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EDEXCEL COMBINED SCIENCE PHYSICS: QUESTIONS BY TOPIC

Conservation of Energy (3)

Combined Science Physics (Higher) Topic 3

5 questions · 49 marks · Mark schemes included

Pearson Edexcel Combined Science (9-1) Physics 1SC0, Higher Tier, June 2018 - June 2025

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HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.
Click any row below to jump straight to that question.
On every question page, click ANSWER in the top-right corner to jump to its mark scheme.
Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION		SOURCE	MARKS	PAGE
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3.	Q1	Paper 1 June 2024	9	8
4.	Q4 <i>also Topic 2</i>	Paper 1 June 2025	10	12
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QUESTIONS

5 questions · 49 marks · lowest tariff first



9-MARK QUESTIONS

3 questions in this booklet



1 (a) Which statement describes conservation of energy in a closed system?

(1)

- ☐ **A** when there are energy transfers, the total energy reduces
- ☐ **B** when there are energy transfers, the total energy does not change
- ☐ **C** when there are no energy transfers, the total energy reduces
- ☐ **D** when there are no energy transfers, the total energy increases

(b) A student uses the apparatus in Figure 1 to find out which of two materials, sand or sawdust, is the better insulator.

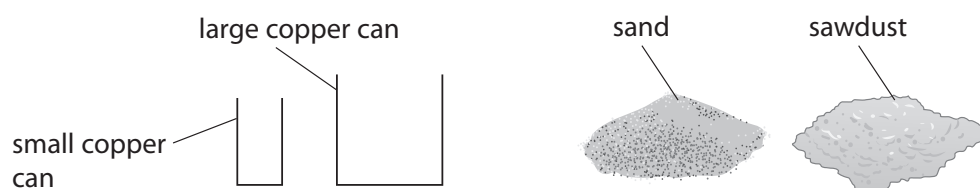


Figure 1

The student also has a kettle to boil water, a thermometer and a stop clock.

- (i) Draw a labelled diagram to show how the student should set up the equipment to investigate which material is the better insulator.

(3)

(ii) Give **three** factors that the student must control in this investigation.

(3)

1.....

2.....

3.....

(c) Expanded polystyrene, used to insulate buildings, has different densities.

Figure 2 shows how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

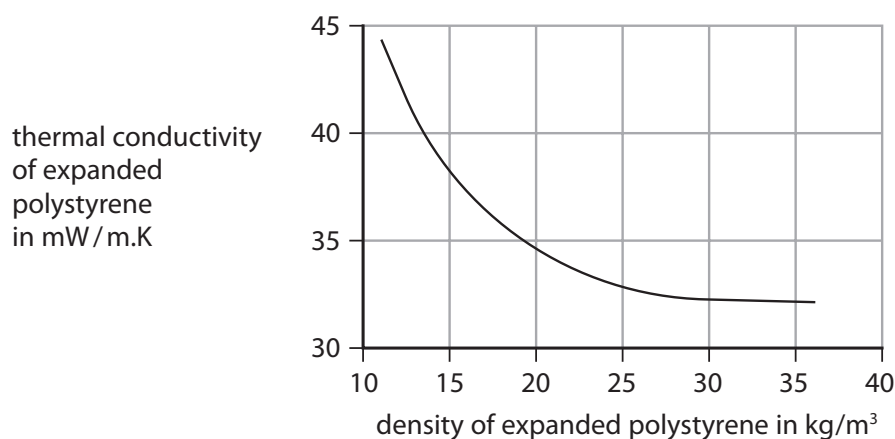


Figure 2

Using the graph in Figure 2, describe how the thermal conductivity of expanded polystyrene changes with the density of expanded polystyrene.

(2)

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.....

(Total for Question 1 = 9 marks)



- 2 (a) Figure 4 shows a football kicked against a wall.

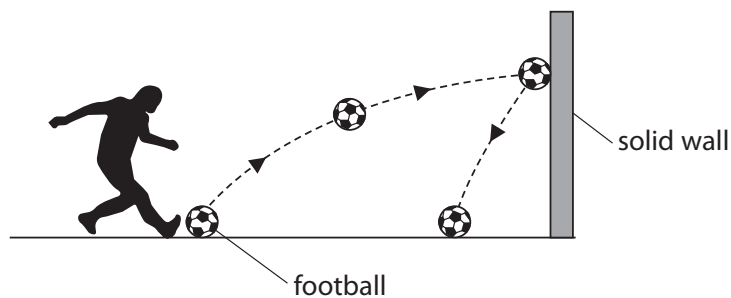


Figure 4

The football has a mass of 0.42 kg.

- (i) The football gains 11 J of gravitational potential energy as it moves from the ground to the wall.

Calculate the height at which the ball hits the wall.

(3)

Gravitational field strength = 10 N/kg

Use the equation

$$\Delta GPE = m \times g \times \Delta h$$

height = ... m

- (ii) Calculate the kinetic energy of the football when it is moving at a velocity of 12 m/s.

(2)

Use the equation

$$KE = \frac{1}{2} \times m \times v^2$$

kinetic energy = ... J



(iii) Describe the energy transfers that happen when the ball hits the wall.

(2)

.....

.....

.....

.....

(b) A stone is held at rest above the ground.

The stone is released and falls until its velocity is 17 m/s .

Calculate the distance the stone has fallen when its velocity has reached 17 m/s .

(2)

distance = ... m

(Total for Question 2 = 9 marks)



- 1 Figure 1 shows a person on a skateboard at the top of a ramp.

At P, the person is not moving.

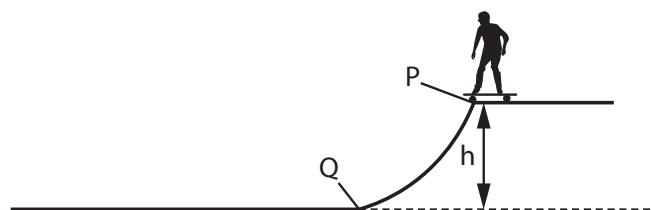


Figure 1

- (a) The person rides the skateboard down the ramp from P to Q.

The gravitational potential energy of the person decreases by 980 J.

The mass of the person is 35 kg.

Calculate h , the height of the ramp.

Use $g = 10 \text{ N/kg}$.

Use the equation

$$\text{change in gravitational potential energy} = m \times g \times h$$

(2)

$h = \dots\dots\dots \text{ m}$

(b) The kinetic energy, KE, of the person at Q is 950 J.

The mass of the person is 35 kg.

Calculate the velocity of the person at Q.

Use the equation

$$v^2 = \frac{2 \times KE}{m} \quad (3)$$

velocity = ... m/s



(c) Figure 2 is a diagram that represents energy changes from P to Q.

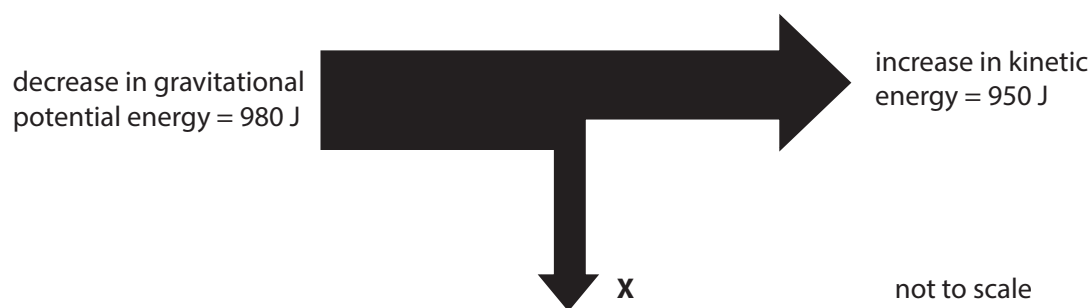


Figure 2

(i) State what is represented by **X**.

(1)

(ii) Calculate the value of **X**.

(1)

value of **X** = ... J

(iii) Calculate the efficiency of the system represented in Figure 2.

(2)

efficiency = ...

(Total for Question 1 = 9 marks)

10-MARK QUESTIONS

1 question in this booklet



- 4 (a) Figure 7 shows a skier sliding down a slope.

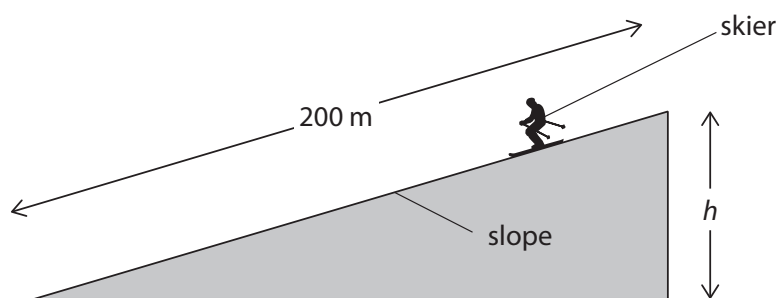


Figure 7

- (i) The gravitational potential energy of the skier decreases by 39 000 J between the top and the bottom of the slope.

The mass of the skier is 70 kg.

Calculate the height, h , of the slope.

The value of g is 10 N/kg.

Use the equation

$$\Delta GPE = m \times g \times h$$

(2)

$$h = \dots\dots\dots \text{ m}$$

- (ii) The skier starts from rest at the top of the slope.

The velocity of the skier at the bottom of the slope is 27 m/s.

Using information from Figure 7, calculate the acceleration of the skier along the slope.

(3)

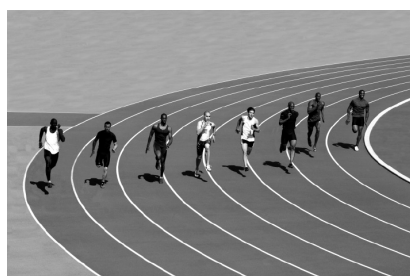
$$\text{acceleration} = \dots\dots\dots \text{ m/s}^2$$

- (iii) When the skier slides from the top to the bottom of the slope, some energy is dissipated.

Explain how to determine the amount of energy dissipated.

(2)

- (b) Figure 8 shows athletes running at a constant speed on a curved section of a track.



(Source: © Photo and Co/Getty Images)

Figure 8

- (i) Even though they are running at a constant speed, the velocity of each athlete is changing.

State why the velocity of each athlete is changing.

(1)

(ii) The athletes start the race on a straight section of track.

Figure 9 shows a distance / time graph for one of the athletes.

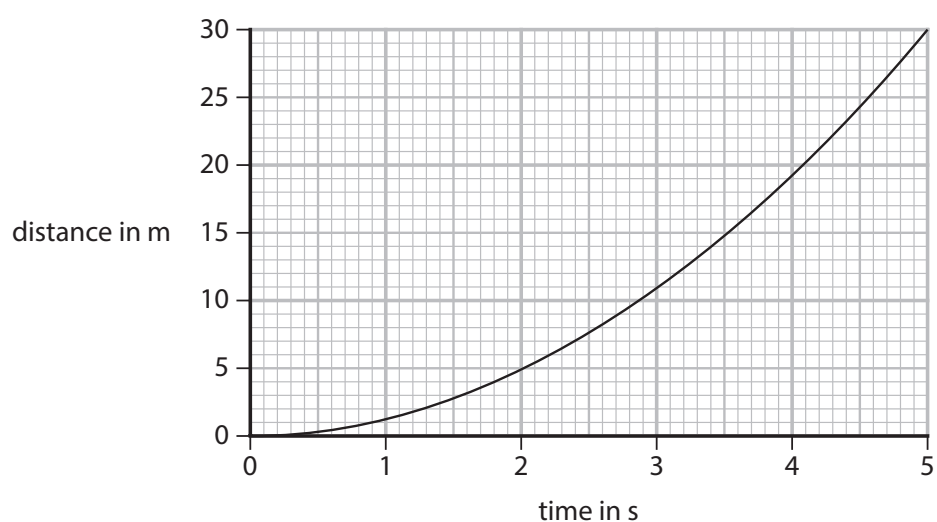


Figure 9

Determine the gradient of this graph at a time of 2.5 s.

(2)

gradient = ... m/s

(Total for Question 4 = 10 marks)

12-MARK QUESTIONS

1 question in this booklet



5 (a) Which of these is a non-renewable source of energy?

(1)

- ☐ A geothermal
- ☐ B natural gas
- ☐ C tidal
- ☐ D solar

(b) Explain why renewable sources provide an increasing fraction of the electricity supply for many countries.

(2)

.....

.....

.....

.....

(c) Electricity can be generated using a water turbine.

(i) Water gains kinetic energy by falling from the top of a dam.

Calculate the minimum height that 7.0 kg of water must fall to gain 1300 J of kinetic energy.

(3)

minimum height = ... m



- (ii) As water enters the turbine at the bottom of the dam, the kinetic energy of 8.0 kg of moving water is 1100 J.

Calculate the speed of the moving water as it enters the turbine.

(3)

speed = ... m/s



(d) Moving air can be used to generate electricity using a wind turbine.

Figure 6 is a graph of kinetic energy against wind speed for a mass of moving air.

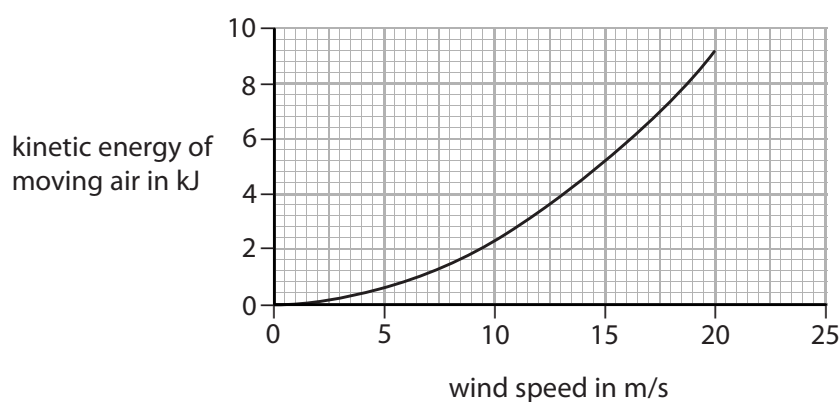


Figure 6

Just before the air reaches a wind turbine it has a wind speed of 15 m/s.

When the air has gone through the turbine it has a wind speed of 13 m/s.

As the air moves through the turbine some of its kinetic energy is transferred to the turbine.

Use the graph to determine the percentage of the kinetic energy transferred to the turbine from the air.

(3)

percentage of kinetic energy transferred from the air = ... %

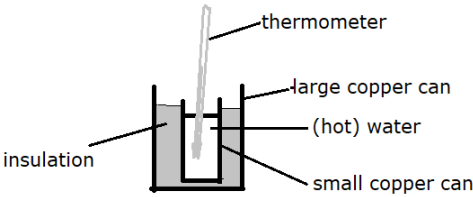
(Total for Question 5 = 12 marks)

MARK SCHEMES

official Pearson Edexcel mark schemes



Question Number	Answer	Mark
1(a)	B. when there are energy transfers, the total energy does not change <i>A is not correct because the total energy does not reduce</i> <i>C is not correct because the total energy does not reduce</i> <i>D is not correct because the total energy does not increase</i>	(1) AO1

Question Number	Answer	Additional guidance	Mark
1(b)(i)	a diagram showing: apparatus labelled to include three from • thermometer • water • insulator / sand / sawdust / material • (copper) can (1) thermometer in the water (1) arrangement for water and insulator in and between copper cans (e.g. as in diagram below) (1) 	independent of arrangement ignore kettle and stop clock accept reverse positions for water and insulator	(3) AO2

Question Number	Answer	Additional guidance	Mark
1(b)(ii)	any three factors from: {mass / volume} of water (1) {volume / thickness / mass} of insulators / materials (1) {starting / initial} temperature of water (1) time interval / temperature change (1)	accept amount / specified values / "how much" accept amount / specified values / "how much" accept temperature of hot / boiling water / specified values accept specified values of interval or change unqualified "same time" is insufficient	(3) AO3

	Answer	Additional guidance	Mark
1(c)	a description giving as the density (of expanded polystyrene) increases the (thermal) conductivity decreases (1) non-linear / gradient decreases / at a decreasing rate / levels off / plateaus / becomes (almost) constant (1)	ORA allow inversely proportional / exponential for non-linear in this context ignore negative correlation unqualified quoted values are insufficient	(2) AO2

Total for Question 1 = 9 marks

	Answer	Additional guidance	Mark
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Question number	Answer	Additional guidance	Mark
2 (a) (i)	substitution (1) $11 = 0.42 \times 10 \times \Delta h$ rearrangement (1) $(\Delta h =) \frac{11}{0.42 \times 10}$ evaluation (1) 2.6 (m)	accept substitution and rearrangement in either order $(\Delta h =) \frac{\Delta GPE}{m \times g}$ accept any value which rounds to 2.6 (m) award 2 marks for 2.6 to any other power of 10 allow 1 mark for 0.38 allow 1 mark for 46(.2) award full marks for the correct answer with no working give full credit for use of $g=9.8$ or 9.81 N/kg (gives 2.7 (m))	(3) AO2

Question number	Answer	Additional guidance	Mark
2 (a) (ii)	substitution(1) $(KE = \frac{1}{2} \times 0.42 \times 12^2)$ evaluation (1) 30 (J)	allow 30.2(4) (J) award 1 mark for 30 240 (J) award 1 mark for 2.52 (J) award 1 mark for 60.5 (J) award full marks for the correct answer with no working	(2) AO2

Question number	Answer	Additional guidance	Mark
2 (a)(iii)	A description including: KE/kinetic (energy store) (1) (transfers to) and one of: elastic (potential energy store) (1) OR thermal (energy of ball/wall/surroundings) (1) OR <u>dissipates</u> (to surroundings) (1)	allow mechanically / mechanical transfer ignore reference to gravitational potential energy allow heat for thermal allow sound in this context ignore reference to the ground	(2) AO2

Question number	Answer	Additional guidance	Mark
2 (b)	selection and substitution (1) $17^{(2)} = 2 \times 10 \times \text{distance}$ evaluation (1) 14(.45) (m)	use of either $v^2 - u^2 = 2ax$ or $v^2 = 2gh$ $17^{(2)} = 2 \times a \times \text{distance}$ allow 289 for 17^2 award full marks for the correct answer without working give full credit for use of $g=9.8$ or 9.81 m/s^2 gives 14.7 (m)	(2) AO2

Total for question 2 =9 marks

	Answer Additional guidance	Mark
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Question number	Answer	Additional guidance	Mark
1(a)	Substitution or rearrangement (1) $980 = 35 \times 10 \times h$	$(\Delta h =) \frac{\Delta GPE}{m \times g}$ or $(\Delta h =) \frac{980}{35 \times 10}$ allow use of 9.8 N/kg or 9.81 N/kg allow substitution into visible incorrectly rearranged algebraic expression	2 A02.1
	evaluation (1) (h =) 2.8 (m)	allow 2.85/2.86/2.9 for use of g = 9.8 N/kg or 9.81 N/kg ignore use of negative for decrease in GPE award full marks for the correct answer without working	

Question number	Answer	Additional guidance	Mark
1 (b)	substitution (1)		3 AO2.1
	$(v^2) = \frac{950 \times 2}{35}$	$\frac{1900}{35}$	
	evaluation of v^2 (1) 54(.29)		
	evaluation of v (1) ($v =$) 7.4 (m/s)	accept values that round to 7.3 (m/s) or 7.4 (m/s)	
		accept answer of 7 (one sig. fig.) award 2 marks for an answer that rounds to 54 (m/s) if no other mark scored, allow 1 mark for an answer that rounds to 0.23 (m/s) (use of mass in g) award full marks for correct answer without working	

Question number	Answer	Additional guidance	Mark
1(c i)	thermal (energy/store) (1)	energy dissipated energy wasted energy lost energy transferred to surroundings energy transferred due to friction energy transferred due to air resistance	1 AO2.1
		allow heat (energy) ignore sound / not useful energy	

Question number	Answer	Additional guidance	Mark
1 (cii)	30 (J) (1)	accept -30 (J)	1 AO2.1

Question number	Answer	Additional guidance	Mark
1 (ciii)	substitution (1) $\frac{950}{980} \times 100$		2 AO2.1
	evaluation (1) 0.97 OR 97%	allow answers that round to 0.97 or 97% for 2 marks allow 1 mark for answers that round to 97 or 0.97%	

		allow 1 mark for answers of 0.96 or 96% (truncated) award full marks for correct answer without working	
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Total Question 1 = 9 marks

Question number	Answer	Additional guidance	Mark
4(a)(i)	rearrangement (1) $h = \frac{\Delta GPE}{m \times g}$ evaluation (1) $(h) = 56 \text{ (m)}$	$h = \frac{39\,000}{70 \times 10}$ allow numbers that round to 56 (m) e.g. 55.71 allow numbers that round to 57 (m) e.g. 56.85 (use of $g=9.8 \text{ N/kg}$) award full marks for correct answer without working	(2) AO3.2

Question number	Answer	Additional guidance	Mark
4(a)(ii)	selection of $v^2 - u^2 = 2 \times a \times x$ (1) rearrangement (1) $a = \frac{v^2 - u^2}{2 \times x}$ evaluation (1) $1.8 \text{ (m/s}^2\text{)}$ ALTERNATIVE METHOD calculation of time = 14.814 using time = distance / average speed (1) substitution (1) $a (=v-u) / t = \frac{27(-0)}{14.814}$ evaluation (1) $1.8 \text{ (m/s}^2\text{)}$	$27^2 - 0^2 = 2 \times a \times 200$ allow $27^2 - 0^2 = 2 \times a \times \text{their (a)(i)}$ $a = \frac{27^2 - 0^2}{2 \times 200}$ allow $a = \frac{27^2 - 0^2}{2 \times \text{their (a)(i)}}$ no ecf for evaluation allow numbers that round down to $1.8 \text{ (m/s}^2\text{)}$ e.g. 1.8225 award full marks for correct answer without working.	(3) AO3.2

Question number	Answer	Additional guidance	Mark
4(a)(iii)	An explanation linking (measure) GPE at top/start and KE at bottom/end (1) energy (at top) subtract energy (at bottom) (1)	allow subtraction of any energies allow difference for subtraction award 2 marks for GPE at top subtract KE at bottom allow for 2 marks 39 000 – 25 515 OR 13485	(2) A03.3a

Question number	Answer	Additional guidance	Mark
4(b)(i)	Any one from: direction is changing (1) velocity is a vector (1)	allow velocity has magnitude and direction ignore acceleration ignore reference to centripetal force ignore speed is changing	(1) A02.1

Question number	Answer	Additional guidance	Mark
4(b)(ii)	tangent drawn to curve (at 2.5 s) (1) evaluation of gradient (1) (gradient =) 6.0 ± 1.0 (m/s)	accept hypotenuse of triangle dependent on MP1	(2) A03.2

Total for Question 4 = 10 marks



Question Number	Answer	Mark
5(a)	B natural gas is the only correct answer A geothermal is not a non-renewable source of energy C tidal is not a non-renewable source of energy D solar is not a non-renewable source of energy	(1) AO 1 1

Question Number	Answer	Additional guidance	Mark
5(b)	an explanation linking: increased use of renewables/decrease use of non-renewables (1) reason (1)	accept "them" as renewable accept reason why renewables are beneficial accept reason why non-renewable(s) are not beneficial	(2) AO 1 1

Question Number	Answer	Additional Guidance	Mark
5(c)(i)	recall (1) $(\Delta PE) = mgh$ substitution and rearrangement (1) $h = \frac{1300}{7 \times 10}$ evaluation (1) 19 (m)	$1300 = 7 \times 10 \times h$ work done = force x distance accept answers that round up to 19 (m) (e.g. 18.57 (m)) award full marks for the correct answer with no working	(3) AO 1 1 AO 2 1

Question Number	Answer	Additional guidance	Mark
5(c)(ii)	recall (1) $KE = \frac{1}{2} m v^2$ substitution and rearrangement (1) $v = \sqrt{(2 \times 1100 \div 8)}$ evaluation (1) 17 (m/s)	$v^2 = \frac{2 \times 1100}{8}$ accept answers that round up to 17 (m/s) (e.g. 16.58 (m/s)) award full marks for the correct answer with no working	(3) AO 1 1 AO 2 1

Question Number	Answer	Additional guidance	Mark
5(d)	reading energies from graph (1) 5.2 and 3.9 (kJ) substitution (1) e.g. $\frac{1.3 \times (100)}{5.2}$ evaluation (1) 25(%)	accept 5.0 to 5.4 and 3.7 to 4.1 0.18 to 0.32 18 to 32 (%) award full marks for the correct answer with no working	(3) AO 2 1

(Total for Question 5 = 12 marks)

