Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

PHYSICS **5054/22**

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.

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

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Cambridge Assessment International Education

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)	points plotted correctly at (1,0.5) (2,1.6) (3,3) (4,5) and (5,7)	**B1**
	smooth curve from origin	**B1**
1(b)(i)	straight line **or** gradient / slope constant	**B1**
	travels equal distances in same time **or** gradient equals speed	**B1**
1(b)(ii)	weight **and** force (upwards) from oil / liquid	**B1**
	forces balanced / cancel / are equal (and opposite) **or** no resultant (force)	**B1**

Question	Answer	Marks
2(a)	150 and 220 in table	**B1**
2(b)	any use of proportionality	**C1**
	1.4 N	**A1**
2(c)(i)	1st line larger at B **and** 2nd line larger at A	**B1**
2(c)(ii)	student loses energy / chemical energy decreases **or** (gravitational) potential energy decreases **and** spring energy increases	**B1**
	idea that increase in spring energy > change / decrease in (grav) PE (so student provides work needed)	**B1**

Question	Answer	Marks
3(a)	the air	**B1**
3(b)	square larger	**B1**
	hole larger	**B1**
3(c)(i)	mass divided by volume **or** mass per unit volume	**B1**
3(c)(ii)	m / d **or** (V=) m / d **or** $5 / 7.5 \times 10^3$ i.e. rearrangement algebraic or numerical to show V as the subject	**C1**
	6.7×10^{-4} m^3 **or** 6.67×10^{-4} m^3 c.a.o.	**A1**

Question	Answer	Marks
4(a)	heat / (thermal) energy needed to change state of unit mass **or** 1 kg	**M1**
	without change in temperature	**A1**
4(b)(i)	(E =) mL **or** (E =) $5.0 \times 10^{-3} \times 3.3 \times 10^5$	**C1**
	1650 J **or** 1700 J **or** 1600 J	**A1**
4(b)(ii)	by conduction and mention of glass / funnel / solid **or** conduction through connections to heater **or** molecular explanation of energy travelling through glass / funnel	**B1**

Question	Answer	Marks
5(a)	(d=) s × t in any form algebraic or numerical,	**C1**
	3.6×10^7 m	**A1**
5(b)(i)	1st two columns correct (sound longitudinal and microwaves transverse)	**B1**
	3rd column correct microwaves electromagnetic	**B1**
5(b)(ii)	Layers / molecules / particles / spring coils close together **or** high(er) pressure (than atmospheric)	**B1**

Question	Answer	Marks
6(a)	**any** two of • ray <u>through</u> middle of lens undeviated • ray parallel to axis passes <u>through</u> focus, 3 cm from lens • ray <u>through</u> focus on left of lens parallel to axis after lens	**B2**
6(b)	inverted **or** real	**B1**
6(c)	image size / object size **or** image distance / object distance numerical or algebraic	**C1**
	rays from lens intersect on diagram (for image) **and** 1.3–1.7	**A1**
6(d)	projector **or** photographic enlarger	**B1**

Question	Answer	Marks
7(a)	magnet is attracted to magnetic material **or** is not attracted to the non-magnetic material	**B1**
7(b)(i)	(direction) to the left **or** away <u>from region 2</u>	**B1**
	like poles / N-poles repel	**B1**
7(b)(ii)	correct direction on at least one of the eight lines and none wrong anywhere else	**B1**
7(b)(iii)	1 field (lines) cut the coil **or** field/flux (in coil) changes	**B1**
	2 voltage large(r) **or** magnetic field is strong(er) / to be in the (magnetic) field **or** more field (lines) cut (in a given time) / so field lines are cut **or** field lines close(r) together / field lines cut in small(er) time	**B1**

Question	Answer	Marks
8(a)	any 2 from • earthing • contact breaker / circuit breaker • double insulation	**B2**
8(b)(i)	fuses are in live wire **or** fuse is connected to W / it	**B1**
8(b)(ii)	switch drawn between the letter W on the diagram and the left-hand lamp	**B1**
8(b)(iii)	current is larger than 5 A fuse blows / melts / breaks (circuit) **or** can only pass currents up to 5 A	**B1**

Question	Answer	Marks
9(a)(i)	will not run out **or** infinite **or** being replaced	**B1**
9(a)(ii)	solar / Sun, tidal, geothermal, biomass, hydroelectric, water waves	**B1**
9(a)(iii)	1 (burning) use of a fossil fuel, e.g. coal, oil, <u>natural</u> gas etc.	**B1**
	2 produces carbon dioxide **or** greenhouse gases (absorb infra-red from Earth)	**B1**
9(b)(i)	(E=) ½mv^2 seen in any form algebraic or numerical	**C1**
	4.7×10^9 J	**A1**
9(b)(ii)	(E=)Pt seen in any form algebraic or numerical	**C1**
	1.5×10^9 J	**A1**
9(b)(iii)	(efficiency=) (energy) output / (energy) input in any form	**C1**
	0.32 **or** 32%	**A1**
9(c)(i)	all peaks and troughs at 500 and -500 to within one small square **and** roughly sinusoidal	**B1**
	one wave takes 0.02 s within one small square	**B1**
9(c)(ii)	1 less energy loss / heat loss / power loss / more efficient	**B1**
	low(er) currents (in line) **or** thin(ner) wires can be used	**B1**
	2 step down transformer **or** voltage reduced (to 240 V) **or** otherwise voltage dangerous	**B1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="2">10(a)</td><td>work done / energy transferred</td><td>B1</td></tr>
<tr><td>work done / energy transferred in taking unit charge (through resistor)</td><td>B1</td></tr>
<tr><td rowspan="2">10(b)(i)</td><td>(I=) V / R in any form algebraic or numerical</td><td>C1</td></tr>
<tr><td>0.24 A</td><td>A1</td></tr>
<tr><td rowspan="2">10(b)(ii)</td><td>(total resistance of) 50 (Ω) seen or 2.4 (V) p.d. across 10 Ω resistor</td><td>C1</td></tr>
<tr><td>12 V</td><td>A1</td></tr>
<tr><td rowspan="2">10(c)</td><td>voltmeter chosen is 0–20 V</td><td>B1</td></tr>
<tr><td>correct explanation of why 0–200 V meter is unsuitable

OR
correct explanation of why 0–2 V meter is unsuitable</td><td>B1</td></tr>
<tr><td rowspan="2">10(d)(i)</td><td>(P)= VI or I^2R or V^2 / R in any form</td><td>C1</td></tr>
<tr><td>0.58 W</td><td>A1</td></tr>
<tr><td>10(d)(ii)</td><td>½P rated resistor blows / too hot / melts</td><td>B1</td></tr>
<tr><td rowspan="3">10(e)</td><td><table><tr><td>current in 10 Ω</td><td>increases</td><td><u>resistance</u> decreases (of parallel combination or total resistance)</td></tr></table></td><td>B1</td></tr>
<tr><td><table><tr><td>p.d. across 10 Ω</td><td>increases</td><td>p.d.is proportional to current
or (p.d.) increases as current increases
or potential divider argument</td></tr></table></td><td>M1+A1</td></tr>
<tr><td><table><tr><td>p.d. across 40 Ω</td><td>decreases</td><td>sum of p.d.s constant / 12 V / value in (b)(ii)
or p.d. across 10 Ω increases
or resistance (40 Ω and R) a smaller fraction of total</td></tr></table></td><td>B1</td></tr>
</table>

Question	Answer	Marks
11(a)(i)	detector (need not be named) **and** absorber **or** ruler (to measure distance in air) **OR** cloud chamber (need not be named) **and** source inside	**B1**
	suitable detector named or labelled, e.g. GM detector, Geiger counter, cloud chamber, photographic film/paper, spark counter **or** counter / ratemeter connected to labelled detector	**B1**
11(a)(ii)	count with source (alone) **or** listen to clicks / sound	**B1**
	count with source **or** listen <u>to clicks</u> and suitable, **named** absorber **or** apply magnetic / electric field at right angles to beam	**B1**
11(a)(iii)	count decreases when absorber used **or** no / background radiation detected **or** particles found to be deflected in correct direction for alpha	**B1**
	(only) alpha-particles absorbed / stopped (by air / paper) **or** deflection is correct for alpha-particles	**B1**
11(b)	ionisation (in air) alpha (>) beta (>) gamma	**B1**
	penetration gamma (>) beta (>) alpha	**B1**
11(c)(i)	(detector) works for longer **or** does not need replacing (as often)	**B1**
11(c)(ii)	any halving seen	**C1**
	3 half-lives or three halvings seen	**C1**
	1290 or 1300 years	**A1**
11(d)(i)	kills / damages cells **or** causes cancer **or** causes mutations	**B1**
11(d)(ii)	ANY 2 from • (source) further away (from the body) • less radiation / fewer particles pass through / reach body / hand • alpha particles stopped / reduced by air • particles spread out from source	**B2**