A fifth of students answered this question correctly.

4.5.1.3 Gravity

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on 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.

4.5.1.3 Gravity

Questions matter

GCSE

Physics

8463/2F

Report on the examination

Version: 1.0
June 2025

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Report on the examination – GCSE - Physics – 8463/2H – June 2025

General comments

Students should pay attention to the number of options that need to be ticked when doing multiple choice questions. They should make sure they cross out wrong options when they change their minds, as marks cannot be awarded where there are multiple ticks instead of one.

Many students demonstrated good maths skills, although there are always issues with rearrangements. Formula triangles are not always helpful. Students who had correctly written down an equation in a previous question and then tried to use a formula triangle often scored no marks, because they don't understand how to use them. If they had substituted into the equation from the equations sheet they would have scored the 1st mark.

Students had access to the equations sheet for this examination series. A minority of the students however did not use them to find the appropriate equation.

Levels of demand

Questions are set at two levels of demand on this paper:

- Low demand questions are targeted at students working at grades 1–3.
- Standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification, not just on questions that may have been targeted at the level at which they are working.

01.1

Over 90 % of the students knew that a protractor is used to measure angles. The phonetic spelling of protractor was allowed.

01.2

Almost 70% of the students scored all four marks for completing the graph. Despite a clear instruction a significant number did not label the y-axis. A number of the students did not use a ruler to draw the line of best fit.

01.3

Most of the students correctly identified the relationship between the angle of incidence and the angle of reflection.

01.4

Half of the students knew which measurement was the amplitude of a wave. Most of the others thought the vertical distance between a peak and a trough was the amplitude.

01.5

About 80 % of the students knew which line showed the wavelength of the wave. The most common incorrect answer was the distance showing half the wavelength.

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4.5.1.3 Gravity

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01.6

Over 90 % of the students correctly calculated the wavelength. Those who did not achieve full marks mainly did so by not choosing the correct unit for wavelength, with Pa being a popular incorrect choice.

01.7

This was well answered, with most of the students scoring both marks. A few inverted the equation and thus calculated the period incorrectly.

02.1

Most of the students correctly calculated the weight of coal.

02.2

Just over 90% of the students were able to use the work done equation correctly. Those that did not get full marks tended to put an additional step into the calculation by dividing the answer 68 000 000 by 4; the number of engines in total.
Occasionally a student would attempt to convert the number calculated into standard form. Whilst not being penalised, this was not required.

02.3

Well answered by most students. As with part 02.2, occasionally a student would attempt to convert the number calculated into standard form.

02.4

Nearly 90% of the students could identify that friction was a contact force.

02.5

Most of the students identified the correct distance-time graph for constant speed.

02.6

This was the 1st calculation that was more challenging for many students. A common error was to use only one of the quoted velocities to calculate the acceleration rather than using the difference between the velocities. However just over 80 % did score full marks, with 10 % scoring zero or not attempting the question.

03.1

Approximately 60% of the students scored both marks. Often students did not know the correct word for a natural satellite. However, many correctly identified ‘star’ for the second word.

03.2

Most of the students knew that we are part of the Milky Way galaxy.

03.3

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Only about 40 % of the students knew that the Sun will eventually become a black dwarf. The most popular wrong answer was that it would become a black hole.

03.4

Just fewer than 40 % of the students knew that a very distant galaxy moves faster than a nearer galaxy.

03.5

About 70 % of the students knew that an increase in the wavelength of light from a distant galaxy is called red-shift.

03.6

About 60 % of the students selected the correct word to describe the beginning of the universe.

03.7

Almost 80 % of the students knew that the universe is expanding.

04.1

Just over 70 % of the students were able to make the connection between the mass of a vehicle and how it would affect the maximum acceleration.

04.2

Over 90 % of the students scored full marks for calculating the resultant force using F = ma. However, some of the students thought that the value of acceleration needed to be squared and then multiplied by mass.

04.3

This level of response question proved too challenging for many. Only just over 1 % of the students scored full marks. Most identified that the driving force would increase, but fewer recognised that as this happened the air resistance would also increase, with many stating that the air resistance would decrease as the cars speed increased.

04.4

Most of the students knew that the thinking distance is affected by the driver's reaction time.

04.5

Just fewer than 70 % of the students were aware that the braking distance is the distance travelled under the braking force.

04.6

Only just over 20 % of the students scored full marks for using the graph of distance against speed to find the stopping distance. The correct distances were often identified from the graph. However, these were then either subtracted from each other, divided or multiplied rather than added.

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4.5.1.3 Gravity

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04.7

Nearly 80 % of the students identified factors that would increase the stopping distance of a car. Despite two being emboldened twice in the question, some students only ticked one box.

05.1

The principal focus was correctly identified by just over 60 % of the students.

05.2

About 80 % of the students knew that the change in direction of light as it enters a lens is called refraction.

05.3

Nearly 70 % the students recognised the shape of a convex lens.

05.4

Under a half of the students managed to correctly measure the object height and image height. This may have been due to a lack of skill or a lack of equipment.

05.5

This was much more successfully answered than part 05.4 with nearly 90 % of the students scoring both marks. These students used their values from part 05.4 to calculate magnification.

05.6

Just fewer than 50 % of the students knew that magnification is a ratio, but almost the same number thought it is a power.

05.7

This was a challenging question. Most of the students that did score a mark were awarded only the first mark point. This was for explaining that white light is transmitted through colourless glass. A lot of the students think of white light as an entity in itself rather than the result of the colours of the visible light combined. Few used the word transmitted but rather described it as passing through or goes through.
For the 2nd and 3rd mark points many of the students decided that white light was reflected or refracted, reinforcing the misconception that white light is a single entity rather than being made up of a combination of wavelengths. The idea that filters would absorb different wavelengths of light seemed to be difficult for the students to express, with very few achieving the third mark.

06.1

Only just over 30 % of the students could identify two magnetic materials from the list, with about 60 % being able to identify one. Again, a number of students ticked just one box or more than two boxes.

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4.5.1.3 Gravity

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06.2
Just over 70 % of the students correctly named the iron nails as induced magnets.

06.3
Just fewer than 40 % of the students knew the direction of the magnetic field.

06.4
Nearly 80 % of the students recognised the shape of the magnetic field around a current carrying wire.

06.5
Very few of the students could give two changes that would increase the magnetic field strength. 'Increasing the current' was a common correct response. Many of the students answered 'increasing the number of coils' as such they were implying the wire was already coiled and not answering the question asked, which was about the straight wire shown in Figure 10.

07.1
Nearly 60 % of the students understood what is meant by the moment of a force. The most common incorrect option was 'The direction of the force.'

07.2
The correct resultant moment was selected by just over 80 % of the students.

07.3
Students generally answered this well, identifying position 7 and on which side of the balance the tag should be placed. Some indicated this on the diagram which was an accepted alternative response, provided what was written did not contradict it.

07.4
Some students wrote the equation for the moment of a force in words and then in symbols. This risks not gaining the mark if either is incorrect. Also, correct use of symbols should be stressed, especially when they are given in the question. It was surprising that some of the students scored zero or did not attempt to write down an equation despite having the equations sheet.

07.5
Almost three quarters of the students were able to rearrange the equation and then calculate the distance between the pivot and the tag on the balance.

08.1
Most of the students found this level of response question difficult to answer. Only just over 1 % gave a level 2 answer. Many of the students scored 2, 1 or 0 marks. Of those that scored a mark the most common response was light travels faster than sound. Many also tried to describe light and sound as transverse and longitudinal waves, with the majority getting this

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confused. Very few identified acceptable similarities. Common answers that did not gain credit included light travels at the speed of light, sound travels at the speed of sound, light can be seen and sound cannot be seen.

08.2

Just fewer than 80 % of the students choose the correct equation for calculating speed.

08.3

This question required students to rearrange the equation. About three quarters of the students scored all three marks.

09.1

About 65 % of the students correctly stated the independent variable in this investigation.

09.2

Just over 40 % of the students scored both marks for identifying a risk of harm and a suitable safety precaution to reduce the risk. Too few students connected a hazard, such as a falling weight, becoming a risk of harm when it hit or hurt the student.

09.3

Students were expected to clearly describe two improvements to the arrangement shown that would improve the accuracy of the results. Many had difficulty describing their ideas clearly and answers were often too vague to gain credit.

09.4

Almost 40 % of the students scored this mark usually by explaining that the spring length was not 0 cm rather than describing the relationship between spring length and force.

09.5

This was not successfully answered, with only about 2 % of the students scoring both marks and a further 13 % scoring one mark. The 1st mark point was for stating or giving a clear description of inelastic deformation. Of those who were awarded marks most of them described how the spring had reached or passed its limit of proportionality.

09.6

Over 90 % of the students selected the correct equation.

09.7

Nearly 80 % of the students scored all three marks. Those that did not often rearranged the equation incorrectly.

10.1

Only about 5% of the students correctly calculated the uncertainty correctly from either the range or the mean.

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4.5.1.3 Gravity

10.2

Just over 40 % of the students identified that a random error had caused the variation in this investigation. A greater proportion of the students thought there was a systematic error but this would not have accounted for the variation in the results.

10.3

This mark was awarded for a clear description of variation in the way the ball was dropped. For example, through different heights, at different speeds, or a different delay each time. Common answers giving reaction time or human error were too vague, to be awarded marks unless qualified.

10.4

Just fewer than 30 % of the students scored all three marks. Many of the students took only one value from the graph rather than a corresponding pair of values and so scored 0. Those that used a pair of correct values often then used them the wrong way round when calculating the gradient.

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4.5.1.3 Gravity

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Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

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