



PHYSICS

5054/21

Paper 2 Theory

May/June 2019

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 **11** 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)(i)	58 km	B1
1(a)(ii)	0.8(0) hr or 48 min	B1
1(b)	steep(er) / larg(er) slope / gradient or travels a larger distance in the same / unit time or takes a shorter time to travel the same distance or covers more distance in less time	B1
1(c)	(s =) d / t numerical or algebraic; 58 / 4	C1
	15 km / hr	A1


Question	Answer	Marks
2(a)	coal and oil underlined	B1
2(b)(i)	water boils or turns to steam	B1
	<u>pressure / force</u> of steam turns turbine or steam at high pressure / pressure difference (across turbine)	B1
2(b)(ii)	(Q =) mcT numerical or algebraic	B1
	4.9×10^7 J	B1

Question	Answer	Marks
3(a)	<i>in spring:</i> elastic or strain (potential energy)	B1
	<i>in muscles:</i> chemical (potential energy)	B1
3(b)	spring extends a different distance for the same (extra) load or load is no longer proportional to extension or becomes easier to pull	B1
3(c)(i)	(W =) Fd numerical or algebraic; 400×0.23	C1
	92 J	A1
3(c)(ii)	measure / determine the no. of times he extends the spring in 60 s	B1
	power = (total) work / time explained	B1

Question	Answer	Marks
4(a)	no / small(er) force between gas molecules (so they separate) or large(r) force between liquid molecules (keeps them together)	B1
	small(er) distance between liquid molecules or large(r) distance between gas molecules or density of liquid larger	B1
4(b)(i)	$P_1V_1 = P_2V_2$	B1
4(b)(ii)	volume change = 8×5 or 40 cm^3 or final volume = $60 \text{ (cm}^3\text{)}$ seen	C1
	$1.2 \times 10^5 \times 100 = p \times 60$	C1
	$2(.0) \times 10^5 \text{ Pa}$	A1
4(b)(iii)	more hits per second or hit more often / more frequently or more hits <u>on walls</u>	B1

Question	Answer	Marks
5(a)	adjusts the variable resistor / rheostat or change the number of cells	B1
5(b)(i)	current proportional to voltage or $V = kI$ where k is a constant	M1
	provided temperature / physical conditions unchanged	A1
5(b)(ii)	at least two values of V/I or I/V shown to be the same;	B1
5(b)(iii)	use 0–10 A range for 220 and 320 mA readings and 0–200 mA range for 100 mA reading or start with 10 A / highest range and either <ul style="list-style-type: none"> • reduce to 200 mA for last reading • reduce range and keeping high value on scale / not over scale 	B1

Question	Answer	Marks
6(a)	blows / melts / cuts off circuit / stops current and when the <u>current</u> is high	B1
6(b)(i)	(I =) P/V numerical or algebraic	B1
	6.2, 6.25 or 6.3 A	B1
6(b)(ii)	any integral value 7–13 A	B1
6(c)	double insulated or outside case / body is plastic / rubber	B1

Question	Answer	Marks
7(a)(i)	<u>magnetic field</u> / flux mentioned	B1
	change in field / flux (in coil) or field (lines) cut coil / wire	B1
7(a)(ii)	more turns or stronger magnet or move magnet faster	B1
7(b)(i)	 correct symbol	B1
7(b)(ii)	converts more of the <u>input energy / power</u> into light / useful energy / power or less energy / power wasted <u>with same input energy / power</u> or <u>in same time</u> or <u>same</u> input power / energy / current gives more light / less energy wasted / power wasted / heat / greater power out or <u>less</u> input power / energy gives same output power / energy	B1

Question	Answer	Marks
8(a)(i)	attempt to use potential divider formula or split 12 V in ratio 200:1200 or $I = 12 / (2000 + 1200)$ numerical or algebraic with <u>total</u> resistance	C1
	7.5 V	A1
8(a)(ii)	resistance (of thermistor / circuit) falls	B1
	fixed resistor has larger fraction / share of total voltage or voltage across thermistor falls and sum of voltages the same or current in circuit increases (and $V = IR$ explained for fixed resistor)	B1
	EITHER	
8(b)	(increased current in coil causes) coil / core / relay to become magnetised	B1
	coil / core attracts (iron / magnetic) switch	B1
	OR	
8(b)	transistor switches on / (gives) high (collector) current	B1
	occurs when base and emitter voltage is high (> 0.6 V) or small current into base gives larger output / collector current	B1

PUBLISHED**Section B**

Question	Answer	Marks
9(a)(i)	amount / measure / quantity of matter / substance (in a body) or (property of a body) that resists (change in) motion	B1
9(a)(ii)	force / pull of <u>gravity</u> or in a gravitational field	B1
9(b)	(a =) F / m algebraic or numerical or 400 (N) seen	C1
	400 / 60	C1
	6.7 m/s ²	A1
9(c)(i)	initial curve of correct shape from origin at 0 to 30 s	B1
	horizontal line at 44 m/s from 30 s to 40 s	B1
	speed drops from 44 to 5 m/s in a time of 4 s	B1
	constant speed of 5 m/s until 200 s (and then to zero)	B1
9(c)(ii)	(a =) $(v - u) / t$ algebraic or numerical	C1
	9.7 or 9.8 m/s ²	A1
9(d)(i)	upwards force / air resistance = weight / downward force	B1
9(d)(ii)	increase in air resistance / upwards force (from parachute)	B1
	upwards / force / air resistance larger than weight / downwards force or resultant force upwards	B1
9(d)(iii)	air resistance decreases (as speed reduces) until it equals weight or (with parachute open) air resistance = weight at lower speed	B1

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Question	Answer	Marks
10(a)(i)	1.7 (cm) seen or any multiple of wavelength measured on diagram	C1
	6.4–7.2 cm	A1
10(a)(ii)	number of waves/cycles/oscillations in one second / unit time	C1
	number of wavelengths/crests/troughs/ <u>wave</u> cycles/ <u>wave</u> oscillations generated/made/pass a point in one second/unit time or number of oscillations of a <u>source/particle</u> in one second / unit time	A1
10(a)(iii)	2.5 Hz	B1
10(a)(iv)	moved up and down	B1
	regularly or at constant frequency / 2.5 times a second	B1
10(a)(v)	<i>speed</i> smaller / decreases and <i>wavelength</i> smaller / decreases	B1
10(b)(i)	tape measure or trundle wheel or microphones	B1
	stopwatch or timer	B1
10(b)(ii)	start timer on seeing the smoke from gun / sound picked up by microphone	B1
	stop timer on hearing sound	B1
	measure (large) distance between students	B1
10(b)(iii)	both between and including 1000 and 10 000 m/s	B1
	solid speed > liquid speed	B1

Question	Answer		Marks
11(a)(i)	Geiger Muller (tube / counter / detector)		B1
11(a)(ii)	keep distance (away from source) or use absorber or use for short time		B1
11(b)(i)	time between emissions varies / unpredictable or different readings (when repeated for same time)		B1
11(b)(ii)	repeated count for a specified time	measure time when count / event occurs	B1
	result not the same	not always the same	B1
11(c)(i)	radiation when there is no source or naturally occurring (radiation) or always present		B1
11(c)(ii)	<u>measure</u> count (rate) with <u>no source</u>		B1
	subtract from (measured) count (rate for same time)		B1
11(d)(i)	4.5 cm		B1
11(d)(ii)	alpha		M1
	range of alpha less than 5–7 cm (in air)		A1
11(d)(iii)	air atoms / molecules lose / gain electrons (to become ions)		B1
11(e)	points plotted at (0, 300) and (40, 150)		B1
	points plotted at (80, 75) and (120, 37.5)		B1
	smooth curve joining at least 3 correct points		B1