
PHYSICS (9–1)**0972/31**

Paper 3 Core Theory

May/June 2019

MARK SCHEME

Maximum Mark: 80

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)	balance	B1
1(a)(ii)	density = mass ÷ volume in any form	C1
	$1260 \div 150$	C1
	8.4	A1
	g / cm^3	B1
1(a)(iii)	1.26 (kg)	B1
1(b)	$W = mg$ in any form	C1
	0.25×10	C1
	2.5 (N)	A1
	Both lines have 2.5 (N)	B1

Question	Answer	Marks
2(a)	<u>moment</u>	B1
2(b)(i)	(sum of) clockwise moment(s) = (sum of) anticlockwise moment(s)	C1
	$1.2 \times 400 = 0.3 \times F$	C1
	1600 (N)	A1
2(b)(ii)	use a longer lever OR pivot closer to log / force F	B1

Question	Answer	Marks
3(a)	67 (cm)	C1
	$(67 \div 5 =) 13.4$ (cm)	A1
3(b)	C 1st ; A 2nd;	B1
	D 4th; E 5th	B1
3(c)	speed = distance \div time in any form OR $(t =)$ distance \div speed	C1
	$11 \div 16$	C1
	0.69 (s)	A1

Question	Answer	Marks
4(a)(i)	Pressure = force \div area in any form	C1
	$50 \div 1.8$	C1
	28 (N / cm ²)	A1
4(a)(ii)	In range 13 500 to 15 000 (N / cm ²)	B1
4(b)(i)	(mercury) <u>barometer</u>	B1
4(b)(ii)	vacuum OR nothing	B1
4(b)(iii)	a value less than 760 mm (Hg) and > 0 mm (Hg)	B1

Question	Answer	Marks
5(a)(i)	It will be used up / cannot be replaced (easily) owtte	B1
5(a)(ii)	nuclear AND oil	B1
5(b)	<p>Advantages– any two from easy to store less atmospheric pollution than other fossil fuels cheaper than other fossil fuels concentrated energy source large reserves can respond to demand</p> <p>reliable</p> <p>Disadvantages – any two from (produces / releases) carbon dioxide (waste gases produce) acid rain (waste gases produced) contribute to global warming non-renewable danger of explosion danger of carbon monoxide poisoning long pipelines needed (from some gas fields)</p>	B4

Question	Answer	Marks
6(a)	0 AND 100 correctly labelled	M1
	36	A1
6(b)(i)	<u>Melting</u>	B1
	Any one of: molecules gain energy molecule (begin to) break (some) bonds arrangement becomes irregular or arrangement changes	B1
6(b)(ii)	<u>boiling</u>	B1
	Any one of: molecules break (all) bonds molecules move (more) freely molecules become widely separated or far apart	B1

Question	Answer	Marks
7(a)	<p>The diagram shows four objects on the left: a radio, a TV remote controller, binoculars for daytime use, and a sunbed. On the right, there are six boxes containing the following radiation types: gamma rays, X-rays, ultraviolet light, visible light, infra-red rays, and microwaves. Red lines indicate the following connections: radio to radio waves, TV remote controller to infra-red rays, binoculars for daytime use to visible light, and sunbed to ultraviolet light. A grey line also connects the radio to gamma rays.</p>	B1
		B1
		B1
7(b)(i)	infrared OR microwaves OR radio waves	B1
7(b)(ii)	speed	B1

Question	Answer	Marks
8(a)(i)	electrons in 1st space	B1
	cloth in 2nd space	B1
8(a)(ii)	<u>negative</u>	B1
8(a)(iii)	like charges repel (each other)	B1
8(b)(i)	ring around copper	B1
8(b)(ii)	(earth wire must be good electrical) conductor	B1

Question	Answer	Marks
9(a)	(position) R	B1
9(b)	$V = IR$ in any form	C1
	$(R =) 6.0 \div 0.5$ OR $6.0 = 0.5 \times R$	C1
	$(R =) 12$	A1
	Ω or ohms	B1
9(c)	both lamps have correct p.d. OR voltage (across them)	B1
	if one lamp fails the other is still lit	B1

Question	Answer	Marks
10(a)	thermistor	B1
10(b)(i)	low (brightness) OR off	M1
	pd or voltage (across lamp) is zero or almost zero	A1
10(b)(ii)	(brightness / it) increases	B1
	p.d. / voltage (across lamp) increases	B1
10(b)(iii)	lamp blows / fuses (when p.d. too high)	B1

Question	Answer	Marks
11(a)	(diagram) A	B1
11(b)(i)	connect coil to (centre zero) meter	B1
	move magnet in OR / AND out of coil	B1
	(observe) deflection on meter	B1
11(b)(ii)	any two from: use stronger magnet move magnet faster more turns on coil OR use more than 100 turns	B2
11(c)	(generator produces) alternating current OR direction of current keeps changing	B1

Question	Answer	Marks
12(a)	positive	B1
	positive	B1
	negative	B1
12(b)(i)	88	B1
12(b)(ii)	138	B1
12(b)(iii)	${}^{223}_{88}\text{Ra}$	B1
12(c)	3 half lives (until 1.0 mg remains)	C1
	$(3 \times 1600) = 4800$ (years)	A1