



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.

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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)	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
	$6.7 \times 10^{-4} \text{ m}^3$ or $6.67 \times 10^{-4} \text{ m}^3$ 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)	$(E =) \text{ mL}$ 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=) $s \times t$ 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 <ul style="list-style-type: none"> • 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 from <u>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 <ul style="list-style-type: none"> • 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=) $\frac{1}{2}mv^2$ 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

Question	Answer	Marks			
10(a)	work done / energy transferred	B1			
	work done / energy transferred in taking unit charge (through resistor)	B1			
10(b)(i)	(I=) V / R in any form algebraic or numerical	C1			
	0.24 A	A1			
10(b)(ii)	(total resistance of) 50 (Ω) seen or 2.4 (V) p.d. across 10 Ω resistor	C1			
	12 V	A1			
10(c)	voltmeter chosen is 0–20 V	B1			
	correct explanation of why 0–200 V meter is unsuitable OR correct explanation of why 0–2 V meter is unsuitable	B1			
10(d)(i)	(P)= VI or I^2R or V^2 / R in any form	C1			
	0.58 W	A1			
10(d)(ii)	$\frac{1}{2}P$ rated resistor blows / too hot / melts	B1			
10(e)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">current in 10 Ω</td> <td style="width: 25%;">increases</td> <td style="width: 50%;">resistance decreases (of parallel combination or total resistance)</td> </tr> </table>	current in 10 Ω	increases	resistance decreases (of parallel combination or total resistance)	B1
	current in 10 Ω	increases	resistance decreases (of parallel combination or total resistance)		
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">p.d. across 10 Ω</td> <td style="width: 25%;">increases</td> <td style="width: 50%;">p.d. is proportional to current or (p.d.) increases as current increases or potential divider argument</td> </tr> </table>	p.d. across 10 Ω	increases	p.d. is proportional to current or (p.d.) increases as current increases or potential divider argument	M1+A1
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<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 25%;">p.d. across 40 Ω</td> <td style="width: 25%;">decreases</td> <td style="width: 50%;">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>	p.d. across 40 Ω	decreases	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	B1	
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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 <ul style="list-style-type: none"> • (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