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Cambridge International General Certificate of Secondary Education

PHYSICS**0625/42**

Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

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Question	Answer	Marks
1(a)(i)	1 straight line from (0,0) to (10,50)	1
	2 gradient/slope	1
1(a)(ii)	$a = \frac{\Delta v}{\Delta t}$ in any form OR $(a =) \frac{\Delta v}{\Delta t}$ OR $(a =) (9-5) \div 10$ OR $4 \div 10$	1
	$(a =) 0.40 \text{ m / s}^2$	1
1(b)(i)	straight line down from any point on y-axis to any speed at 100 s	1
	from (0,50) to (100,15)	1
1(b)(ii)	uses area <u>under graph</u> OR av speed $\times$ time OR $s = ut + \frac{1}{2} at^2$ OR $v^2 = u^2 + 2as$	1
	$100 \times (50 + 15) \div 2$ OR $100 \times 15 + \frac{1}{2} (100 \times 35)$ OR $5000 - \frac{1}{2} \times 0.35 \times 100^2$	1
	3300 m	1

Question	Answer	Marks
2(a)	average/overall/combined density (of the metal and air contained) less (than density of sea water)	1
2(b)	$(P =) h \times \rho \times g$ OR $(V =) A \times l$ in any form	1
	$(P =) 1.2 \times 1020 \times 10 =) 12\,000$ (Pa) OR $(V =) 0.8 \times 1.2 =) 0.96$ (m ³)	1
	$P = F \div A$ OR $(F =) P \times A$ OR $(W =) V \times \rho \times g$	1
	$(F =) 12240 \times 0.80 =) 9800$ N OR $(F = W =) 9800$ N	1
2(c)	same numerical answer as (b)	1
	resultant/net (vertical) force = 0 OR downward force = upward force OR forces are balanced	1

Question	Answer	Marks
3(a)	$(KE =) \frac{1}{2} \times m \times v^2$	1
	$(KE =) \frac{1}{2} \times 9500 \times 75^2$	1
	$(KE =) 2.7 \times 10^7$ J	1
3(b)	$KE = F \times l$ OR $(F =) KE \div l$ OR $(F =) 2.671875 \times 10^7 \times 150$ OR $v^2 - u^2 = 2ax$ OR $(a =) v^2 - u^2 \div (2 \times x)$ OR $(a =) 75^2 \div (2 \times 150) = 18.75$	1
	$(F =) 1.8 \times 10^5$ N OR $((F =) m \times a = 9500 \times 18.75) = 1.8 \times 10^5$ N	1

Question	Answer	Marks
4(a)(i)	atoms drawn close to each other and in rows	1
4(a)(ii)	atoms drawn far apart and randomly positioned	1
4(b)(i)	(atoms) vibrate/oscillate	1
4(b)(ii)	attractive forces between atoms/molecules (in the rock) OR energy/work to separate atoms/molecules	1
	force (applied must be large enough) to overcome forces between atoms/molecules OR work/energy (large) enough to separate atoms/molecules	1
4(c)	helium spreads/diffuses/moves freely/collides with air (molecules)	1
	the helium atoms travel in all directions/randomly/at high speed	1
	OR helium rises	(1)
	helium has low density OR He atoms high speed	(1)

Question	Answer	Marks
5	<u>diagram</u> shows cans placed near heater	1
	put thermometers in <u>water</u> AND observe readings	1
	good detail e.g. cans equal distances from heater same water volumes/levels thermometers same positions in cans	1
	higher thermometer reading in black (painted) can OR black (surface) good/best/better absorber	1

Question	Answer	Marks
6(a)	frequency 35 000 Hz ringed	1
	longitudinal ringed	1
6(b)	$v = f \lambda$ OR $(\lambda =) v \div f$	1
	$(\lambda =) 3 \times 10^8 \div 1.3 \times 10^{17}$	1
	$(\lambda =) 2.3 \times 10^{-9} \text{ m}$	1
6(c)	X-rays ionising/harmful/dangerous (to humans)	1
	Any one from: patient rarely exposed low total dose on patient meaningful comment about benefit outweighs danger dentist frequently exposed total dose on dentist would be high if stayed in room	1
6(d)	microwaves harmful/dangerous (to humans)	1
	microwaves would pass through open door	1

Question	Answer	Marks
7(a)	(speed/it) decreases refractive index > 1.0 OR $\sin(i) > \sin(r)$ OR $i > r$ OR refraction/bends towards normal OR $n_p > n_w$ OR $\sin(i) \div \sin(r) = c_w \div c_p$	1
7(b)(i)	paraxial ray refracts through F_2 other ray continues undeviated	1
7(b)(ii)	candidate's rays from (b)(i) traced <u>back</u> to intersection image marked from intersection of candidate's rays to axis	1
7(b)(iii)	in range 2.7 cm to 3.3 cm AND rays converge to the left of the object	1
7(b)(iv)	virtual AND light does not pass through image/cannot be projected on to a screen OR object distance $< f$ OR on left of object	1

Question	Answer	Marks
8(a)(i)	variable resistor OR rheostat	1
8(a)(ii)	voltmeter symbol correctly connected across $20\ \Omega$ resistor	1
8(b)	$(I =) V \div R$ OR $6.0 \div 20$ OR (any value < 6.0) $\div 20$ correct calculation of I for $V > 0$ accept point on graph with correct co-ordinates, apart from the origin straight line from (0,0) to (6.0,0.30) tolerance within $\frac{1}{2}$ small square	1
8(c)(i)	(combined resistance) less (than the resistance of either/smaller resistor)	1
8(c)(ii)	steeper OR gradient greater OR description of how the line differs (e.g. reaches 0.40 A before V reaches 6.0 V) ignore 2nd line above 1st line	1

Question	Answer	Marks
9(a)(i)	forces on AB and CD in opposite (vertical) directions	1
9(a)(ii)	Column 2 increased by factor 3 Box 6	1
	Column 3 increased by factor 3 Box 6	1
	Column 4 decreased by factor 2 Box 3	1
9(b)(i)	deflects OR shows $I/V/p.d.$	1
	returns to zero	1
9(b)(ii)	produces/changes magnetic field	1
	S pole at bottom OR magnetic field opposes motion/(magnetic) field of magnet	1

Question	Answer	Marks
10(a)(i)	electrons/–ve charges (in metal) <u>move</u> o.w.t.t.e. to top half/move up	1
10(a)(ii)	more –ve charges in top half than bottom OR more +ve charges in bottom half than top NOT if contradiction e.g. more +ve in top and more –ve in top	1
10(a)(iii)	helps (keep plastic sheet in place)/yes	1
	unlike charges attract OR attractive force between metal plate and plastic sheet	1
10(b)	1 both threads angled away from other ball	1
	2 like/same/positive charges <u>repel</u>	1

Question	Answer	Marks
11(a)	^{231}Th	1
	^{90}Th	1
11(b)(i)	splitting of a nucleus into (2) parts/light(er)nucleus	1
11(b)(ii)	(fission involves production of) ionising radiation OR radiation dangerous/harmful (to humans)	1
	(thick concrete walls) absorb/stop the radiation (and so protect workers)	1
11(b)(iii)	no CO_2/SO_2 /greenhouse gases/acid rain	1
	nuclear waste (disposal) OR leaks of radioactive material OR risk of radiation in case of accident	1
11(c)	(52 hours =) 2 half-lives OR evidence of 2 halvings	1
	(after 52 hours number of thorium atoms left = $4.8 \times 10^9 \div 4 =$) 1.2×10^9 OR (number of thorium atoms decayed =) $\frac{3}{4} \times 4.8 \times 10^9$	1
	(number of atoms decayed = $4.8 \times 10^9 - 1.2 \times 10^9$) = 3.6×10^9	1