
PHYSICS

5054/21

Paper 2 Theory

May/June 2017

MARK SCHEME

Maximum Mark: 75

Published

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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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	B1
1(b)(i)	800 kg	B1
1(b)(ii)	400 N	B1
1(b)(iii)	(a =) F / m formula or with numbers	C1
	0.50 m / s ²	A1
1(c)	change in $v = at$ in words or numbers	C1
	12 m / s	A1

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

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

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

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 $40\ \Omega$ or $13(.3\ \Omega)$	C1
	$R_t = R_1 + R_2$ or $20 +$ any attempt at parallel calculation	C1
	$33(.3)\ \Omega$	A1
5(b)	$V_2 = V_3$	B1
	V_1 largest or larger than either V_2 or V_3	B1

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

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

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

PUBLISHED**Section B**

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

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

Question	Answer	Marks
11(a)	battery and ammeter symbols correct	B1
	thermistor symbol correct	B1
	all connected in series	B1
11(b)(i)1	0.05 (A) seen	C1
	(V =) IR or 0.05×240	C1
	12 V	A1
11(b)(i)2	(R =) V / I or 0.12 (A) seen	C1
	100 Ω	A1
11(b)(ii)	description of change in resistance in two equal changes in temperature, e.g. 240–100 and 100–48	C1
	difference values obtained are not the same, with one value shown e.g. 140 and 52 (Ω)	A1
11(c)(i)	two different metals connected together	B1
	voltmeter, ammeter or galvanometer in series	B1
	clear junction of two different metals used as the place to measure temperature	B1
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	B2