
PHYSICS**5054/21**

Paper 2 Theory

October/November 2017

MARK SCHEME

Maximum Mark: 75

Published

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Section A

Question	Answer	Marks
1(a)	$(\rho =)m / V$ or $23 / (3.6 \times 0.35 \times 0.025)$ or $23 / 0.0315$	C1
	730 kg / m^3	A1
1(b)(i)	230 N	B1
1(b)(ii)	$(\Gamma =)Wx_{\perp}$ or 230×1.3	C1
	300 Nm	A1
1(c)	moment of painter / clockwise moment (about support) is greater than / not equal to / different from moment of plank / anticlockwise moment	B1


Question	Answer	Marks
2(a)(i)	(pressure =)force / area	B1
2(a)(ii)	fewer molecules or less gas or more space / further apart	B1
	less frequent collisions (with walls)	B1
	less force exerted on walls	B1
2(b)	$(p_1 =)p_2V_2 / V_1$ or $p_1V_1 = p_2V_2$ $1.0 \times 10^5 \times 9.4 \times 10^{-4} / 1.8 \times 10^{-4}$	C1
	$5.2 \times 10^5 \text{ Pa}$	A1

Question	Answer	Marks
3(a)	any two of: irregular arrangement (of molecules) intermolecular forces weak(er) / not held as firmly together intermolecular distances greater / more spaced out move in clusters through the liquid (not just vibrations) or positions not fixed or can slide past each other	B2
3(b)(i)	work done or forces overcome	B1
	atoms pulled apart or bonds broken	B1
3(b)(ii)	(Q =)ml or 0.84×64 or $0.84 \times 64\ 000$	C1
	54 kJ or 54 000 J	A1

Question	Answer	Marks
4(a)	use of boiling water	B1
	thermometer in boiling water or in steam above boiling water	B1
	mercury level at 100 °C mark or use of pure / distilled water or at a pressure of one atmosphere	B1
4(b)	(range is) decreased / smaller / reduced	B1
	ethanol (thread) reaches the end at a lower temperature	B1

Question	Answer	Marks
5(a)	pressure / vibrational / longitudinal (wave) or (wave that consists of) compressions and rarefactions or sound <u>wave</u> or inaudible sound	B1
	<u>frequency</u> greater than 15 kHz–25 kHz	B1
5(b)	(ultrasound) transmitted into body	B1
	echo / reflection from (baby / fetus)	B1
	image produced	B1

Question	Answer	Marks
6	EITHER	
6(a)	(high) positive potential	B1
	very low gas pressure or heat filament continuously / filament must remain hot	B1
6(b)	determine distance / number of squares between pulses	M1
	multiply by time-base setting or multiply by number of ms / div	A1

Question	Answer	Marks								
6	OR									
6(a)		B1								
6(b)(i)	(the NAND gate has a) power supply / battery or it is an active device	B1								
6(b)(ii)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>inputs</th> <th>output</th> </tr> </thead> <tbody> <tr> <td>0 0</td> <td>1</td> </tr> <tr> <td>0 1</td> <td>1</td> </tr> <tr> <td>1 0</td> <td>1</td> </tr> </tbody> </table>	inputs	output	0 0	1	0 1	1	1 0	1	B1
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1 1	0									

Question	Answer	Marks
7(a)	PQ: a force towards the top of the page (second box) ticked	B1
	QR: a force towards the right of the page (bottom box) ticked	B1
7(b)	current reversed	B1
	both forces reversed	B1
7(c)	force(s) decrease or less heat generated	B1

Question	Answer	Marks
8(a)(i)	2 protons and 2 neutrons (joined together)	B1
8(a)(ii)	it is (positively)charged	B1
	it pulls electrons from molecules of air or knocks electrons from the molecules of air or gains electrons from air molecules	B1
8(a)(iii)	1 stronger and 2 stronger	B1
8(b)(i)	idea of halving	C1
	$(N =)4.8 \times 10^7 / 1.5 \times 10^6$ or 1 / 32 or 5 (half-lives)	C1
	1.6 / 1.65 / 1.7 $\times 10^6$ s	A1
8(b)(ii)	radioactive emission is a random process	B1

Section B

Question	Answer	Marks
9(a)(i)	$(WD) = Fx$ or $2.8 \times 10^6 \times 9.7$	C1
	$2.7 \times 10^7 \text{ J}$	A1
9(a)(ii)	from chemical (potential energy)	B1
	to thermal (energy) / heat	B1
9(b)(i)	$(a =)F / m$ or $2.8 \times 10^6 / 2.2 \times 10^8$	C1
	0.013 m / s^2	A1
9(b)(ii)	1 deceleration / it decreases	B1
	resistive force decreases or resistive force depends on speed	B1
	2 curve/line from 9.7 to zero and gradient negative (allow zero at end)	B1
	magnitude of gradient decreasing	B1
	3 area mentioned	B1
	area <u>under</u> line / curve or convert cm^2 (of graph paper) to distance or in terms of the scales	B1
9(c)(i)	(efficiency =) useful energy output / total energy input or useful power output / total power input	B1
9(c)(ii)	33×0.64 or 12 MJ / s	C1
	21 MJ / s	A1

Question	Answer	Marks
10(a)	P - gamma(-rays) or γ (-rays)	
	Q - ultraviolet (radiation)	
	R - microwaves	
	any one correct	C1
	all three correct	A1
10(b)	P and X-rays and Q ticked	B1
10(c)(i)	$(f =)c / \lambda$ or $3.0 \times 10^8 / 9.4 \times 10^{-7}$	C1
	3.2×10^N	C1
	3.2×10^{14} Hz	A1
10(c)(ii)	infra-red / radiation / signal / wave emitted by control and received at set	B1
	infra-red / radiation / signal / wave is encoded or is decoded	B1
10(d)(i)	normal indicated and angle of incidence indicated	B1
10(d)(ii)	$n = \sin i / \sin r$ or $1.5 = \sin 57^\circ / \sin r$ or $(r =)\sin^{-1}(\sin 57^\circ / n)$ or $\sin^{-1}(\sin 57^\circ / 1.5)$	C1
	34°	A1
10(d)(iii)	1 no change	B1
	2 3 decreases and decreases	B1

Question	Answer	Marks
10(d)(iv)	ray in glass between normal and continuation of the incident ray	B1
	ray in air between continuation of the refracted ray and side of prism	B1

Question	Answer	Marks
11(a)(i)	any suitable solid insulator (e.g. nylon, plastic, glass, rubber, polystyrene)	B1
11(a)(ii)	positive charges near to rod	B1
	negative charges opposite rod and equal in number and 7 or fewer	B1
11(a)(iii)	1 electrons / negative charges flow towards earth	B1
	repelled (by negative charge on rod)	B1
	(sphere) becomes positive	B1
	2 flow of electrons / negative charge and (in direction) earth to sphere	B1
11(b)(i)	$1/R = 1/R_1 + 1/R_2$ or $R_1 R_2 / (R_1 + R_2)$ or $1/R = 1/15 + 1/60$ or $15 \times 60 / 75$ or $15 \times 60 / (15 + 60)$	C1
	12 (Ω) or 0.083 (Ω)	C1
	30 Ω	A1
11(b)(ii)	$(I =)V/R$ or 7.5/30	C1
	0.25 A	A1

Question	Answer	Marks
11(b)(iii)	18 Ω resistor underlined 2 and 60 Ω resistor underlined	B1
11(b)(iv)	five cells in series and all in same direction	B1
11(b)(v)	resistance increases and current decreases	B1