AQA style exam paper

VideoPlato Academy

GCSE

PHYSICS

8463/1H

Higher Tier   Paper 1

Mark Scheme

Question 1

Question	Answers	Extra Information	Mark	Spec. Ref.
01.1	decrease		1	4.3.3.1

Question	Answers	Extra Information	Mark	Spec. Ref.
01.2	Use $p_1V_1=p_2V_2$: $150 \times 2.0 = p_2 \times 1.5$	*correctly substituting values*	1	4.3.3.2
	Rearrange for p_2: $p_2 = 150 \times 2.0 / 1.5$	*correct rearrangement*	1	
	Calculate p_2 = 200kPa	*final correct answer*	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
01.3	The gas particles are compressed into a smaller space, so the number of collisions with the container walls <u>per second</u> increases.	*number of collisions is insufficient – number in a specific time, frequency, or rate of collisions must be mentioned*	1	4.3.3.2
	Each collision exerts a force on the wall of the cylinder.		1	
	<u>Increased frequency of collisions leads to a greater total force</u> which increases pressure.		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
01.4	Particles move randomly/in random directions	*Accept: particles move freely*	1	4.3.1.1 4.3.3.1
	Particles move with a range of speeds	*Accept: particles move continuously in straight lines until they collide*	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
01.5	*Mass = density x volume* *(m = ρ x V)*			4.3.1.1
	mass = 0.0012 x 325		1	
	mass = 0.39 (g)	*Accept: 3.9 x 10^{-4} kg (or correctly state answer in kg)*	1	

TOTAL QUESTION 1	11

Question 2

Question	Answers	Extra Information	Mark	Spec. Ref.
02.1	Light emitting diode	*Accept LED*	1	4.2.1.1

Question	Answers	Extra Information	Mark	Spec. Ref.
02.2	230 (V)		1	4.2.3.1

Question	Answers	Extra Information	Mark	Spec. Ref.
02.3	The potential difference supplied alternates between <u>positive and negative</u>	*Allow voltage or current for potential difference*	1	4.2.3.1

Question	Answers	Extra Information	Mark	Spec. Ref.
02.4	10 A fuse circled		1	4.2.3.2 4.2.4.1
	Current = Power / Voltage *(I = P/V)*			
	Current = 2000/230			
	Current = **8.7** (A)		1	
	13A fuse does not offer enough protection	*Accept: too high current rating does not offer enough protection / is dangerous*	1	
	the 5A fuse would blow unnecessarily/prevent the washing machine from working properly	*Accept: too low current rating prevents washing machine from working properly*	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
02.5	If the live wire comes into contact with the metal case, the case would become live (posing a risk of electric shock).		1	4.2.3.2
	The earth wire provides a low-resistance path to the ground *or* the electricity is conducted through the earth wire		1	
	causing a surge in current that blows the fuse and disconnects the circuit		1	

TOTAL QUESTION 2	10

Question 3

Question	Answers	Extra Information	Mark	Spec. Ref.
03.1	Gravitational potential energy at the top of the flight = m g h			4.1.1.2 4.1.2.1
	E_p = 0.160 x 9.8 x 12 = 18.82 (J)		1	
	Kinetic energy when caught $= \frac{1}{2} mv^2$ 18.82 = ½ x 0.160 x v^2		1	
	v^2 = 18.82 x 2 / 0.160 or v^2 = 235.2		1	
		alternative method mgh = ½ mv^2 *or* gh = ½v^2 *1 mark* 9.8 x 12 = ½ x v^2 *1 mark* 235.2 = v^2 *1 mark* *alternative method* v^2 = u^2 + 2as so v^2 = 0 + (2 x 9.8 x 12) *1 mark* *for recognising u is zero* *1 mark* *for correct substitution* v^2 = 235.2 *1 mark*		
	answer v = **15.34**		1	
	v = 15 (m/s) *2 sig fig*		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
03.2	*Work done = Energy transferred* $\Delta W = \frac{1}{2}mv^2$ $\Delta W = \frac{1}{2}$ x 0.160 x 15^2 Or $\Delta W = mgh$ $\Delta W = 0.160$ x 9.8 x 12	Allow error carried forward for incorrect mass conversion from 3.1 Allow error carried forward for incorrect speed from 3.2	1	4.1.1.1
	$\Delta W =$ **19** (J)	allow 18.85J (or 18.9J), 18.82J (or 18.8J)	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
03.3	$E_e = \frac{1}{2}ke^2$ $72 = \frac{1}{2}$ x k x 0.3^2		1	4.1.1.2
	2 x $72 / 0.3^2 = k$		1	
	$k = 1600$ (N/m)		1	

TOTAL QUESTION 3	10

Question 4

Question	Answers	Extra Information	Mark	Spec. Ref.
04.1	A datalogger can take many readings in the same time that a human can take one. Dataloggers do not need to rest or take breaks.	Either for 1 mark Do not allow dataloggers are more accurate/precise.	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
04.2	A bar chart.		1	
	The material type is not a <u>continuous variable</u> or The material type is a <u>categoric variable</u>	Either for one mark	1	

Page **6** of **14**
VideoPlato Academy

Question	Answers	Mark	Spec. Ref.
04.3	**Level 3:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced. Including a risk assessment, repeats and mean, and identification of control variables	5–6	4.1.2.1
	Level 2: The design/plan would not necessarily lead to a valid outcome but should include some at least one of the following: risk assessment, repeats and calculating mean, the identification of control variables. Most steps are identified, but the plan is not fully logically sequenced.	3–4	
	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:
	
	Method
	
	  o Initial temperature recorded by datalogger
	  o Stop clock used to time 15 minutes
	  o Final temperature recorded by datalogger
	  o Repeat with different materials
	  o The control is the result with no insulation
	
	Calculations
	
	  o Temperature difference = initial temperature – final temperature
	  o Repeats are made and a mean average is calculated
	
	Control variables
	
	  o Initial temperature should be the same for each material
	  o Thickness of the insulator should be the same for each material
	  o The mass/volume of the water should be the same for each material
	
	Risk assessment
	
	The risk is identified:
	    hot water can cause burns or scalds
	Precautions:
	    Stand when doing the practical / allow equipment to cool before moving or packing away.		

Question	Answers	Extra Information	Mark	Spec. Ref.
04.4	The resolution is 0.1 ℃		1	

TOTAL QUESTION 4		**10**	
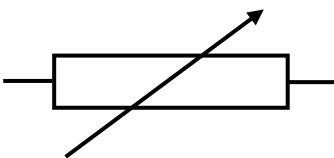
Question 5

Question	Answers	Extra Information	Mark	Spec. Ref.
05.1	6V – 2V = **4** (V)		 1	4.2.2

Question	Answers	Extra Information	Mark	Spec. Ref.
05.2	R = V / I = 4 / 20 Current = **0.2** Unit: **A**	 *Allow amps or amperes*	 1 1 1	4.2.1.3

Question	Answers	Extra Information	Mark	Spec. Ref.
05.3	The total resistance will be less The current will increase So the lamp will be brighter	 *Allow: voltage across resistor will be less*	1 1 1	4.2.2
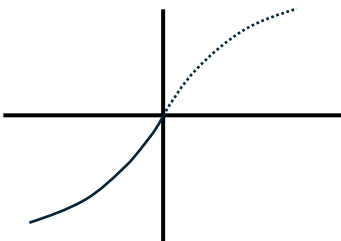
Question	Answers	Extra Information	Mark	Spec. Ref.
05.4	$E = Q\,V$ Q = 180 / 6 Charge = **30** (C)		 1 1	4.2.4.2

Question	Answers	Extra Information	Mark	Spec. Ref.
05.5			1	4.2.1.1

Question	Answers	Extra Information	Mark	Spec. Ref.
05.6	Sensible x-axis scale	*(0 to 1.0 amps)*	1	4.2.1.4
	All points correct	*Allow 1 mark for 4 points correct*	2	
	Appropriate curve drawn from the origin		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
05.7	Current read from graph (in the range 0.56 to 0.58 A)		1	4.2.1.2
	$Q = It$ Q = 0.57 x (6 x 60)	*Allow ecf for incorrect current reading*	1	
	Charge = **205** (C)	*Allow: 202 (using 0.56A) and 209 (using 0.58A)*	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
05.8	Correct shape by eye 		1	4.2.1.4

TOTAL QUESTION 5	18

Question 6

Question	Answers	Extra Information	Mark	Spec. Ref.
06.1	Most of the alpha particles go straight through the gold lead suggesting that most of an atom is empty space		1	4.4.1.3
	Some alpha particles were deflected by small angles suggesting that there was a positive nucleus in the atom		1	
	because the alpha particles are positive and are repelled		1	
	Very few alpha particles are deflected through large angles suggesting that the nucleus is very small		1	
	and contains most of the mass of the atom		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
06.2	They have the same number of protons (& electrons)		1	4.4.1.2
	Au-197 has 2 more neutrons than Au- 195		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
06.3	Alpha radiation is very ionising		1	4.4.2.1
	Ionising radiation can cause cells to mutate / die / become cancerous		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
06.4	Irradiation is exposure to ionising radiation		1	4.4.2.4
	When contamination occurs then the thing that is contaminated becomes radioactive/gives off radiation	*Allow: when radioactive dust/particles fall on a substance*	1	

TOTAL QUESTION 6	11

Question 7

Question	Answers	Extra Information	Mark	Spec. Ref.
07.1	*Energy to get to 100°* $E = m \, c \, \Delta\theta$ $\Delta\theta = 100 - 18 = 82°$ $E = 0.76 \times 4200 \times 82$ $\quad = 261,744$ (J) *Energy to vaporise* $E = m l_v$ $\quad = 0.76 \times 2,260$ $\quad = 1,717,600$ (J) Total Energy $= 261,744 + 1,717,600$ $= 2,979,344$ (J) Time $E = P \, t$ $T = 2,979,344 \, / \, 450$ $\quad = \mathbf{6,621}$ (seconds)		 1 1 1 1 1 1	4.1.1.3 4.1.1.4 4.3.2.2 4.3.2.3
		Allow ecf for incorrect temperature change		
		Allow ecf for incorrectly calculated energies		
		Allow answer rounding to 110 minutes / 6,600 seconds with correct calculation		

TOTAL QUESTION 7	6

Question 8

Question	Answers	Extra Information	Mark	Spec. Ref.
08.1	^{222}Rn + ^{4}He $_{86}Rn$ + $_{2}He$	*Correct mass numbers* *Correct atomic numbers*	1 1	4.4.2.2

Question	Answers	Extra Information	Mark	Spec. Ref.
08.2	After 4 days → 50% After 8 days → 25% After 12 days → **12.5%**	*An answer of 12.5% scores both marks* *Recognising that it is 3 half-lives scores 1 mark if no others awarded*	2	4.4.2.3

Question	Answers	Extra Information	Mark	Spec. Ref.
08.3	A neutron is absorbed by a nucleus Which then splits into 2 smaller nuclei Releasing 2 or 3 more neutrons	*Allow: a neutron hits a nucleus* *Allow: releasing more neutron**s***	1 1 1	4.4.4.1

Question	Answers	Extra Information	Mark	Spec. Ref.
08.4	The water acts as a <u>moderator</u> to <u>slow neutrons</u> The water acts as a <u>coolant</u> to take heat <u>energy away from the reactor</u>	*Accept: moderator reduces the energy of the neutrons*	1 1	4.4.4.1

Question	Answers	Extra Information	Mark	Spec. Ref.
08.5	26.3% (gas) + 0.6% (coal) = **26.9%**		1	4.1.3

Question	Answers	Mark	Spec. Ref.
08.6	**Level 2:** Advantages and disadvantages of nuclear as well as wind and solar are compared	3–4	4.1.3
	Level 1: Some comparisons are made	1–2	
	No relevant content	0	
	Indicative content • Nuclear supplies reliable continuous electricity but wind and solar only work when the conditions are right • Nuclear supplies a lot of energy from only one power station whereas wind and solar need a lot of space/land • Wind and solar produce little waste but nuclear produces radioactive waste • Wind and solar are free energy resources but nuclear fuel needs to be refined • Wind and solar are renewable but nuclear fuel is non-renewable *Ignore discussion of CO_2 or greenhouse gas emissions*		

TOTAL QUESTION 8	14

Question 9

Question	Answers	Extra Information	Mark	Spec. Ref.
09.1	Friction causes electrons to move <u>from</u> the cloth to the rod		1	4.2.5.1
	Electrons have a negative charge		1	
	The cloth becomes positively charged		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
09.2	The Perspex rod is <u>repelled</u> and rotates away	*Perspex rod moves/rotates is not sufficient*	1	4.2.5.1

Question	Answers	Extra Information	Mark	Spec. Ref.
09.3	The ruler is an electrical conductor	*Allow: it is a conductor*	1	4.2.5.1

TOTAL QUESTION 9	5

Question 10

Question	Answers	Extra Information	Mark	Spec. Ref.
10.1	Nuclear fusion is when two small nuclei combine to form a larger nucleus (releasing energy)		1	4.4.4.2
	Some of the mass is given off as energy	*Allow mass is converted into energy*	1	

Question	Answers	Extra Information	Mark	Spec. Ref.
10.2	Efficiency = $\frac{useful\ power\ out}{total\ power\ in}$ × 100% 30 % = (3000 / P) x 100%			4.1.2.2
	P = 3000 x (100% / 30%)		1	
	Minimum output P = **10,000** (W)		1	

Question	Answers	Extra Information	Mark	Spec. Ref.
10.3	(As the solar panel absorbs energy from the sun) the thermal energy store of the water increases		1	4.1.1.1

TOTAL QUESTION 10	5