
PHYSICS

5054/22

Paper 2 Theory

October/November 2018

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.

Cambridge International will not enter into discussions about these mark schemes.

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

PUBLISHED**Generic Marking Principles**

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Question	Answer	Marks
1(a)	it / speed does not have a direction / is a scalar quantity	B1
1(b)(i)	direction (of velocity) changes (as it moves around the Earth)	B1
	its velocity <u>changes</u> with time (this is an acceleration)	B1
1(b)(ii)	arrow from satellite towards (centre of) Earth	B1
1(c)	no work done and force perpendicular to motion / no movement in direction of force	B1
	(kinetic and gravitational potential) energy remains constant / no effect	B1

Question	Answer	Marks
2(a)	(place where entire) mass (seems) to be located	B1
2(b)	wide base / base area large	B1
	low centre of mass	B1
2(c)	suspend lamina next to plumb line / mass on string	B1
	mark vertical line on lamina / line along string / plumb line	B1
	repeat from another point and centre of mass at intersection of lines	B1

Question	Answer	Marks
3(a)	all the water is heated or the water is mixed up or water heated uniformly or distributes heat (better)	B1
	heated water rises or cold water sinks or convection transfers thermal energy (upwards)	B1

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Question	Answer	Marks
3(b)(i)	molecules move / vibrate <u>faster</u> / <u>more</u> kinetic energy	B1
	molecules push each other apart or molecules move apart or space between molecules increases or vibrate with greater amplitude	B1
3(b)(ii)	rises and liquids expand more (than solids)	B1

Question	Answer	Marks
4(a)(i)	radiation or infrared (radiation / waves) or light	B1
4(a)(ii)	it / a black surface is a good absorber / poor reflector of radiation	B1
	<u>more</u> energy / power output or <u>more</u> electricity produced	B1
4(b)(i)	$(P =) VI t$ or $24 \times 15 \times 3600$ or $24 \times 15 \times 60$ or 22 000 (J)	C1
	1.3×10^6 J	A1
4(b)(ii)	$(\Delta Q =) mc\Delta T$ or 29 (°C) or 45 – 16 (°C)	C1
	$51 \times 4200 \times 29$ or $51 \times 4200 \times (45 - 16)$	C1
	6.2×10^6 J	A1

Question	Answer	Marks
5(a)	charges / electrons are not free to move (in an insulator)	B1
	any sensible example e.g. plastic / nylon / glass / rubber	B1
5(b)(i)	negative charge on left of K and positive charge on right of L	M1
	equal numbers of charges and number ≤ 5 and no charges on right of K and no charges on left of L	A1

Question	Answer	Marks
5(b)(ii)	1 (negative) charge spreads throughout (surface of) sphere	B1
	2 (positive) charge on L disappears or L becomes neutral or equal number of positive and negative charges	B1

Question	Answer	Marks
6(a)	32 counts / minute	B1
6(b)(i)	second (beta-particles) and third (gamma-rays) boxes ticked	B1
6(b)(ii)	1 28	B1
	2 32	B1
6(c)(i)	(average) time (taken for)	M1
	count rate / number of nuclei / number of atoms to halve	A1
6(c)(ii)	some readings are bigger than those before / readings fluctuate	B1
	half-life / 5.3 years too long or 5 / 6 minutes too short	B1

Question	Answer	Marks
7(a)	magnetic (material)	B1
	temporary / soft magnetic (material)	B1
7(b)(i)	it / a.c. changes direction or changes polarity / from positive to negative (continually)	B1
	it / a.c. has varying size or is sinusoidal / like a sine wave	B1

Question	Answer	Marks
7(b)(ii)	magnetic field (in core / secondary coil) is not changing / remains constant	B1
	no (electromagnetic) <u>induction</u>	B1

Question	Answer	Marks
8(a)(i)	1 quantity of matter (in a body)	B1
	2 balance or scales	B1
8(a)(ii)	(k.e. =) $\frac{1}{2}mv^2$	C1
	$\frac{1}{2} \times 0.16 \times 8.7^2$	C1
	6.1 J	A1
8(b)(i)	1 deceleration or retardation	B1
	2 negative gradient or line slopes downwards (left to right)	B1
8(b)(ii)	1 $0.88 \text{ s} \leq \text{time} \leq 0.90 \text{ s}$	B1
	2 area or counting squares or $\frac{1}{2}bh$ in some form	C1
	$3.7 \text{ s} \leq \text{distance} \leq 4.1 \text{ m}$	A1
8(b)(iii)	ball hits ground or short time for deceleration or large force or ground is hard	B1
8(b)(iv)	internal / thermal energy (of ball and ground) has increased	B1
	(internal energy) from kinetic energy	B1

Question	Answer	Marks
8(c)	any two from: smaller time to drop to zero velocity / hit ground line not straight or velocity does not change uniformly or gradient not constant smaller area under (first part of) graph or less distance travelled slower final velocity initial downward gradient steeper	B2

Question	Answer	Marks
9(a)	frequency of sound wave small(er) or its frequency is less than 20 000 Hz	B1
9(b)(i)	transmission of energy	B1
	(through a medium) with no net movement of medium or by vibrating particles	B1
	vibrations parallel (and antiparallel) to wave / energy travel direction or cannot be polarised	B1
9(b)(ii)	1 two centres of rarefactions labelled <i>R</i>	B1
	2 distance from one point to adjacent identical point indicated (with double-headed arrow)	B1
	3. $(v =) f\lambda$ or $25\,000 \times 0.047 / 0.048 / 0.049$ or $25\,000 \times 4.7 / 4.8 / 4.9$ or $25\,000 \times 47 / 48 / 49$	C1
	1200 m / s	A1
9(c)(i)	decreases	B1
9(c)(ii)	four / five straight lines in air that touch the compressions still in the liquid and no intermediate / extra lines between the correct lines	B1
	at least four compressions in air parallel to each other	B1
	at least four straight lines at shallower angle from horizontal and slope correct	B1

Question	Answer	Marks
9(d)	object (to be cleaned) immersed in liquid / solvent	B1
	object / liquid agitated / vibrated by ultrasound	B1
	dirt (particles) shaken off or dislodges / removes dirt	B1

Question	Answer	Marks
10(a)	electrons c.a.o.	M1
	towards the ammeter or away from the negative terminal or towards the positive terminal	A1
10(b)(i)	thermistor c.a.o.	B1
10(b)(ii)	$1/R_T = 1/R_1 + 1/R_2$ or $1/R_T = 1/1.5 + 1/6.0$ or $(R_T =) R_1R_2/(R_1 + R_2)$ or $1.5 \times 6.0 / (1.5 + 6.0)$	C1
	1.2 (Ω)	C1
	2.5 Ω	A1
10(b)(iii)	$(I =) V/R$ or $12/2.5$	C1
	4.8 (A)	A1
10(b)(iv)	$I_A = I_R + I_Z$	B1
10(c)	resistance of Z / thermistor decreases	B1
	resistance of parallel combination decreases or total resistance (of circuit) decreases or current increases	B1
	voltage (across 1.3 Ω) increases	B1
	trace moves towards top of screen / upwards	B1

Question	Answer	Marks
10(d)(i)	8	B1
10(d)(ii)	1.5 V	B1