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**PHYSICS**

**5054/21**

Paper 2 Theory

**May/June 2017**

MARK SCHEME

Maximum Mark: 75

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**Published**

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Question	Answer	Marks
1(a)	A – contact or reaction force B – driving force C – force of gravity D – air resistance and friction	<b>B1</b>
1(b)(i)	800 kg	<b>B1</b>
1(b)(ii)	400 N	<b>B1</b>
1(b)(iii)	(a =) $F / m$ formula or with numbers	<b>C1</b>
	$0.50 \text{ m / s}^2$	<b>A1</b>
1(c)	change in $v = at$ in words or numbers	<b>C1</b>
	$12 \text{ m / s}$	<b>A1</b>

Question	Answer	Marks
2(a)	greater pressure in Fig. 2.2 <b>and</b> smaller area (in contact) in Fig. 2.2 <b>or <u>more force</u></b> through the back legs	<b>B1</b>
	pressure is inversely proportional to area <b>or</b> pressure is force / area	<b>B1</b>
2(b)	Any 2 of <ul style="list-style-type: none"> <li>• centre of mass (on or) outside base / chair / leg</li> <li>• weight acts on left of / outside chair leg</li> </ul>	<b>B1</b>
	<ul style="list-style-type: none"> <li>• (anticlockwise) moment (created)</li> </ul>	<b>B1</b>

Question	Answer	Marks
3(a)	conduction in metal <b>or</b> convection (in liquid) mentioned by name	<b>B1</b>
	conduction explained as heat / energy passing from molecule to molecule <b>or</b> movement / diffusion / collision of (free) electrons	<b>B1</b>
	convection explained by rising of hot liquid <b>or</b> correct density changes	<b>B1</b>
3(b)	air is a bad conductor <b>or</b> less area in contact / all of cup does not touch plate	<b>B1</b>
3(c)	white <b>and</b> shiny	<b>B1</b>
	less radiation emitted / less emission	<b>B1</b>

Question	Answer	Marks
4(a)(i)	image height / object height <b>or</b> image distance / object distance	<b>B1</b>
4(a)(ii)	rays go to / meet at image <b>or</b> can be formed on a screen	<b>B1</b>
4(b)(i)	horizontal ray continued to bottom of I	<b>B1</b>
4(b)(ii)	2.4 cm	<b>B1</b>
4(b)(iii)	any two other rays drawn, e.g. through centre of lens	<b>B1</b>

Question	Answer	Marks
5(a)	$1/R_t = 1/R_1 + 1/R_2$ or $R_t = R_1R_2/(R_1 + R_2)$ formulae or numbers using 20 and $40\ \Omega$ <b>or</b> $13(.3\ \Omega)$	<b>C1</b>
	$R_t = R_1 + R_2$ or 20 + any attempt at parallel calculation	<b>C1</b>
	$33(.3)\ \Omega$	<b>A1</b>
5(b)	$V_2 = V_3$	<b>B1</b>
	$V_1$ largest or larger than either $V_2$ or $V_3$	<b>B1</b>

Question	Answer	Marks
6(a)(i)	200 W	<b>B1</b>
6(a)(ii)	power $\times$ time <b>or</b> any numerical value of power $\times$ 3	<b>C1</b>
	0.6(0)	<b>A1</b>
6(a)(iii)	(I =) P / V algebraic or numerical	<b>C1</b>
	0.17 A	<b>A1</b>
6(b)	(if in neutral) rest of circuit / lamps / television not live / still high voltage / still 240 V <b>or</b> live has high voltage / 240 V / can cause shock	<b>C1</b>
	(if in neutral) <u>when</u> (switched) <u>off</u> circuit / lamps / television not live / still high voltage / still 240 V	<b>A1</b>

Question	Answer	Marks
7(a)(i)	arrow or other indication left to right in rod or correct in circuit labelled C	<b>B1</b>
7(a)(ii)	arrow from N-pole to S-pole labelled M	<b>B1</b>
7(a)(iii)	arrow downwards labelled F	<b>B1</b>
7(b)(i)	rod cuts magnetic field / flux lines <b>or</b> flux (in circuit)1 changes	<b>B1</b>
	<b>induced</b> e.m.f. / voltage / current formed	<b>B1</b>
7(b)(ii)	move rod faster	<b>B1</b>

Question	Answer	Marks
8(a)	(high frequency) electromagnetic wave / ray	<b>B1</b>
8(b)	top line of beta 0	<b>B1</b>
	Xe proton and neutron numbers both balance	<b>B1</b>
8(c)	gamma rays pass out of / are not stopped by body	<b>B1</b>
	less chance of cell or gene damage / cancer / radiation sickness / mutation / ionisation (of body tissues)	<b>B1</b>

**PUBLISHED****Section B**

Question	Answer	Marks
9(a)(i)	not being replaced <b>or</b> will run out	<b>B1</b>
9(a)(ii)	only oil in 1st column	<b>B1</b>
	only wind and hydroelectric in 2nd column	<b>B1</b>
	geothermal in 3rd column	<b>B1</b>
9(a)(iii)	less greenhouse gases / global warming / acid rain / <b>or</b> toxic gases / oil spills <b>and</b> how they affect a <u>named</u> organism / ecosystem	<b>B1</b>
9(a)(iv)	nuclear waste / radioactive waste causes (storage) problems <b>or</b> explosion / melt down / leak emits radioactivity	<b>B1</b>
9(b)(i)	generator (and transformer)	<b>B1</b>
9(b)(ii)	kinetic (energy)	<b>B1</b>
9(b)(iii)	1 24 000 kg	<b>B1</b>
	2 formula $(E) = mL$ <b>or</b> $(E = ) mcT$ seen	<b>C1</b>
	$24\,000 \times 2.3 \times 10^6$ <b>or</b> $5.5(2) \times 10^{10}$ (J)	<b>C1</b>
	$24\,000 \times 4200 \times 90$ <b>or</b> $9.0(72) \times 10^9$ (J)	<b>C1</b>
	$6.4 \times 10^{10}$ J	<b>A1</b>
9(b)(iv)	low current	<b>B1</b>
	less energy / heat loss (in resistance or cables) <b>or</b> thinner wires can be used	<b>B1</b>

Question	Answer	Marks
10(a)(i)	both reflected rays correct by eye	<b>B1</b>
	image in correct position shown by continuation of rays behind mirror	<b>B1</b>
10(a)(ii)	virtual <b>or</b> upright <b>or</b> laterally inverted <b>or</b> same size (as object)	<b>B1</b>
10(b)(i)	line ( joining points )	<b>C1</b>
	line joining points / particles on wave with same phase <b>or</b> line joining points along a crest etc.	<b>A1</b>
10(b)(ii)1	correct angle to surface $\pm 7^\circ$ with correct orientation <b>and</b> similar wavelength (by eye)	<b>B1</b>
10(b)(ii)2	at least two lines at smaller angle to surface with correct orientation in slower medium	<b>B1</b>
	showing smaller and constant wavelength with wavefronts deviated in correct direction	<b>B1</b>
10(c)(i)	$(v = ) f\lambda$ <b>or</b> $2(000) \times 16$	<b>C1</b>
	32 000 cm / s <b>or</b> 320 m / s	<b>A1</b>
10(c)(ii)1	a range with 15–25 Hz as the lowest frequency <b>and</b> 15–30 kHz as the highest	<b>B1</b>
10(c)(ii)2	1.6 cm (if highest frequency is 20 000 Hz)	<b>B1</b>
10(c)(iii)	tube or other method to produce (narrow) beam of sound on source and/or on detector	<b>B1</b>
	stated detector <b>or</b> stated reflector	<b>B1</b>
	detector moved to find maximum loudness <b>or</b> angles $i$ and $r$ measured with suitable experiment	<b>B1</b>

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Question	Answer	Marks
11(a)	battery and ammeter symbols correct	<b>B1</b>
	thermistor symbol correct	<b>B1</b>
	all connected in series	<b>B1</b>
11(b)(i)1	0.05 (A) seen	<b>C1</b>
	(V = ) IR <b>or</b> $0.05 \times 240$	<b>C1</b>
	12 V	<b>A1</b>
11(b)(i)2	(R = ) V / I <b>or</b> 0.12 (A) seen	<b>C1</b>
	100 $\Omega$	<b>A1</b>
11(b)(ii)	description of change in resistance in two equal changes in temperature, e.g. 240–100 and 100–48	<b>C1</b>
	difference values obtained are not the same, with one value shown e.g. 140 and 52 ( $\Omega$ )	<b>A1</b>
11(c)(i)	two different metals connected together	<b>B1</b>
	voltmeter, ammeter or galvanometer in series	<b>B1</b>
	clear junction of two different metals used as the place to measure temperature	<b>B1</b>
11(c)(ii)	ANY 2 lines from measures high(er) temperatures more sensitive to changes in temperature measures fast(er) changing temperatures / reading can be taken more rapidly produce electronic output / output may be stored or processed / may be read remotely	<b>B2</b>