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**PHYSICS**

**0625/42**

Paper 4 Extended Theory

**May/June 2017**

MARK SCHEME

Maximum Mark: 80

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**Published**

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

Question	Answer	Marks
1(a)(i)	(a scalar) does <b>not</b> have direction	<b>B1</b>
1(a)(ii)	energy <b>and</b> temperature	<b>B1</b>
1(b)	straight line <b>and</b> non-zero gradient	<b>B1</b>
1(c)	scale $\geq 1$ cm: 1 m / s	<b>B1</b>
	two arrows/lines <b>and</b> correct resultant OR rectangle and correct diagonal (towards bottom left)	<b>B1</b>
	7.2 $\rightarrow$ 7.6 m/s	<b>B1</b>
	26.0° $\leq$ angle below E–W $\leq$ 30.5° OR 239.5° $\leq$ bearing $\leq$ 244°	<b>B1</b>
	<b>Total:</b>	<b>7</b>

Question	Answer	Marks
2(a)	Column 1 Box 3 mass same	<b>B1</b>
	Column 2 Box 4 weight 1/6	<b>B1</b>
	Column 3 Box 3 deceleration same	<b>B1</b>
2(b)	$P = F/A$ in any form or $(F =) PA$	<b>C1</b>
	$(F_1 = 500\,000 \times 0.00065 = ) 330$ (N)	<b>C1</b>
	$F_1 d_1 = F_2 d_2$ in any form or $F_1 d_1 / d_2$	<b>C1</b>
	$(F_2 = 325 \times 7/24 = ) 95$ N	<b>A1</b>
	<b>Total:</b>	<b>7</b>

Question	Answer	Marks
3(a)	'force and time'	<b>B1</b>
3(b)(i)1.	(momentum =) $mv$	<b>C1</b>
	(momentum = $2.4 \times 3 =$ ) $7.2 \text{ kg m/s OR Ns}$	<b>A1</b>
3(b)(i)2.	$(m_A + m_B)v = m_A \times 3$ OR momentum conserved	<b>C1</b>
	$(v = 7.2 / 3.6 = ) 2.0 \text{ m/s}$	<b>A1</b>
3(b)(i)3.	(impulse / $Ft =$ ) $m(v - u)$	<b>C1</b>
	(impulse / $Ft = 1.2 \times (2-0) =$ ) $2.4 \text{ kg m/s OR Ns}$	<b>A1</b>
3(b)(ii)	thermal/sound energy (produced at collision/lost)	<b>B1</b>
	<b>Total:</b>	<b>8</b>

Question	Answer	Marks
4(a)	impulse/change of momentum (of molecules) during collision	<b>B1</b>
	{force (to change momentum) <u>of molecules</u> OR <u>molecules</u> hitting walls} (causes pressure)	<b>B1</b>
4(b)	more (frequent) collisions <u>with walls</u>	<b>B1</b>
	greater (total ) force (caused by molecules) OR reduced area OR grater (rate) change of momentum (of molecules)	<b>B1</b>
4(c)	$p_1V_1 = p_2V_2$ in any form OR ( $p_2 =$ ) $p_1V_1/V_2$	<b>C1</b>
	( $p_2 = 500 \times 1.1 \times 10^5 / 200 =$ ) $2.8 \times 10^5 \text{ Pa}$	<b>A1</b>
	<b>Total:</b>	<b>6</b>

Question	Answer	Marks
5(a)(i)	$E = mc(\Delta)T$ in any form or $(E=) mc(\Delta)T$	<b>C1</b>
	$(E = 0.6 \times 4200 \times 80 =) 200\,000$ (J)	<b>C1</b>
	$E = VIt$ in any form or $(t=) E / VI$	<b>C1</b>
	$(t = 201\,600 / (12 \times 240) =) 70$ s	<b>A1</b>
5(a)(ii)	no (thermal) energy losses	<b>B1</b>
5(b)	put (hot) water in bottle AND place thermometers/measure temperatures each side of (centre of) bottle	<b>M1</b>
	put thermometers near bottle	<b>A1</b>
	good detail e.g. <ul style="list-style-type: none"> <li>• thermometers equal distances from bottle</li> <li>• thermometer bulbs same height</li> <li>• record temperatures regularly</li> </ul>	<b>A1</b>
	thermometer near black has higher reading/rises faster/larger temperature difference or reverse argument	<b>A1</b>
	<b>Total:</b>	<b>9</b>


Question	Answer	Marks
6(a)(i)	3.4 cm	<b>B1</b>
6(a)(ii)	30 cm	<b>B1</b>
6(b)	$v = f \lambda$ in any form <b>or</b> $(f = )v / \lambda$	<b>C1</b>
	$(f = 8.0/2.5 = ) 3.2$ Hz	<b>A1</b>
6(c)(i)	3 crests straight AND some spreading out	<b>B1</b>
	2 wavelengths same as original	<b>B1</b>
6(c)(ii)1.	(wavelength) increases/ longer AND (because wave) travels further in same/periodic time or because wave has higher speed /moves faster	<b>B1</b>
6(c)(i)2.	<u>More</u> diffraction/spreading/deflection out/more curved OR no/smaller straight part in centre	<b>B1</b>
	<b>Total:</b>	<b>8</b>

Question	Answer	Marks
7(a)(i)	(n = ) speed in air / speed in liquid	<b>C1</b>
	$(n = 3 \times 10^8 / 2.0 \times 10^8) = 1.5$	<b>A1</b>
7(a)(ii)	$n = \sin i / \sin r$ in any form	<b>C1</b>
	$(r = \sin^{-1} (\sin 40 / 1.5) = ) 25^\circ$	<b>A1</b>
7(b)	one ray from object either with refraction at surface OR vertical	<b>M1</b>
	another ray from object, must have refraction at surface away from normal	<b>A1</b>
	both rays extended back to meet <u>in the liquid</u> AND intersection labelled image/ I	<b>B1</b>
	<b>Total:</b>	<b>7</b>

Question	Answer	Marks
8(a)(i)	P=VI in any form OR $(I = ) P/V$	<b>C1</b>
	$(I = 9.0 / 6.0 = ) 1.5 \text{ A}$	<b>A1</b>
8(a)(ii)	V=IR in any form OR $(R = ) V/I$ OR $P=V^2/R$ in any form OR $(R = ) V^2/P$	<b>C1</b>
	$(R = 6.0 / 1.5 = ) 4.0 \Omega$ or $(R = 36 / 9.0 = ) 4.0 \Omega$	<b>A1</b>
8(b)(i)	resistance <u>of wire</u> is greater (than at X) OR current is less OR p.d. <u>across lamp</u> is less	<b>B1</b>
8(b)(ii)	(for normal brightness of lamp, ) resistance <u>of circuit</u> $(= 12 / 1.5) = 8.0 \Omega$	<b>C1</b>
	resistance <u>of wire</u> $= (8.0 - 4.0 = ) = 4.0 \Omega$	<b>C1</b>
	(distance AX $= 1.0 \times 4/5 = ) 0.80 \text{ m}$ OR (sliding contact is) 0.80 m (from A)	<b>A1</b>
	OR V across AX = 6.0 V	<b>(C1)</b>
	resistance <u>of wire</u> $= (6/\text{current from a(i)} = ) 4.0 \Omega$	<b>(C1)</b>
	(distance AX $= 1.0 \times 4/5 = ) 0.80 \text{ m}$ OR (sliding contact is) 0.80 m (from A)	<b>(A1)</b>
	<b>Total:</b>	<b>8</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
9(a)(i)	arrow left to right <b>and</b> horizontal, labelled (M)	<b>B1</b>
9(a)(ii)	if M L to R arrow downwards, labelled (F) if M R to L arrow upwards, labelled (F)	<b>B1</b>
9(b)	<u>force</u> reversed/opposite of 9(a)(i)	<b>B1</b>
9(c)(i)	one ring (roughly circular) centred on wire	<b>M1</b>
	(at least) three rings (roughly circular)	<b>A1</b>
	field lines clockwise (as drawn)	<b>B1</b>
9(c)(ii)	(magnetic field is) stronger <b>or</b> field lines closer together	<b>B1</b>
9(d)	(vertically) downwards	<b>B1</b>
	<b>Total:</b>	<b>8</b>



Question	Answer	Marks
10(a)	2→4 arrows outwards at any angle 	<b>B1</b>
10(b)	NOR	<b>B1</b>
10(c)(i)	logic circuit with 2 inputs & 1 output. Circuit contains at least 2 <u>acceptable</u> gates. No other gates used	<b>M1</b>
	logic circuit that produces correct output	<b>A1</b>
10(c)(ii)	work from input to output, any intermediate point labelled X following <u>acceptable</u> gate(s) only with truth table correct for circuit drawn	<b>B1</b>
	<b>Total:</b>	<b>5</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
11(a)	(some) $\beta$ /beta/radiation would penetrate gloves/reach other body parts (so insufficient protection)	<b>B1</b>
	middle: any path to the left within $45^\circ$ of horizontal	<b>B1</b>
	bottom: path to the right and deflected down ending in a straight line	<b>B1</b>
11(b)	radiation from background/rock/air/outer space/cosmic rays	<b>B1</b>
	random variation owtte.	<b>B1</b>
11(c)	thick gloves would stop $\alpha$ /alpha (so helpful)	<b>B1</b>
	(some) $\beta$ /beta/radiation would penetrate gloves/reach other body parts (so insufficient protection)	<b>B1</b>
	<b>Total:</b>	<b>7</b>