



**Cambridge Assessment International Education**  
Cambridge Ordinary Level

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**PHYSICS**

**5054/21**

Paper 2 Theory

**October/November 2017**

MARK SCHEME

Maximum Mark: 75

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**Published**

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

**PUBLISHED****Section A**

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


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

Question	Answer	Marks
3(a)	any <b>two</b> 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) <b>or</b> positions not fixed <b>or</b> can slide past each other	<b>B2</b>
3(b)(i)	work done <b>or</b> forces overcome	<b>B1</b>
	atoms pulled apart <b>or</b> bonds broken	<b>B1</b>
3(b)(ii)	(Q = )ml <b>or</b> $0.84 \times 64$ <b>or</b> $0.84 \times 64\ 000$	<b>C1</b>
	54 kJ <b>or</b> 54 000 J	<b>A1</b>

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

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

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

Question	Answer	Marks								
6	<b>OR</b>									
6(a)		<b>B1</b>								
6(b)(i)	(the NAND gate has a) power supply / battery <b>or</b> it is an active device	<b>B1</b>								
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	<b>B1</b>
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Question	Answer	Marks
7(a)	PQ: a force towards the top of the page (second box) ticked	<b>B1</b>
	QR: a force towards the right of the page (bottom box) ticked	<b>B1</b>
7(b)	current reversed	<b>B1</b>
	both forces reversed	<b>B1</b>
7(c)	force(s) decrease <b>or</b> less heat generated	<b>B1</b>

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

**PUBLISHED****Section B**

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

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



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

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

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