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Cambridge International General Certificate of Secondary Education

PHYSICS

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Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

Published

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This document consists of **10** printed pages.



Question	Answer	Marks
1(a)(i)	constant velocity / speed	B1
1(a)(ii)	deceleration / negative acceleration	B1
1(a)(iii)	Stationary	B1
1(b)	$v = \text{gradient OR } \frac{\text{distance}}{\text{time}}$ OR $\frac{160}{100}$ OR evidence of use of gradient	C1
	($v =$) 1.6 m/s	A1
1(c)	line curves upwards with increasing gradient NOT vertical	B1

Question	Answer	Marks
2(a)	$KE = \frac{1}{2} mv^2$ in any form OR $(KE) = \frac{1}{2} \times 1.2 \times 10^6 \times 0.04^2$	C1
	($KE =$) 960 J	A1

Question	Answer	Marks
2(b)	EITHER	
	(change in momentum) = mv OR (change in momentum) = $1.2 \times 10^6 \times 0.04$	C1
	(=) 4.8×10^4 (kg m/s)	C1
	change in momentum = Ft in any form	C1
	(Force = $4.8 \times 10^4 / 0.3 =$) 1.6×10^5 N	A1
	OR	
	$a = (v-u)/t = 0.04/0.3$	(C1)
	$= 0.13$ (m/s ²)	(C1)
	$F = ma$	(C1)
	(Force = $1.2 \times 10^6 \times 0.13 =$) 1.6×10^5 N	(A1)
2(c)	Work done or KE transferred = Fd in any form	C1
	(distance = $960 / 1.6 \times 10^5 =$) 6.0×10^{-3} m OR 0.006 m OR 0.60 cm	A1
2(d)	smaller force (on dock/ship) because increases time of collision OR increased distance of collision (on the dock/ship)	B1

Question	Answer	Marks
3(a)	$(p) = \rho gh$ in any form OR $(p =) 1030 \times 10 \times 3.0 \times 10^3$ $3.1 \times 10^7 \text{ Pa}$	C1 A1
3(b)(i)	$v = d/t$ OR $v = 2d/t$ in any form $1500 = \frac{2d}{0.50}$ OR $2d = 1500 \times 0.50$ 380 m	C1 C1 A1
3(b)(ii)	distance smaller (first box ticked) AND speed of sound lower (in air than liquid)	B1

Question	Answer	Marks
4(a)	Any two from: bubbles form OR occurs throughout liquid only occurs at one temperature/boiling point does not produce cooling OR not affected by surface area / humidity / draught OR does not lower KE of molecules left in the liquid.	B2
4(b)	$E = Pt$ in any form OR $(E) = 370 \times 240$ $= 89\,000 \text{ (J)}$ $E = mc\Delta T$ in any form (temperature increase =) $89\,000 / \{5.0 \times 420\} =) 42^\circ\text{C}$	C1 A1 C1 A1

Question	Answer	Marks
5(a)	any mention of <u>radiation/infra-red radiation</u> wrt silvered surfaces	B1
	silvered surfaces are poor emitters / poor absorbers / (good) reflectors	B1
	glass is a poor conductor OR glass reduces thermal energy / heat gain by conduction	B1
	vacuum prevents thermal energy / heat gain by conduction OR convection	B1
	stopper reduces thermal energy / heat gain by convection	B1
5(b)	any suitable insulator e.g. cork, plastic, rubber	B1

Question	Answer	Marks
6(a)(i)	diffraction	B1
6(a)(ii)	wave on left half the wavelength of waves in Fig 6.1	B1
	both wavelengths on right same wavelength as on left	B1
	much less spreading than in Fig 6.1	B1
6(b)	3 numbers correct	B1
	all 5 numbers correct (Correct answer: 1, 4, 5, 3, 2)	B1
6(c)(i)	3.0×10^8 m/s	B1
6(c)(ii)	$v = f\lambda$ in any form OR ($\lambda = v/f$)	C1
	96×10^6 seen	C1
	$(\lambda = \frac{3.0 \times 10^8}{96 \times 10^6} =) 3.1 \text{ m}$	A1

Question	Answer	Marks
7(a)	40°	B1
7(b)	n = 1.3 OR seen in calculation	C1
	$\sin i / \sin r = n$ in any form OR $\sin 40 / \sin r = n$ $\sin i / \sin r = 1 / n$	C1
	($\sin r = 1.3 \times \sin 40^\circ$) ($r = 57^\circ$)	A1

Question	Answer	Marks
8(a)	$P = VI$ in any form	C1
	$I (= \frac{700}{240}) = 2.9 \text{ A}$	A1
8(b)	13 A fuse	B1
	any two out of: 2.9 + 7.5 SEEN if too low it would break / blow / melt when the appliances are operating normally if fuse too high wouldn't break / blow until current was too high which would be dangerous (to people /wires /appliance)	B2
8(c)	(Resistance inversely proportional to area so) resistance of thicker wire is lower	B1
	Fuse will melt at higher current	B1
	because heating effect = $I^2 R$ OR less heating effect (for same current) $owtte$	B1
8(d)(i)	Any two renewable sources of energy from: solar, wind, water, hydroelectric, waves, tidal, geothermal	B2
8(d)(ii)	Any relevant disadvantage for one of their <u>correct</u> answers to (d)(i) e.g.: Energy for wind / waves / Sun not always available Cost of building wind turbines or tidal barrages or hydroelectric dams Wind turbines affect the scenery of some areas Solar (farms) use (agricultural) land / takes up a lot of space	B1

Question	Answer	Marks															
9(a)	light dependent resistor OR LDR	B1															
9(b)	<table border="1"> <thead> <tr> <th>Input 1</th><th>Input 2</th><th>Output</th></tr> </thead> <tbody> <tr> <td>0</td><td>0</td><td>1</td></tr> <tr> <td>0</td><td>1</td><td>0</td></tr> <tr> <td>1</td><td>0</td><td>0</td></tr> <tr> <td>1</td><td>1</td><td>0</td></tr> </tbody> </table>	Input 1	Input 2	Output	0	0	1	0	1	0	1	0	0	1	1	0	
Input 1	Input 2	Output															
0	0	1															
0	1	0															
1	0	0															
1	1	0															
	2 input columns and one output column AND 4 correct rows of input	B1															
	All 4 rows with correct, in any order	B1															
9(c)	D E 1 1 1 1 0 0 0 1 all D correct first 2 rows of E correct last 2 rows of E correct	B1															
9(d)	conductors have free / delocalised electrons / electrons which move (freely) (electrons in insulators don't move or are fixed)	B1															

Question	Answer	Marks
10(a)	Correct shape of graph showing one rotation	B1
	Graph starts from maximum voltage (positive or negative) (labelled horizontal)	B1
	Graph passes through zero twice, labelled 1 / 4 and 3 / 4 revolution	B1
10(b)	induced e.m.f. caused by coil cutting magnetic field OR coil moving in magnetic field	B1
10(c)	slip rings	B1
	(provide) continuous connection while coil rotating	B1
10(d)	Any two of: increase strength of magnetic field increase speed of rotation of the coil increase numbers of turns of coil	B2

Question	Answer	Marks
11(a)	${}_{95}^{241}\text{Am} \rightarrow {}_2^4\alpha + {}_{93}^{237}\text{Np}$	
	Am on L with correct proton no	B1
	Am on L with correct nucleon no	B1
	alpha symbol on R with correct proton and nucleon no	B1
	Np on R with correct proton and nucleon no.	B1
11(b)(i)	current decreases / is stopped AND alpha particles absorbed (by smoke) owtte	B1
11(b)(ii)	Any two from: alpha particles highly ionizing / more ionising than beta particles or gamma rays alpha particles short range (in air) safer to use alpha because they do not travel out of smoke detector	B2