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PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2017**

MARK SCHEME

Maximum Mark: 80

Published

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

Question	Answer	Marks
2(a)	Extension of a spring is (directly) proportional to load / force / weight OR $F = ke$ where e is extension	**B1**
2(b)(i)	Straight line drawn from origin to (64 mm, 120 N)	**B1**
2(b)(ii)	$F = ke$ in any form OR 120 / 64 OR 120 / 6.4 OR 120 / 0.064	**C1**
	c.a.o. 1.9 N / mm OR 19 N / cm OR 1900 N / m	**A1**
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	**B1**
	The elastic limit / limit of proportionality of the spring has been exceeded	**B1**

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	**B1**
3(b)(i)	$d = m / V$ OR in words OR 0.44 / 0.080^3 OR 0.44 / 5.12×10^{-4} OR 440 / 8^3 OR 440 / 512 OR 0.44 / 8^3 OR 0.44 / 512	**C1**
	0.86 g / cm^3 OR 860 kg / m^3 OR 8.6×10^{-4} kg / cm^3	**A1**
3(b)(ii)	Sinks OR does not float AND (cube) denser (than oil)	**B1**
3(c)(i)	$W = mg$ OR (g =) W / m OR 0.70 / 0.44	**C1**
	1.6 N / kg	**A1**
3(c)(ii)	(P =) hdg OR $0.030 \times 850 \times 1.6$	**C1**
	41 Pa	**A1**

Question	Answer	Marks
4(a)	Atoms collide with wall (and rebound) OR atoms rebound from wall	**B1**
	(Atoms) undergo change of momentum	**C1**
	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	**A1**
4(b)(i)	Fewer atoms per unit volume OR density of gas less	**B1**
	Rate of collision (with walls of balloon) decreases OR Fewer collisions per unit area	**B1**
4(b)(ii)	PV = constant OR $P_1V_2 = P_2V_2$ OR (P_2 =) P_1V_1 / V_2 OR $1.0 \times 10^5 \times 9.6 / 12$	**C1**
	8.0×10^4 Pa	**A1**

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

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

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

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

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

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

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

Question	Answer	Marks
11(a)(i)	An electron	**M1**
	In / from / by the nucleus	**A1**
11(a)(ii)	Proton numbers balance on left and right sides of equation	**B1**
	Nucleons numbers balance on left and right sides of equation	**B1**
	$^{0}_{-1}\beta$	**B1**
11(b)	Time for activity / count rate / number of nuclei / number of atoms to halve	**B1**
11(c)(i)	α-particles would be stopped / absorbed by the plastic / bottle	**B1**
11(c)(ii)	γ-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	**B1**