
PHYSICS

5054/21

Paper 2 Theory

May/June 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.

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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)	distance measured (between 2 marks) with metre rule or tape measure	B1
	time measured (between 2 marks) with stopwatch / stopclock / timer	B1
	(average speed =) (total) distance / time	B1
1(b)(i)	decrease in speed or deceleration	B1
1(b)(ii)	$(\Delta v =) a \times t$ in any form numerical or algebraic	C1
	4.5 m / s	A1

Question	Answer	Marks
2(a)(i)	equal and opposite forces or no resultant force	B1
2(a)(ii)	box moves / slides	B1
2(a)(iii)	constant velocity or constant speed and direction	B1
2(b)	(resultant force) 15 (N) seen	C1
	$(a=) F / m$ in any form numerical or algebraic	C1
	0.60 m / s ²	A1

Question	Answer	Marks
3(a)	they / molecules hit (inside) wall	B1
	they / molecules create a force and a reference to <u>area</u>	B1
3(b)(i)	$p_1V_1 = p_2V_2$ in any form numerical or algebraic	C1
	400 cm ³	A1
3(b)(ii)	ANY 2 from <ul style="list-style-type: none"> • no gas / air / molecules escape(s) • temperature constant • no forces between molecules 	B2

Question	Answer	Marks
4(a)	force × distance (moved)	C1
	force × distance <u>moved</u> in direction of force	A1
4(b)	mgh in any form numerical or algebraic	C1
	21 J	A1
4(c)	larger force is needed (by woman / on rope)	B1
	(because of either) <ul style="list-style-type: none"> • friction / heat produced • <u>weight</u> of rope / her arms • flag / rope gains K.E. • flag accelerates / gains speed 	B1

Question	Answer	Marks
5(a)	correct circuit symbols for battery, resistor, <u>variable resistor</u> , ammeter and voltmeter	B1
	ammeter in series with resistor and voltmeter in parallel in correct series circuit	B1
5(b)(i)	$(R=) V / I$ in any form numerical or algebraic	C1
	3.5 Ω	A1
5(b)(ii)	voltage or current or power too large	B1
	calculation of power as 5(.04) W or 5.6 W or max voltage as 3.4(2) V or 3.2(4) V or max current as 0.88 A or 0.93 A	B1
5(b)(iii)	no and half voltage (2.1 V across each) or half current (0.54 A through each) or quarter power (1.13 W in each)	B1

Question	Answer	Marks
6(a)	rod in coil	B1
	current passed through coil	B1
6(b)	bring close to (both ends of) another magnet	B1
	repelled (from one end) by magnet	B1

Question	Answer	Marks
7(a)	friction (between shoes and carpet) causes charging or <u>electrons</u> move from foot to carpet or carpet to foot	B1
	charge / electrons (on person) flows (to handle causing shock) or v.v.	B1
7(b)(i)	they / drops repel (each other)	B1
	they / drops have same charge (as each other)	B1
7(b)(ii)	(positive) drops attracted by negative (leg)	B1

Question	Answer	Marks
8(a)	coil A (has more turns) and voltage to house less than 25 000 V / step down transformer	B1
8(b)	to transfer the field from primary to secondary or to increase flux / field / flux linkage <u>in coil B</u>	B1
8(c)	changing magnetic field / flux (in B or secondary) or field lines cut	B1
8(d)	advantage: <ul style="list-style-type: none"> • visual effect • ability for more development above ground • no chance of touching it and electrocution (in normal use) • less likely to be damaged by storm / wind 	B1
	disadvantage: <ul style="list-style-type: none"> • cost of <u>construction</u> • difficulty of maintenance or damage due to digging / erosion • difficulty of knowing where line is / finding or repairing faults 	B1

Question	Answer	Marks
9(a)	true false false true all 4 correct 2 marks	B1
	3 correct 1 mark	B1
9(b)(i)	correct refraction towards normal on entering prism	B1
	splitting into colours occurs at first surface	B1
	red at top and blue / violet at bottom <u>inside</u> and outside prism if shown	B1
9(b)(ii)	(different colours have) different speeds in the glass or different refractive indices	B1
	different (angles of) <u>refraction</u> or <u>refract</u> at different angles	B1
9(c)(i)	$3(.0) \times 10^8 \text{ m/s}$	B1
9(c)(ii)	(t=) d / s in any form algebraic or numerical, e.g.	C1
	500 s	A1
9(d)(i)	(I=) Q / t in any form algebraic or numerical, e.g. 180 / 2	C1
	1.5 A	A1
9(d)(ii)	1st column helium nucleus or 2 protons and 2 neutrons	B1
	2nd column positive and neutral / no / charge / none	B1
	3rd column paper / <u>thin</u> metal / skin / few cm air etc. and (thick) lead / thick metal / concrete / stone / earth OR never completely stopped / nothing	B1

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Question	Answer	Marks
10(a)(i)	<i>Pair 1</i> boiling occurs at one temperature / constant temperature evaporation occurs at all / any temperature	B1
	<i>Pair 2</i> boiling occurs within / throughout liquid or causes bubbles evaporation occurs at surface	B1
	<i>Pair 3</i> boiling requires a heat <u>source</u> / affected by rate of heating evaporation causes cooling / affected by wind etc.	B1
	<i>Pair 4</i> temperature remains constant during boiling evaporation temperature drops / liquid cools	B1
10(a)(ii)	(thermal energy) used to break bonds or work done against intermolecular forces	B1
	molecules move further apart or P.E. increases or (molecules) push back the atmosphere	B1

Question	Answer	Marks
10(b)(i)	(M=) DV in any form algebraic or numerical	C1
	0.077 kg / s or 0.077 kg	A1
10(b)(ii)	(E=) mcT in any form algebraic or numerical	C1
	37 – 16 or 21 (°C) seen	C1
	6800 J	A1
10(b)(iii)	1 input / electrical <u>energy or power</u> mentioned	B1
10(b)(iii)	2 (efficiency =) output (energy / power) ÷ input (energy / power)	B1
10(b)(iv)	avoid electrocution / shock / current through body or avoid pipe being live or to allow a current / charges to earth / ground or fuse blows to stop electrocution	B1
	when <u>live</u> / <u>heater</u> touches metal / water	B1

Question	Answer	Marks
11(a)(i)	tank with water	B1
	dipper (bar or point) touches or in surface of water	B1
	light source / stroboscope / video	B1
	dipper moves up and down (to create wave)	B1
11(a)(ii)	observe (surface of) water OR place particle / cork on surface OR equivalent movable / rotating object	B1
	moves up and down	B1
11(a)(iii)	line joining points	M1
	that are at the same point in the motion	A1
11(b)(i)	<i>difference</i> : Q has a greater / different amplitude or phase	B1
	<i>similarity</i> : same frequency; same time for one wave (period); both transverse; oscillation up and down	B1
11(b)(ii)	time 300 (ms) or 0.3 (s)	C1
	(f=) $1 / t$ numerical or algebraic in any form	C1
	3.3 Hz	A1
11(b)(ii)	$2 (\lambda =) v / f$ or $v = dt$ – numerical or algebraic in any form	C1
	0.060 m	A1