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**PHYSICS**

**0625/41**

Paper 4 Extended Theory

**October/November 2017**

MARK SCHEME

Maximum Mark: 80

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

Question	Answer	Marks
1(a)(i)	Distance = area under graph OR $0.5 \times 20 \times 13$	<b>C1</b>
	130 m	<b>A1</b>
1(a)(ii)	$(a =) (v - u) / t$ OR $(a =) v / t$ OR $13 / 20$	<b>C1</b>
	$0.65 \text{ m / s}^2$	<b>A1</b>
1(a)(iii)	$(F =) ma$ OR $1200 \times 0.65$	<b>C1</b>
	= 780 N	<b>A1</b>
1(b)	Acceleration decreases OR rate of increase of speed decreases OR speed increases at a lower rate	<b>B1</b>

Question	Answer	Marks
2(a)	Extension of a spring is (directly) proportional to load / force / weight OR $F = ke$ where $e$ is extension	<b>B1</b>
2(b)(i)	<u>Straight</u> line drawn from origin to (64 mm, 120 N)	<b>B1</b>
2(b)(ii)	$F = ke$ in any form OR $120 / 64$ OR $120 / 6.4$ OR $120 / 0.064$	<b>C1</b>
	c.a.o. $1.9 \text{ N / mm}$ OR $19 \text{ N / cm}$ OR $1900 \text{ N / m}$	<b>A1</b>
2(c)	Above 120 N / at 140 N, the spring does not obey Hooke's law OR the extension is not proportional to the load / weight / force	<b>B1</b>
	The elastic limit / limit of proportionality of the spring has been exceeded	<b>B1</b>

Question	Answer	Marks
3(a)	(Measure of) quantity / amount of matter OR (property) that resists change in motion / speed / momentum OR measure of a body's inertia	<b>B1</b>
3(b)(i)	$d = m / V$ OR in words OR $0.44 / 0.080^3$ OR $0.44 / 5.12 \times 10^{-4}$ OR $440 / 8^3$ OR $440 / 512$ OR $0.44 / 8^3$ OR $0.44 / 512$	<b>C1</b>
	$0.86 \text{ g / cm}^3$ OR $860 \text{ kg / m}^3$ OR $8.6 \times 10^{-4} \text{ kg / cm}^3$	<b>A1</b>
3(b)(ii)	Sinks OR does not float AND (cube) denser (than oil)	<b>B1</b>
3(c)(i)	$W = mg$ OR ( $g =$ ) $W / m$ OR $0.70 / 0.44$	<b>C1</b>
	$1.6 \text{ N / kg}$	<b>A1</b>
3(c)(ii)	$(P =) hdg$ OR $0.030 \times 850 \times 1.6$	<b>C1</b>
	$41 \text{ Pa}$	<b>A1</b>

Question	Answer	Marks
4(a)	Atoms collide with wall (and rebound) OR atoms rebound from wall	<b>B1</b>
	(Atoms) undergo change of momentum	<b>C1</b>
	Force on wall = (total) rate of change of momentum (of atoms) OR = change of momentum (of atoms) per second OR = change of momentum (of atoms) / time	<b>A1</b>
4(b)(i)	Fewer atoms per unit volume OR density of gas less	<b>B1</b>
	Rate of collision (with walls of balloon) decreases OR Fewer collisions per unit area	<b>B1</b>
4(b)(ii)	$PV = \text{constant}$ OR $P_1V_1 = P_2V_2$ OR ( $P_2 =$ ) $P_1V_1 / V_2$ OR $1.0 \times 10^5 \times 9.6 / 12$	<b>C1</b>
	$8.0 \times 10^4 \text{ Pa}$	<b>A1</b>

Question	Answer	Marks
5(a)	Tick 2nd box only	<b>B1</b>
5(b)(i)	At least 3 parallel wavefronts in shallow water sloping upwards from left to right	<b>B1</b>
	Wavefronts in shallow water meet wavefronts in deep water	<b>B1</b>
5(b)(ii)	Indication that frequency is same in deep and shallow water	<b>C1</b>
	In deep water $v = f\lambda$ in any form OR $(f =) v/\lambda$ OR $80/1.4$	<b>C1</b>
	= 57.1 (Hz)	<b>C1</b>
	Wavelength in shallow water = $v/f$ OR $60/57.1 = 1.05$ cm	<b>A1</b>
	OR	
	speed in deep water / speed in shallow water = $0.80/0.60$	<b>(C1)</b>
	= 1.33	<b>(C1)</b>
	(f is constant so) $\lambda$ in deep water / $\lambda$ in shallow water = 1.33	<b>(C1)</b>
$\lambda$ in shallow water = $1.4/1.33 = 1.05$ cm	<b>(A1)</b>	

Question	Answer	Marks
6(a)	1500 m / s    liquid 5000 m / s    solid 300 m / s     gas	<b>B2</b>
6(b)(i)	X and Y marked at centres of any two rarefactions	<b>B1</b>
6(b)(ii)	Area of low pressure or low density (of atoms) or where atoms / molecules far apart	<b>B1</b>
6(c)	$v = d / t$ or $2 d / t$ in any form	<b>C1</b>
	$d = vt / 2$ OR $3.0 \times 10^8 \times 2.56 / 2$	<b>C1</b>
	$3.84 \times 10^8$ m OR $3.84 \times 10^5$ km	<b>A1</b>


Question	Answer	Marks
7(a)	One ray with correct path through lens	<b>B1</b>
	Another ray with correct path through lens Rays intersect to right of F and below axis, inverted image	<b>B1</b>
	drawn <u>and</u> labelled I	<b>B1</b>
7(b)	enlarged, upright and virtual <u>only</u> underlined or ringed	<b>B2</b>
	Two of above descriptions underlined	<b>B1</b>
7(c)	On entering prism: green ray deflection more than red ray and above normal	<b>B1</b>
	On leaving prism: diverging downwards from red ray and not along surface of prism	<b>B1</b>

Question	Answer	Marks
8	Hydroelectric	
8(a)	Hydroelectric named OR water from behind dam	<b>B1</b>
	K.E. of (falling) water used / P.E. of stored water	<b>B1</b>
	Turbine / waterwheel / paddle wheel operated	<b>B1</b>
	(Turbine) turns / drives a generator (that produces electricity)	<b>B1</b>
8(b)	Rain (fills lakes in high places)	<b>B1</b>
	Cause of rain is the Sun, so renewable	<b>B1</b>
8(c)	Sun evaporates water from sea etc. to fall (later) as rain	<b>B1</b>
	Sun is the source of energy.	<b>B1</b>
8	Tidal flow	
8(a)	Tides / tidal flow named	<b>B1</b>
	K.E. of water used	<b>B1</b>
	Turbine / waterwheel / paddle wheel operated	<b>B1</b>
	(Turbine) turns / drives a generator (that produces electricity)	<b>B1</b>
8(b)	Moon (and Sun) causes tides	<b>B1</b>
	Moon (and Sun) permanently in place, so renewable	<b>B1</b>
8(c)	Attraction due to Moon's (and Sun's) gravity causes tides	<b>B1</b>
	Sun is a source of (part of) the energy OR Sun is not the primary source of energy	<b>B1</b>

Question	Answer	Marks
8	Waves	
8(a)	Waves on surface of sea	<b>B1</b>
	K.E. of water used to oscillate a floating mechanism	<b>B1</b>
	Turbine / waterwheel / paddle wheel operated	<b>B1</b>
	(Turbine) turns / drives a generator (that produces electricity)	<b>B1</b>
8(b)	Wind causes waves	<b>B1</b>
	Sun causes wind, so renewable	<b>B1</b>
8(c)	Winds are air currents caused by thermal energy / heat from the Sun	<b>B1</b>
	Sun is the source of energy	<b>B1</b>

Question	Answer	Marks
9(a)(i)	$(3 \times 1.5 =) 4.5 \text{ V}$	<b>B1</b>
9(a)(ii)	$1/R = 1/R_1 + 1/R_2$ OR $R = 1/(1/R_1 + 1/R_2)$ OR $(R =) R_1R_2/(R_1 + R_2)$	<b>C1</b>
	Correct substitution of 3 and 6	<b>C1</b>
	$(R =) 2.0 \Omega$	<b>A1</b>
9(a)(iii)	$V = IR$ in any form OR $(I =) V/R$ OR $4.5/3$	<b>C1</b>
	1.5 A	<b>A1</b>
	OR	
	$I_{\text{total}} = 4.5/2 = 2.25 \text{ A}$	<b>(C1)</b>
	For $3 \Omega$ , $I = 2.25 \times 6/9 = 1.5 \text{ A}$	<b>(A1)</b>
9(b)(i)	Connect ammeter (in wire) from A to B OR from H to G	<b>B1</b>
9(b)(ii)	Connect voltmeter (terminals) to A and H OR B and G OR C and D OR E and F	<b>B1</b>



Question	Answer	Marks
10(a)(i)		<b>B1</b>
10(a)(ii)	To allow flow (of current) in one direction	<b>B1</b>
10(b)(i)	Wire from B to + or – terminal of battery and wire from A to other terminal of battery	<b>B1</b>
	Diode to allow current in at + terminal or out at – terminal	<b>B1</b>
10(b)(ii)	Alternating current in coil Y sets up alternating magnetic field OR causes change in magnetic flux	<b>B1</b>
	Alternating field / change in flux cuts coil X OR Alternating field links with coil X	<b>B1</b>
	(Alternating) voltage / current is <u>induced</u> in coil X OR (Alternating) voltage / current is produced in coil X by electromagnetic induction	<b>B1</b>

Question	Answer	Marks
11(a)(i)	An electron	<b>M1</b>
	In / from / by the nucleus	<b>A1</b>
11(a)(ii)	Proton numbers balance on left and right sides of equation	<b>B1</b>
	Nucleons numbers balance on left and right sides of equation	<b>B1</b>
	${}^0_{-1}\beta$	<b>B1</b>
11(b)	Time for activity / count rate / number of nuclei / number of atoms to halve	<b>B1</b>
11(c)(i)	$\alpha$ -particles would be stopped / absorbed by <u>the plastic</u> / <u>bottle</u>	<b>B1</b>
11(c)(ii)	$\gamma$ -rays would not be absorbed by the liquid / bottle OR reading not reduced (in passing through liquid / bottle) OR very penetrative so no change in detector reading	<b>B1</b>