AQA GCSE Physics | 8463

SPECIFICATION POINT 4.1.1.2

Changes in energy

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**47**
Available paper years	**2007–2025**

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.

4.1.1.2 Changes in energy

Answer 01 · Mark scheme June 2007 | PHY1A | Original Q4 | Legacy

Four	**A**	0.38	**4**
	B	2	**2**
	C	38	**3**
	D	60	**1**

Answer 02 · Mark scheme June 2007 | PHY1A | Original Q5 | Legacy

Five	**A**	decreases	**2**
	B	increases	**1**
	C	is unchanged	**4**
	D	rises	**3**

Answer 03 · Mark scheme November 2007 | PHY1A | Original Q1 | Legacy

One	**A**	chemical energy to heat	**3**
	B	electrical energy to heat	**4**
	C	light energy to electrical energy	**1**
	D	kinetic energy to electrical energy	**2**

Answer 04 · Mark scheme November 2007 | PHY1A | Original Q6 | Legacy

Six	**A**	gravitational potential energy	**1**
	B	kinetic energy	**2**
	C	light energy	**4**
	D	thermal energy	**3**

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

4.1.1.2 Changes in energy

Answer 05 · Mark scheme

Question 5

question	answers	extra information	mark
(a)	any **two** from: • *(*burning*)* fossil fuels produces greenhouse gases / pollutant gases / acid rain / leads to global warming • nuclear fuels produce dangerous waste • fossil fuels are non-renewable • renewable energy resources produce no pollutant gases • large amounts of energy are available • running costs are low	accept a named fossil fuel accept a named pollutant gas accept radioactive for dangerous accept reference to dangers of nuclear fuels accept running out of fuels accept renewable won't run out accept any reasonable benefit of renewables accept any reasonable drawback of non-renewables do **not** accept better for the environment on its own	2
(b)	**R U S T**	all in correct order allow **2** marks for 2 correct allow **1** mark for one correct	3
total			5

4.1.1.2 Changes in energy

Answer 05 · Mark scheme

January 2008 | PHY1F | Original Q5 | Legacy

PHY1F

4.1.1.2 Changes in energy

Answer 06 · 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

4.1.1.2 Changes in energy

Answer 06 · Mark scheme

January 2008 | PHY2F | Original Q1 | Legacy

PHY2F

4.1.1.2 Changes in energy

Answer 07 · Mark scheme

Question 2

question	answers	extra information	mark
(a)(i)	mass speed	do **not** accept weight accept velocity answers can be in either order	1 1
(ii)	zero	accept nothing	1
(b)(i)	100	allow **1** mark for correct substitution of data	2
(ii)	conserved		1
total			6

4.1.1.2 Changes in energy

Answer 07 · Mark scheme

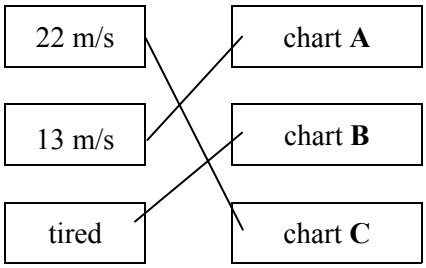
January 2008 | PHY2F | Original Q2 | Legacy

PHY2F

4.1.1.2 Changes in energy

Answer 08 · Mark scheme

Question 3

question	answers	extra information	mark
(a)(i)	constant		1
(ii)	heat		1
(b)(i)	3 links correct  	allow **1** mark for 1 correct link if more than one line is drawn from a condition mark all lines from that condition incorrect	2
(ii)	increased		1
total			5

4.1.1.2 Changes in energy

Answer 08 · Mark scheme January 2008 | PHY2F | Original Q3 | Legacy

PHY2F

Answer 09 · Mark scheme March 2008 | PHY1AP | Original Q2 | Legacy

Two	**A**	electrical energy	**3**
	B	thermal energy	**4**
	C	light energy	**1**
	D	kinetic energy	**2**

Answer 10 · Mark scheme June 2008 | PHY1AP | Original Q1 | Legacy

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

Answer 11 · Mark scheme November 2008 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	electrical	**1**
	B	heat	**4**
	C	light	**2**
	D	sound	**3**

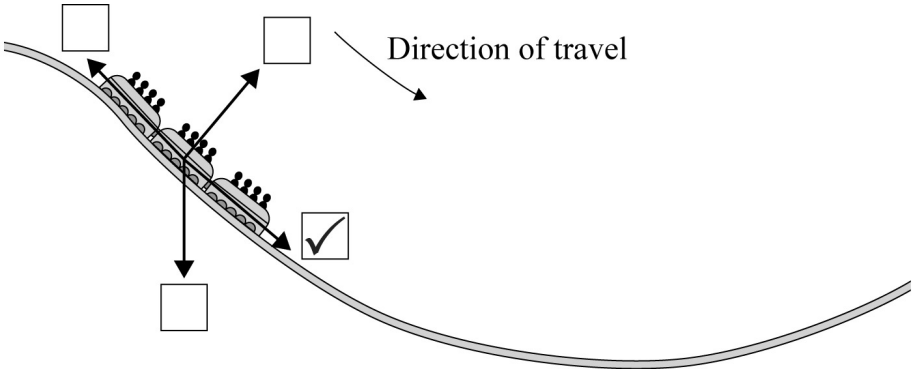
Answer 12 · Mark scheme November 2008 | PHY1AP | Original Q5 | Legacy

Five	**A**	0.6	**4**				
	B	5	**3**				
	C	15	**2**				
	D	30	**1**				
	A		**B**		**C**		**D**

4.1.1.2 Changes in energy

Answer 13 · 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**

4.1.1.2 Changes in energy

Answer 13 · Mark scheme January 2009 | PHY2F | Original Q7 | Legacy

PHY2F

Answer 14 · Mark scheme March 2009 | PHY1AP | Original Q6 | Legacy

Six	**1**	**3**	**1**	**2**

Answer 15 · Mark scheme June 2009 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	fan	**3**
	B	lamp	**2**
	C	oven	**4**
	D	radio	**1**

Answer 16 · Mark scheme November 2009 | PHY1AP | Original Q5 | Legacy

Five	**A**	0.6	**4**
	B	140	**2**
	C	200	**3**
	D	300	**1**

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

Answer 17 · Mark scheme March 2010 | PHY1AP | Original Q2 | Legacy

Two	**A**	heat (thermal energy)	**1**
	B	light	**3**
	C	movement (kinetic energy)	**4**
	D	sound	**2**

Answer 18 · Mark scheme March 2010 | PHY1AP | Original Q5 | Legacy

Five	**A**	0.25	**4**
	B	60	**3**
	C	100	**1**
	D	240	**2**

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

4.1.1.2 Changes in energy

Answer 19 · Mark scheme

June 2010 | PHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	chemical energy	**4**
	B	electrical energy	**3**
	C	heat (thermal energy)	**2**
	D	kinetic energy	**1**

Answer 20 · Mark scheme

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**

4.1.1.2 Changes in energy

Answer 20 · Mark scheme June 2010 | PHY2F | Original Q6 | Legacy

PHY2F

Answer 21 · Mark scheme November 2010 | PHY1AP | Original Q5 | Legacy

Five	**A** electric drill **1** **B** desk lamp **3** **C** hair dryer **2** **D** television **4**			
	A	**B**	**C**	**D**

4.1.1.2 Changes in energy

Answer 22 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	kinetic		1
5(b)	**Z**		1
5(c)(i)	generates a lot more energy / electricity / power **or** can supply (energy / electricity / power) to more homes	need fewer conventional large-scale hydroelectric power stations is neutral	1
5(c)(ii)	Large areas of land are flooded.		1
5(d)(i)	National Grid	this answer only	1
5(d)(ii)	less energy / heat loss (from the cables)	accept wasted for loss accept answers in terms of fewer transformers needed do **not** accept less electricity lost / wasted do **not** accept no energy lost	1

Question 5 continues on the next page . . .

PHY1F

Question 5 continued . . .

question	answers	extra information	mark
5(e)	any **one** from: • fewer rivers (suitable for generators) • less mountainous (so rivers fall smaller distances)	accept answers in terms of difficulty linking villages and towns to grid (in Nepal) accept answers in terms of more isolated communities accept answers in terms of UK having more resources for large-scale power stations	1
Total			**7**

4.1.1.2 Changes in energy

Answer 22 · Mark scheme January 2011 | PHY1F | Original Q5 | Legacy

PHY1F

Answer 23 · Mark scheme June 2011 | PHY1AP | Original Q5 | Legacy

Five	**A** 10%	**2**
	B 20%	**3**
	C 40%	**4**
	D 50%	**1**

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

4.1.1.2 Changes in energy

Answer 24 · Mark scheme

June 2011 | PHY2F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	lorry greatest mass	reason only scores if lorry chosen accept weight for mass accept heaviest accept correct calculations for all 3 vehicles the biggest is insufficient	1 1
3(a)(ii)	2450	allow **1** mark for correct substitution ie 175 × 14	2
3(b)(i)	increases	accept any clear indication of the correct answer	1
3(b)(ii)	speed increases	accept velocity for speed accept gets faster do **not** accept it accelerates on its own moves more is insufficient	1
3(b)(iii)	straight line going to 6, 20 horizontal line from 6,20 to 8,20	allow **1** mark for a curve going to 6,20 **or** a straight line diagonally upwards but missing 6,20 allow a horizontal line from where their **diagonal** meets 20m/s to 8,20	2 1
Total			**9**

4.1.1.2 Changes in energy

Answer 24 · Mark scheme June 2011 | PHY2F | Original Q3 | Legacy

PHY2F

4.1.1.2 Changes in energy

Answer 25 · Mark scheme

June 2012 | PH1FP | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	fan drill washing machine	four circled including correct three scores **1** mark five circled scores zero	1 1 1
1(b)	Appliances only transfer part of the energy usefully The energy transferred by appliances makes the surroundings warmer		1 1
Total			**5**

4.1.1.2 Changes in energy

Answer 25 · Mark scheme

June 2012 | PH1FP | Original Q1 | Legacy

PH1FP

4.1.1.2 Changes in energy

Answer 26 · Mark scheme

June 2012 | PH2FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	**B C**	either order	1
7(a)(ii)	elastic potential (energy)	accept strain for elastic	1
7(b)(i)	measured / recorded the length of the spring (and not extension) extension does not equal zero when force = 0	mark both parts together accept measured **A**–**C** (and not **B**–**C**) accept did not work out/measure the extension accept line should pass through the origin	1 1
7(b)(ii)	point marked at 5.5 (N) up to that point force and extension are (directly) proportional	accept any point between 5.0 and 5.6 inclusive accept it's at the end of the straight part (of the graph line) accept past that point force and extension are no longer (directly) proportional accept the line starts to curve	1 1
7(c)	1.8	allow **1** mark for correct substitution, ie 25 x 0.072 provided no subsequent step shown an answer 1800 gains **1** mark an incorrect conversion from mm to m with a subsequent correct calculation gains **1** mark	2
Total			**8**

4.1.1.2 Changes in energy

Answer 26 · Mark scheme June 2012 | PH2FP | Original Q7 | Legacy

PH2FP

Answer 27 · 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**	

4.1.1.2 Changes in energy

Answer 27 · Mark scheme

June 2014 | PH2FP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

4.1.1.2 Changes in energy

Answer 28 · Mark scheme June 2014 | PH2FP | Original Q8 | Legacy

8(a)(i)	friction		1	AO1 2.1.3a

8(a)(ii)	air resistance	accept drag friction is insufficient	1	AO1 2.1.3a

8(a)(iii)	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** **6**	**AO spec ref**
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO2 AO3 2.1.4c
No relevant content.	There is an attempt to explain in terms of forces A and B why the velocity of the cyclist changes between any two points **or** a description of how the velocity changes between any two points.	There is an explanation in terms of forces A and B of how the velocity changes between X and Y and between Y and Z **or** a complete description of how the velocity changes from X to Z. **or** an explanation and description of velocity change for either X to Y or Y to Z	There is a clear explanation in terms of forces A and B of how the velocity changes between X and Z **and** a description of the change in velocity between X and Z.	

Answer 28 · Mark scheme

examples of the points made in the response	extra information
X to Y • at X force A is greater than force B • cyclist accelerates • and velocity increases • as cyclist moves toward Y, force B (air resistance) increases (with increasing velocity) • resultant force decreases • cyclist continues to accelerate but at a smaller value • so velocity continues to increase but at a lower rate **Y to Z** • from Y to Z force B (air resistance) increases • acceleration decreases • force B becomes equal to force A • resultant force is now zero • acceleration becomes zero • velocity increases until… • cyclist travels at constant / terminal velocity	accept speed for velocity throughout

Question	Answers	Extra information	Mark	AO spec ref
8(b)(i)	3360	allow **1** mark for correct substitution, ie 140 × 24 provided no subsequent step accept 3400 for **2** marks if correct substitution is shown	2	AO1 AO2 2.2.1b
	joule / J	do **not** accept j do **not** accept Nm	1	
8(b)(ii)	decreases	accept an alternative word / description for decrease do not accept slows down	1	AO1 2.1.3e
	temperature	accept thermal energy accept heat	1	
Total			**13**	

4.1.1.2 Changes in energy

Answer 29 · Mark scheme June 2015 | PH2FP | Original Q3 | Legacy

The full source mark scheme begins on page 60. Follow original question 3 in that document.

Answer 30 · Mark scheme June 2015 | PH2FP | Original Q5 | Legacy

The full source mark scheme begins on page 60. Follow original question 5 in that document.

4.1.1.2 Changes in energy

Answer 31 · Mark scheme June 2016 | PH2FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	gravity	accept weight for gravity air resistance is insufficient	1	AO1 2.2.1f
6(b)(i)	800	allow **1** mark for correct substitution ie P = $\frac{2240}{2.8}$ provided no subsequent step	2	AO2 2.2.1e
6(b)(ii)	2240 J		1	AO1 2.2.1f
6(c)(i)	(vertical) height	accept (height of) stairs	1	AO3 2.2.1f
6(c)(ii)	a fast / short time (for a lighter student) may give the greatest power **or** a slow / long time (for a heavy student) may give the least power	accept time is a factor fitness is insufficient	1	AO3 2.2.1e
Total			**6**	

4.1.1.2 Changes in energy

Answer 31 · Mark scheme

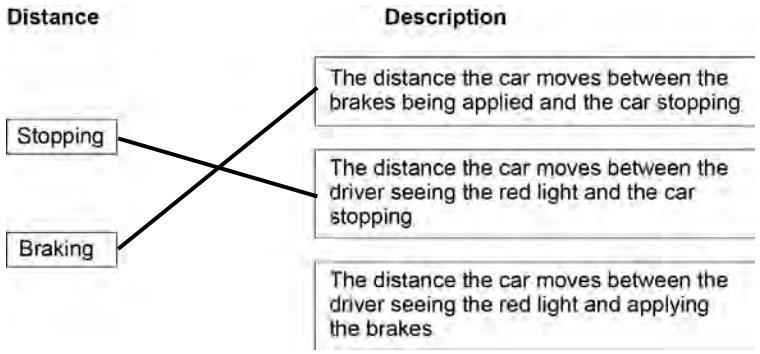
June 2016 | PH2FP | Original Q6 | Legacy



4.1.1.2 Changes in energy

Answer 32 · Mark scheme

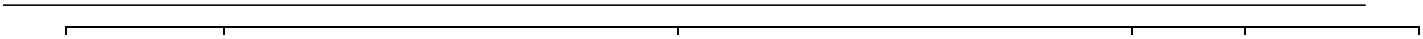
June 2017 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	 If more than one line goes from a 'distance' box, all those lines are incorrect		2	AO1 2.1.3c
2(b)(i)	0.8s		1	AO2 2.1.3c
2(b)(ii)	increases thinking distance so increases (overall) stopping distance	 takes longer to stop more likely to have an accident is insufficient	1 1	AO1 2.1.3c, d
2(b)(iii)	$\frac{1}{2} \times 750 \times 8^2$		1	AO2 2.2.1g
2(b)(iv)	decrease(s) increase(s)	correct order only	1 1	AO1 2.1.3e
Total			8	

4.1.1.2 Changes in energy

Answer 32 · Mark scheme

June 2017 | PH2FP | Original Q2 | Legacy



4.1.1.2 Changes in energy

Answer 33 · Mark scheme June 2018 | 8463/1F | Original Q1

Question	Answers	Extra information	Mark	AO/ Spec. Ref
01.1	chemical kinetic	in this order only	1 1	AO1 4.1.1.1
01.2	$E_k = 0.5 \times 80 \times 12^2$ $E_k = 5760$ (J)	an answer of 5760 (J) scores **2** marks	1 1	AO2 4.1.1.2
01.3	E = 0.040 × 480 × 50 E = 960 (J)	an answer of 960 (J) scores **2** marks	1 1	AO2 4.1.1.3
01.4	increased		1	AO1 4.3.2.1
Total			**7**	

4.1.1.2 Changes in energy

Answer 33 · Mark scheme

June 2018 | 8463/1F | Original Q1



4.1.1.2 Changes in energy

Answer 34 · 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**	

4.1.1.2 Changes in energy

Answer 35 · 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**	

4.1.1.2 Changes in energy

Answer 36 · Mark scheme

June 2019 | 8463/1F | Original Q11

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	$41 = \frac{9.8 \times h}{0.12}$ $h = \frac{41 \times 0.12}{9.8}$ h = 0.50 (m)	an answer of 0.50 scores **3** marks allow a correct answer that rounds to 0.50 for **3** marks	1 1 1	4.1.1.2 AO2
11.2	kinetic energy = 0.5 × mass × (speed)^2 ***or*** $E_k = ½ mv^2$		1	4.1.1.2 AO1
11.3	$270 = ½ \times m \times 3^2$ $m = \frac{270}{(½ \times 3^2)}$ **or** $m = \frac{270}{4.5}$ m = 60 (kg)	an answer of 60 (kg) scores **3** marks	1 1 1	4.1.1.2 AO2

Answer 36 · Mark scheme

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

4.1.1.2 Changes in energy

Answer 37 · 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**	

Answer 38 · Mark scheme

November 2020 | 8463/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	(the north pole of the floating magnet is) repelled from the north pole (of the fixed magnet) and attracted to the south pole (of the fixed magnet)	allow following a magnetic field line for **1 mark** if no other marks scored	1 1	AO3 4.7.1.1 4.7.1.2
05.2	it was attracted (to the fixed magnet)	allow it sticks / joins to the (fixed) magnet allow it becomes an induced magnet allow it becomes magnetised	1	AO1 4.7.1.2
05.3	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		3–4	AO1 4.7.1.2
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content: • mark where the compass points on the paper • move the compass to the marked point • repeat until you go back to the magnet • join up the points • add an arrow pointing from the north pole to the south pole • repeat for positions (above and below the bar magnet)			
05.4	C B A	allow **1** mark for one letter in the correct box	2	AO2 4.7.2.1
05.5	$E_e = 0.5 \times 200 \times 0.040^2$ $E_e = 0.16$ (J)		1 1	AO2 4.5.3
Total			**11**	

4.1.1.2 Changes in energy

Answer 39 · Mark scheme

November 2021 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	gravitational potential kinetic	this order only	1 1	AO1 4.1.1.2 4.1.1.1
07.2	kinetic energy = 0.5 × mass × speed^2 **or** $E_k = ½mv^2$		1	AO1 4.1.1.2
07.3	$5040 = 0.5 \times m \times 12^2$ $m = \frac{5040}{0.5 \times 12^2}$ m = 70 (kg)		1 1 1	AO2 4.1.1.2
07.4	the thermal energy increases.		1	AO1 4.1.1.1
Total			**7**	

Answer 40 · Mark scheme

November 2021 | 8463/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO/ Spec. Ref
09.1	will return to its original shape/length when the force is removed	 allow (when) the child gets off the second mark is dependent on scoring the first mark	1 1	AO2 4.5.3

09.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO1 4.5.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • set up a clamp stand with a clamp • hang the spring from the clamp • use a second clamp and boss to fix a (half) metre rule alongside the spring • record the ruler reading that is level with the bottom of the spring • hang a 1 N / a known weight from the bottom of the spring • record the new position of the bottom of the spring • calculate the extension of the spring • measure the extension of the spring • add further weights to the spring so the force increases 1 N at a time up to 5 N • for each new force record the position of the bottom of the spring and calculate / measure the extension Indicative content continues on the next page…		

Answer 40 · Mark scheme

November 2021 | 8463/2F | Original Q9

	Risk Assessment Hazard: Clamp (stand, boss and masses) might fall off desk Risk: injury to feet Precaution: Use clamp to fix apparatus to the bench **or** Ensure that the slotted masses hang over the base/foot of the stand **or** Ensure that the boss is screwed tightly into the stand and clamp **or** Put (heavy) masses on the base/foot of the stand **or** Stand up so that you can move out of the way Hazard: Spring could break / come loose Risk: damage eye Precaution: Wear safety goggles If a risk assessment / hazard is not given, the answer can still reach level 3, but not full marks. Full marks may be awarded for alternative feasible methods.			

09.3	force = spring constant × extension		1	AO1 4.5.3

09.4	5.00 0.125 $k = \frac{5.00}{0.125}$ k = 40 (N/m)	allow any correct pair of values from the graph allow a misread value(s) from the graph allow a correct calculation using their incorrect value(s)	1 1 1	AO2 4.5.3

09.5	the line is straight and passes through the origin	allow the line does not curve allow a constant gradient	1 1	AO3 4.5.3

4.1.1.2 Changes in energy

Answer 40 · Mark scheme

09.6	e = 0.20 m $E_e = 0.5 \times 13 \times 0.20^2$ E_e = 0.26 (J)	 allow an incorrectly / not converted value of e use of two incorrectly/not converted values scores a máximum of 1 mark	1 1 1	AO2 4.5.3

Total			**17**

4.1.1.2 Changes in energy

Answer 41 · Mark scheme

June 2022 | 8463/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	gravitational potential kinetic	this order only	1 1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	$E_e = 0.5 \times 120\,000 \times 0.015^2$ $E_e = 13.5$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	$E = 540$ (J)	allow their answer from question **01.2** x 40	1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	$E_k = 0.45 \times 600$ $E_k = 270$ (J)		1 1	AO2 4.1.2.2

4.1.1.2 Changes in energy

Answer 41 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	energy is transferred to the surroundings		1	AO2 4.1.1.1

Total Question 1		**8**

4.1.1.2 Changes in energy

Answer 42 · 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

4.1.1.2 Changes in energy

Answer 42 · Mark scheme

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**

Answer 43 · 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

4.1.1.2 Changes in energy

Answer 43 · 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

4.1.1.2 Changes in energy

Answer 44 · Mark scheme

June 2023 | 8463/1F | Original Q6

Question 6

Question	Answers	Mark	AO / Spec. Ref.
06.1	<table><tr><th>Energy store</th><th>Less than at A</th><th>The same as at A</th><th>More than at A</th></tr><tr><td>The student's gravitational potential energy</td><td>✓</td><td></td><td></td></tr><tr><td>The student's kinetic energy</td><td></td><td></td><td>✓</td></tr><tr><td>The bungee cord's elastic potential energy</td><td></td><td></td><td>✓</td></tr></table> additional tick in a row negates the mark for that row	1 1 1	AO1 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	$E_e = 0.5 \times 78.4 \times 25^2$ $E_e = 24\ 500$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	greatest spring constant	allow needs largest force (per metre) to stretch the cord	1	AO3 4.1.1.2

4.1.1.2 Changes in energy

Answer 44 · Mark scheme June 2023 | 8463/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	A greatest extension before snapping	 MP2 dependent on scoring MP1	1 1	AO3 4.1.1.2

Total Question 6	**8**

Answer 45 · 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

4.1.1.2 Changes in energy

Answer 45 · Mark scheme

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**

Answer 46 · Mark scheme

June 2025 | 8463/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	the speed increased		1	AO1 4.3.3.1

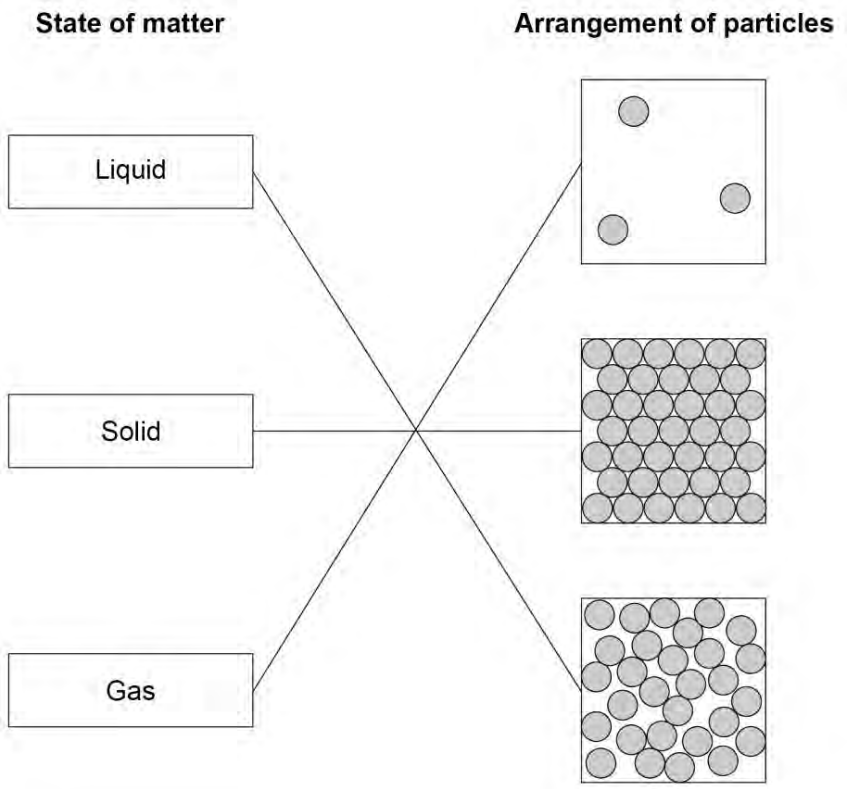
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the kinetic energy increased		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	the number of collisions each second increased		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	the force exerted increased		1	AO1 4.3.3.1

4.1.1.2 Changes in energy

Answer 46 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
04.5	 do **not** accept more than one line from a box on the left allow **1** mark for 1 or 2 correct lines	2	AO1 4.3.1.1

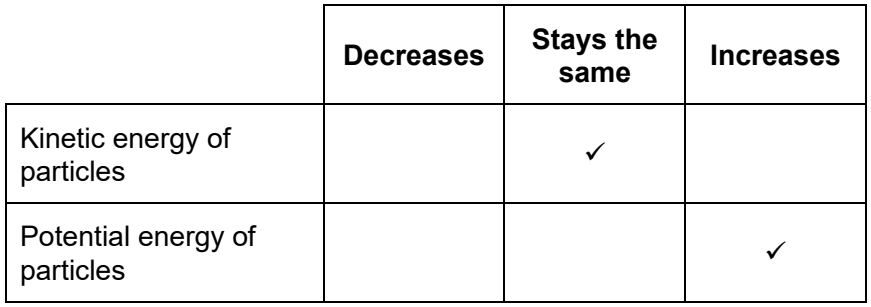
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	liquid		1	AO3 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	solid		1	AO3 4.3.1.2

4.1.1.2 Changes in energy

Answer 46 · Mark scheme

June 2025 | 8463/1F | Original Q4

Question	Answers	Mark	AO / Spec. Ref.
04.8			AO1 4.3.2.1
	do **not** accept more than one tick in each row		

	Decreases	Stays the same	Increases	Mark
Kinetic energy of particles		✓		1
Potential energy of particles			✓	1

Total Question 4	10

Answer 47 · 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

4.1.1.2 Changes in energy

Answer 47 · 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

4.1.1.2 Changes in energy

GCSE

Additional Science / Physics

PH2FP

Mark scheme

4408/4403
June 2015

Version/Stage: 1.0: Final

4.1.1.2 Changes in energy

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

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

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

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Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

3.8 Accept / allow

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

3.9 Ignore / Insufficient / Do not allow

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

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

4. Quality of Communication and levels marking

In Question **8c** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

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

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

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

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

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

4.1.1.2 Changes in energy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
1(a)	increases	accept reaches highest value do **not** accept increases and decreases	1	AO2 2.3.2	**E**
1(b)(i)	increases		1	AO1 2.3.2m	**A**
1(b)(ii)	increases		1	AO1 2.3.2m	**A**
1(c)	18 watt	allow **1** mark for correct substitution i.e. 12 x 1.5 provided no subsequent step accept W answer may be indicated in the list	2 1	AO2 2.4.2c AO1 2.4.2c	**E**
Total			**6**		

4.1.1.2 Changes in energy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
2(a)	inside the Sun		1	AO1 2.6.2b	**A**
2(b)	fusion		1	AO1 2.6.2a	**G**
2(c)	energy		1	AO1 2.6.2f	**A**
Total			**3**		

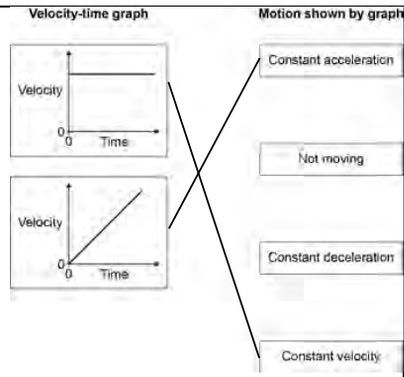
4.1.1.2 Changes in energy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
3(a)	3 (.0)	allow **1** mark for correct substitution i.e. 25 x 0.12 provided no subsequent step	2	AO2 2.1.5d	**E**
3(b)(i)	elastic potential kinetic	correct order only	1 1	AO1 2.1.5c 2.2	**G**
3(b)(ii)	increases to 80(mm) (or more)	 accept any number greater than 75 an answer 'it (more than) doubles' gains both marks	1 1	AO3 2.1.5a	**E**
3(c)(i)	weight		1	AO1 2.1	**A**
3(c)(ii)	Downward speed increases		1	AO1 2.1.1e	**A**
Total			**8**		

4.1.1.2 Changes in energy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
4(a)(i)	(3-pin) plug	do **not** accept plug socket	1	AO1 2.4.1d	**E**
4(a)(ii)	live and neutral		1	AO1 2.4.1e	**A**
4(a)(iii)	double		1	AO1 2.4.1j	**G**
4(b)	Direct current (d.c.) only		1	AO1 2.4.1a	**A**
4(c)(i)	live		1	AO1 2.4.1g	**G**
4(c)(ii)	too great a current flows	accept a surge of current accept too great a power accept an electrical fault do **not** accept voltage / energy / electricity too high	1	AO1 2.4.1g	**E**
4(c)(iii)	can be reset (disconnects circuit) faster	accept does not need replacing cheaper is insufficient does not melt is insufficient quicker to fix / replace is insufficient	1 1	AO2 2.4	**E**
Total			**8**		

4.1.1.2 Changes in energy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
5(a)		if more than one line is drawn from a graph then all those lines are wrong allow **1** mark for 1 correct line	2	AO1 2.1.2f	**G**
5(b)	speed		1	AO1 2.1.2d	**G**
5(c)(i)	2.25	allow **1** mark for correct substitution i.e. $a = \frac{9-0}{4}$ or $a = \frac{9}{4}$ provided no subsequent step	2	AO2 2.1.2e	**E**
5(c)(ii)	The air resistance increases		1	AO1 2.1.4a	**A**
5(d)	2000 J mass is half **or** kinetic energy depends on mass	 do **not** accept weight for mass	1 1	AO2 2.2.1g	**E**
Total			**8**		

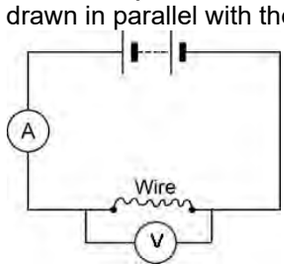
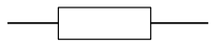
4.1.1.2 Changes in energy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
6(a)	cell damage *or* cancer	accept kills/mutates cells radiation poisoning is insufficient ionising is insufficient	1	AO3 2.5.2g	**E**
6(b)(i)	any **one** from: • use tongs to pick up source • wear gloves • use (lead) shielding • minimise time (of exposure) • maximise distance (between source and teacher)	accept any other sensible and practical suggestion ignore reference to increasing / decreasing the number / thickness of lead sheets	1	AO3 2.5	**E**
6(b)(ii)	<u>background</u>		1	AO1 2.5.2b	**E**
6(c)(i)	curve drawn *from point 2,160*	do **not** accept straight lines drawn from dot to dot	1	AO2 2.5	**E**
6(c)(ii)	(also) increases	less radiation passes through is insufficient	1	AO3 2.5	**E**
6(c)(iii)	50	accept any value from 40 to 56 inclusive	1	AO3 2.5	**E**
6(d)	gamma only gamma (radiation) can pass through lead	 accept alpha **and** beta cannot pass through lead a general property of gamma radiation is insufficient	1 1	AO2 2.5.2e	**E**
Total			**8**		

4.1.1.2 Changes in energy

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
7(a)(i)	p.d. is (directly) proportional to current **or** gradient/slope is constant ***or*** the lines show constant resistance	accept lines are straight / diagonal	1	AO2 2.3.2d/e/g	**E**
7(a)(ii)	C for the same p.d. the current is the smallest	reason only scores if C is chosen accept lowest gradient **and** the gradient = 1/R	1 1	AO2 2.3.2i	**E**
7(b)(i) clip with table 1	ohm	accept correct symbol Ω accept an answer written in Table 1 if not given in answer space	1	AO1 2.3.2h	**E**
7(b)(ii)	K and L only length varies	reason only scores if both K and L are chosen accept type of metal and the diameter are the same	1 1	AO3 2.3.2	**E**
7(b)(iii)	measure the resistance of more wires made from different metals	accept test more (types of) metals measure the resistance of more wires is insufficient they only use two metals is insufficient	1	AO3 2.3.2	**E**

7(c)(i)	voltmeter symbol correct and drawn in parallel with the wire 	accept voltmeter symbol correct and drawn in parallel with the battery	1	AO1 2.3.2c/f	**E**
7(c)(ii)	correct symbol drawn 	symbol must be rectangular	1	AO1 2.3.2c	**E**
Total			**9**		

Question	**Answers**	**Extra information**	**Mark**	**AO / Spec. ref.**	**ID**
8(a)	(an equal amount of) positive charge	do **not** accept charge on the atom / nucleus is positive	1	AO3 2.5.1	**E**
8(b)(i)	a (significant) number of alpha particles were scattered by more than 4° **or** alpha particles deflected backwards measurements / results could not be explained by 'plum pudding' model **or** measurements / results did not support predictions	accept (some) measurements / results were unexpected can be explained by the nuclear model is insufficient accept measurements / results did not support hypothesis	1 1	AO1 2.5 AO1	**E**
8(b)(ii)	many/(over)100 000 measurements / results taken	accept Rutherford(and Marsden) were respected scientists **or** scientists were respected accept measurements / results taken over several months the experiment was repeated many times is insufficient	1	AO3 2.5	**E**

PMT

Question 8 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
8(c)			6	AO1 2.5.1a/b/c	**E**

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no relevant content	A brief description is given with some particles correctly named	A description is given with all three particles named **plus either** the polarity of charge associated with the three particles **or** the relative mass of the three particles **or** the relative mass for one particle and the relative charge for one particle given	A more detailed description is given, naming the particles and polarity of charge **and either** the relative mass is given for at least two particles **or** the relative charge is given for at least two particles

examples of the points made in the response	extra information		
brief description contains protons, neutrons and electrons protons are positive electrons are negative neutrons are uncharged has a nucleus **relative charge** proton +1 electron – 1 neutron 0 **relative mass** proton 1 neutron 1 electron (about) 1/2000 **more detailed description** protons and neutrons make up the nucleus electrons orbit the nucleus electrons are in shells most of the atom is empty space nucleus occupies a very small fraction of the volume of the atom electrons orbit at a relatively large distance from the nucleus most of the mass of the atom is contained in the nucleus the nucleus as a whole is positively charged total number of protons in the nucleus equals the total number of electrons orbiting it in an atom	accept protons and neutrons have the same mass accept electrons have tiny / negligible mass zero mass is neutral		

Total		**10**

4.1.1.2 Changes in energy

Answer 41 · Examiner comments June 2022 | 8463/1F | Original Q1

Question 1 (Low demand)

01.1 About 40% of students answered this question correctly.

01.2 Approximately 80% of students answered this question correctly. The most common mistake was to not square the extension. This would then just score a mark for the substitution, if correct.

01.3 Students were required to multiply their answer to question **01.2** by 40. However, many students did not answer this correctly. Many students tried to calculate the elastic potential energy using the equation, scoring zero marks. About 60% of students answered this question correctly.

01.4 About 65% of students scored 2 marks on this question. However, a number of students didn't score any marks as they did not appear to be able to calculate a percentage, which is one of the mathematical skills stated in the specification.

01.5 Approximately 60% of students answered this question correctly.

Answer 42 · 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.

4.1.1.2 Changes in energy

Answer 43 · 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.

Answer 43 · 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 44 · Examiner comments — June 2023 | 8463/1F | Original Q6

Question 6 (Low Demand)

06.1 This question discriminated well with 24% of students scoring 3 marks, 39 % scoring 2 marks and 30% scoring 1 mark, for comparing the energy stores.

06.2 82% of students scored 2 marks for this calculation. The most common mistake was to forget to square the extension.

06.3 34% of students gave the correct reason.

06.4 While 39% of students chose cord A, only 34% of students gave a correct reason. ‘Greater extension’ was insufficient unless also linked to ‘snapping’.

4.1.1.2 Changes in energy

Answer 45 · 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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4.1.1.2 Changes in energy

Answer 46 · Examiner comments June 2025 | 8463/1F | Original Q4

04.1
Just over 90 % of the students knew that the speed of the gas particles increased.

04.2
Nearly 80 % of the students knew that the kinetic energy of the gas particles increased.

04.3
Nearly 90 % of the students knew that the number of collisions each second increased.

04.4
Just over 70 % of the students knew that the force exerted by the gas particles increased.

04.5
When completing a matching type questions students should be encouraged to draw straight lines only.

04.6
Just fewer than 50 % of the students identified the state as liquid.

04.7
Just over 50 % of the students identified the state as solid.

Answer 46 · Examiner comments June 2025 | 8463/1F | Original Q4

04.8
Students found this question about internal energy difficult. Only about 11 % of the students scored 2 marks, while a further 33 % of the students scored 1 mark.

4.1.1.2 Changes in energy

Answer 47 · 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 47 · 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.

4.1.1.2 Changes in energy

AQA

GCSE
PHYSICS

8463/1F: Paper 1
Report on the Examination

8463
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4.1.1.2 Changes in energy

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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.

4.1.1.2 Changes in energy

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.

4.1.1.2 Changes in energy

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.