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PHYSICS

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Paper 4 Extended Theory

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MARK SCHEME

Maximum Mark: 80

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



Question	Answer	Marks
1(a)	force and impulse underlined	B1
1(b)(i)	($v =$) <i>at</i> OR 2.2×3.0	C1
	6.6 m/s	A1
1(b)(ii)	3.3 m/s	B1
1(c)	curve/line starts at origin	B1
	initial gradient zero OR curve passing through (3.0, 9.9)	B1
	gradient increasing (with time)	B1
	Total:	7

Question	Answer	Marks
2(a)	(momentum =) mass $\times$ velocity	B1
2(b)(i)	($p =$) 3.2×4.0	C1
	13 kg m/s	A1
2(b)(ii)	momentum conserved	C1
	$12.8 - (3.2 \times 1.5)$ OR $12.8 - 4.8$ OR 8.0 OR $8.0 \div 1.6$	C1
	5.0 m/s	A1
2(c)	($F =$) $\frac{\Delta p}{\Delta t}$ or $8.0 \div 0.050$	C1
	160 N	A1
2(d)	internal energy (of blocks) increase OR thermal energy/sound energy (lost/produced at collision)	B1
	Total:	9

Question	Answer	Marks
3(a)	$(\rho =) \frac{m}{V}$ OR $180 \div 210$ OR $0.18 \div 210$	C1
	0.86 g/cm^3	A1
3(b)	floats OR words to the same effect	B1
	density of wood is less than density of liquid	B1
	Total:	4
Question	Answer	Marks
4	$F_1 d_1 = F_2 d_2$ OR $(F_2 =) \frac{F_1 d_1}{d_2}$ OR $200 \times 22 \div 8.0$	C1
	550 (N) or $200 \times 22 \div 8.0$	C1
	$(p =) \frac{F}{A}$ OR $550 \div 0.00050$ OR $200 \times 22 \div (8.0 \times 0.00050)$	C1
	$1.1 \times 10^6 \text{ Pa}$	A1
	Total:	4

Question	Answer	Marks
5(a)	white kit cooler OR black kit warmer	M1
	white poor absorber/good reflector of (IR) <u>radiation/heat/thermal energy</u> OR v.v. for black	A1
5(b)(i)	any two pairs from: more/less wind; dries quicker/slower temperature increases/decreases/sunnier/cloudier; dries quicker/slower stops/starts raining; dries quicker/slower less/more humid; dries quicker/slower	B2
5(b)(ii)	molecules with most (kinetic) energy (escape) OR water cools	B1
	escape liquid/break intermolecular bonds / molecules enter air / evaporate / become vapour	B1
	Total:	6
Question	Answer	Marks
6(a)	<u>molecules/they</u> move/collide	B1
	molecules/they move/collide with <u>walls</u>	B1
	<u>change</u> of momentum OR force on area	B1
6(b)(i)	$pV = \text{constant}$ OR $p_1 V_1 = p_2 V_2$	B1
6(b)(ii)1	100 (kPa) OR 1.0×10^5 (Pa)	M1
	Pa OR kPa	A1
6(b)(ii)2	($p =$)50 (kPa)	C1
	$3700 \text{ m} < p < 3900 \text{ m}$	A1
	Total:	8

Question	Answer	Marks
7(a)(i)	$(v =)f\lambda$ or 6000×0.25	C1
	1500 m/s	A1
7(a)(ii)	$300 \text{ m/s} \leq c \leq 360 \text{ m/s}$	B1
7(a)(iii)	less and travels less far in same/periodic time	B1
7(b)	vibration/oscillation	B1
	vibration/oscillation parallel to direction of travel OR compressions and rarefactions	B1
7(c)(i)	inversely related OR the wider the gap, the less the diffraction OR v.v.	B1
7(c)(ii)	directly related OR greater wavelength, greater diffraction OR v.v.	B1
	Total:	8

Question	Answer	Marks
8(a)	OP/it is along the normal/at 90° (to the curved surface)	B1
8(b)(i)	$\sin i / \sin r = n$	C1
	$\sin r / \sin 30(^{\circ}) = 1.5$ OR $\sin r = 1.5 \times \sin 30(^{\circ})$	C1
	49°	A1
8(b)(ii)	ray bends away from the normal c.a.o.	B1
8(c)	angle (from normal) of refraction increases	B1
	refracted ray travels along boundary OR reflected ray becomes brighter OR refracted ray becomes dimmer	B1
	light reflects back into glass (with $i = r$)	B1
	Total:	8

Question	Answer	Marks
9(a)	$(I =) \frac{P}{V}$ OR $24 \div 6.0$ OR 4.0 (A) OR $(R =) \frac{V}{I}$	C1
	$6.0 \div 4.0$	C1
	1.5Ω	A1
9(b)(i)	6.0 V	B1
9(b)(ii)	1.5Ω	B1
9(b)(iii)	$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ OR $1 \div 1.5 = \frac{1}{R_1} + \frac{1}{R_2}$ OR $1 \div 1.5 = \frac{2}{R}$	C1
	$3.0 (\Omega)$	A1
9(c)	resistance of circuit/parallel pair increases	B1
	current (in lamp) decreases OR less p.d. across lamp	B1
	Total:	9

Question	Answer	Marks
10(a)(i)	<u>magnetic</u> field mentioned	B1
	changing (magnetic) field in core/Q	B1
	induction in Q	B1
10(a)(ii)	(iron is) magnetic and temporary magnetic	B1
10(b)(i)	$(V_S =)V_P \times N_S \div N_P$ OR $4.0 \times 340 \div 200$	C1
	6.8 V	A1
10(b)(ii)	$(I_P =)I_S V_S / V_P$ OR $3.5 \times 6.8 \div 4.0$	C1
	6.0 A	A1
10(c)	less energy wasted (in cables)	B1
	cheaper and one from: thinner cables fewer pylons fewer power stations/less fuel required	B1
	Total:	10

Question	Answer	Marks
11(a)(i)	produces a narrow beam of γ -rays OR absorb γ -rays that are not on path shown	B1
11(a)(ii)	no change	B1
	γ -rays not deflected	B1
	γ -rays are electromagnetic radiation/uncharged OR not deflected by magnetic field	B1
11(b)	(ionising effect of) α-particles greater than β-particles and β-particles greater than γ-rays	B1
	any two from: mass $\alpha > \text{mass } \beta > \text{mass } \gamma$ charge $\alpha > \text{charge } \beta > \text{charge } \gamma$ speed $\gamma > \text{speed } \beta > \text{speed } \alpha$	B2
	Total:	7