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**PHYSICS**

**0625/41**

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 **11** printed pages.

Question	Answer	Marks
1(a)	decrease of velocity / speed OR slows / slowing down	<b>B1</b>
1(b)(i)	Area under graph OR $\frac{1}{2}(u+v)t$ OR $\frac{1}{2} \times (11 + 5) \times 3$ OR $\frac{1}{2}(6 \times 3)$ OR $(3 \times 5)$	<b>C1</b>
	24 m	<b>A1</b>
1(b)(ii)	$(a =) \Delta v / \Delta t$ OR $(v - u) / t$ OR $(5 - 11) / (6 - 3)$	<b>C1</b>
	2.0 m/s <sup>2</sup>	<b>A1</b>
1(c)(i)	(deceleration) decreases	<b>B1</b>
1(c)(ii)	(Resultant force) decreases	<b>B1</b>
	<b>Total:</b>	<b>7</b>

Question	Answer	Marks
2(a)(i)	$Ft$ OR $180 \times 0.050$	C1
	9.0 Ns OR 9.0 kg m/s	A1
2(a)(ii)	$Ft = m(v - u)$ OR $Ft = mv - mu$ OR $Ft = mv$ OR (m =) $Ft/v$ OR 9.0/20	C1
	0.45 kg	A1
2(a)(iii)	$mgh = \frac{1}{2}mv^2$ OR $(h =) v^2/2g$	C1
	$(h =) 20^2/(2 \times 10)$	C1
	20 m	A1
	OR $t = v/g = 2$	(C1)
	$h = \text{average speed} \times \text{time}$	(C1)
	20 m	(A1)
2(b)	Elastic (energy) OR strain (energy)	B1
	<b>Total:</b>	<b>8</b>

Question	Answer	Marks
3(a)(i)	(Weight is) force/pull of gravity (acting on an object)	<b>B1</b>
3(a)(ii)	Mass $\times$ acceleration due to gravity OR $mg$ OR $350 \times 7.5$	<b>C1</b>
	2600 N	<b>A1</b>
3(b)	$(\rho =) m/V$ in any form	<b>C1</b>
	0.27 (kg/m <sup>3</sup> ) OR 270 (g/m <sup>3</sup> )	<b>A1</b>
	Balloon moves/floats <u>up</u>	<b>B1</b>
	(Floats when) density of balloon less than density of atmosphere OR (sinks when) density of balloon greater than atmosphere	<b>B1</b>
	OR $(\rho =) m/V$ in any form	<b>(C1)</b>
	110 g	<b>(A1)</b>
	Balloon rises	<b>(B1)</b>
	<b>Total:</b>	<b>7</b>

<b>Question</b>	<b>Answer</b>	<b>Marks</b>
4(a)(i)	60 W	<b>B1</b>
4(a)(ii)	<u>Radiation</u> and either conduction or convection	<b>B1</b>
4(b)(i)	Radiation mentioned	<b>B1</b>
	Higher reading or rises faster on thermometer A	<b>B1</b>
	Black (surface) is a good/better emitter (than polished surface) OR polished (surface) is a poor/bad/worse emitter (than black surface)	<b>B1</b>
4(b)(ii)	(Compared with black bulb thermometer) readings rise more slowly OR readings are low(er)	<b>B1</b>
	Shiny (bulb) surfaces are good/better reflectors (of radiation) OR Shiny (bulb) surfaces are poor/bad/worse absorbers (of radiation)	<b>B1</b>
4(c)	Firefighter does not get too hot/burned (from radiation)	<b>B1</b>
	<b>Total:</b>	<b>8</b>


Question	Answer	Marks
5(a)	Pressure increases	<b>B1</b>
	Molecules (of gas) move faster/their <u>kinetic</u> energy increases/their momentum increases	<b>B1</b>
	(Molecules) collide with walls/piston more often/more frequently OR greater (rate of) change of momentum	<b>B1</b>
	(Molecules) exert greater/more force (on wall)/hit (walls) <u>harder</u>	<b>B1</b>
5(b)	Pressure (of gas) falls <b>and</b> volume (of gas) increases	<b>B1</b>
	Initially there is a larger pressure inside than outside/atmospheric pressure OR (Piston stops when) pressure (of gas) = external/outside/atmospheric pressure	<b>B1</b>
	<b>Total:</b>	<b>6</b>

Question	Answer	Marks
6(a)(i)	(Ray passes into the air and) refracts / changes direction / bends	<b>B1</b>
6(a)(ii)	Total internal reflection (takes place)	<b>B1</b>
6(b)(i)	Total internal reflection at B with angle of incidence equal to angle of reflection (by eye)	<b>B1</b>
	Refraction into air at right-hand face with angle of refraction greater than angle of incidence	<b>B1</b>
6(b)(ii)	$(n =) 1/\sin c$ OR $1/\sin 41$	<b>M1</b>
	1.5	<b>A1</b>
	<b>Total:</b>	<b>6</b>

Question	Answer	Marks
7(a)	Number of wavefronts (generated/produced/passing a point) in 1 sec/per sec/in unit time	<b>B1</b>
7(b)(i)	(Part of wave where) pressure/density is higher OR molecules are closer together	<b>B1</b>
7(b)(ii)	At least 3 wavefronts shown as part semi-circles	<b>B1</b>
	Same separation between wavefronts drawn by candidate as for incident wavefronts	<b>B1</b>
7(b)(iii)	Less spreading out OR less diffraction	<b>B1</b>
7(c)(i)	$(\lambda =) v/f$ OR 340/6800	<b>C1</b>
	0.050 m	<b>A1</b>
7(c)(ii)	In range 900 – 2000 m/s	<b>B1</b>
	<b>Total:</b>	<b>8</b>

Question	Answer	Marks
8(a)	Steel/aluminium/nickel/cobalt/alnico/neodymium/ferrite/alcomax	<b>B1</b>
8(b)(i)	Mention of <u>magnetic</u> field or <u>magnetic</u> flux OR field created by bar magnet	<b>B1</b>
	(Magnetic) field (lines) of magnet cut by coil OR (magnetic) field (lines) linked with/through/in the coil <u>changes</u> OR(magnetic) flux (through coil) <u>changes</u>	<b>B1</b>
	e.m.f. <u>induced</u>	<b>B1</b>
8(b)(ii)	Direction of movement of magnet through the coil OR which pole of magnet enters the coil	<b>B1</b>
	Direction of induced e.m.f. opposes change producing it OR (coil) end near magnet/left-hand end becomes a N-pole OR (coil) repels magnet (when moved in)	<b>B1</b>
8(c)	Hammer the magnet	<b>M1</b>
	repeatedly/until demagnetised/in E/W direction	<b>A1</b>
	OR Heat the magnet	<b>(M1)</b>
	high temperature/red hot/in E-W direction	<b>(A1)</b>
	OR Place magnet in coil carrying A.C.	<b>(M1)</b>
	Remove magnet from coil OR decrease the current (slowly) to zero	<b>(A1)</b>
	<b>Total:</b>	<b>8</b>



Question	Answer	Marks
9(a)(i)	LDR OR light-dependent resistor	<b>B1</b>
9(a)(ii)		<b>B1</b>
9(b)(i)	$I = V/R$	<b>C1</b>
	(total resistance =) 1.2 + 2.4 OR 3.6 seen	<b>C1</b>
	$I = 6.0 / (1.2 + 2.4)$ OR 1.67 or 1.7 (mA)	<b>C1</b>
	(V =) 4.0 V	<b>A1</b>
	OR $(V_1) = [R_1 / (R_1 + R_2)] V$	<b>(C1)</b>
	(total resistance =) 1.2 + 2.4 OR 3.6 seen	<b>(C1)</b>
	$(V_1) = (2.4 / 3.6) 6.0$	<b>(C1)</b>
	= 4.0 V	<b>(A1)</b>
9(b)(ii)	Replace the 1.2 k $\Omega$ resistor with one of higher value OR Increase the temperature (of the thermistor or the room)	<b>B1</b>
	<b>Total:</b>	<b>7</b>

Question	Answer	Marks
10(a)	Electrons/negative charges removed from/flow from/lost (from the object)	<b>B1</b>
10(b)(i)	At least 3 plus signs in top half of sphere	<b>B1</b>
	Same number of minus signs in bottom half of sphere	<b>B1</b>
	OR Excess of plus signs over minus signs in top half of sphere	<b>(B1)</b>
	Equal excess of minus signs over plus signs in bottom half of sphere	<b>(B1)</b>
10(b)(ii)	(with rod present) connect earth (to sphere) OR touch (sphere) with conductor/finger	<b>M1</b>
	Remove earth wire <b>and</b> then remove charged rod OR remove conductor/finger <b>and</b> then rod.	<b>A1</b>
	<b>Total:</b>	<b>5</b>

Question	Answer	Marks
11(a)	Background count rate stated as in range 17 – 21 counts/s	<b>B1</b>
	Background used on at least 2 of first 3 readings	<b>C1</b>
	Any halving of corrected or uncorrected reading	<b>C1</b>
	(half-life =) ½ hour	<b>A1</b>
11(b)	${}^3_1\text{H}$ on LHS of an equation	<b>B1</b>
	${}^0_{-1}\beta$ on RHS of equation	<b>B1</b>
	Equation all correct: ${}^3_1\text{H} = {}^0_{-1}\beta + {}^3_2\text{X}$	<b>B1</b>
11(c)	Top: any path to the left within 45° horizontal	<b>B1</b>
	Middle: path to the right and deflected down (ending in a straight line)	<b>B1</b>
	Bottom: path not deflected OR path to the right and deflected up <u>much</u> less than middle path	<b>B1</b>
	<b>Total:</b>	<b>10</b>