



Rewarding Learning

General Certificate of Secondary Education

Science: Physics

Unit 2

Higher Tier

[GPY22]

Assessment

**MARK
SCHEME**

General Marking Instructions

Introduction

Mark schemes are intended to ensure that the GCSE examinations are marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria which they should apply in allocating marks to candidates' responses.

Assessment objectives

Below are the assessment objectives for GCSE Physics

Candidates must:

- AO1** Demonstrate knowledge and understanding of scientific ideas, scientific techniques and procedures;
- AO2** Apply knowledge and understanding of scientific ideas, scientific enquiry, techniques and procedures; and
- AO3** Analyse information and ideas to interpret and evaluate; make judgements and draw conclusions; develop and improve experimental procedures.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality of response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in marking

Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners are encouraged to be positive in their marking, giving appropriate credit for what candidates know, understand and can do rather than penalising candidates for errors or omissions. Examiners should make use of the whole of the available mark range for any particular question and be prepared to award full marks for a response which is as good as might reasonably be expected of a 16-year-old GCSE candidate. Candidates can be awarded full marks for an answer if they have not shown a method. The advice to show clearly is to allow partial credit to be awarded.

Awarding zero marks

Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate. If the starting point for a response is clearly incorrect Physics then award 0.

Marking Calculations

In marking answers involving calculations, examiners should apply the 'own figure rule' so that candidates are not penalised more than once for a computational error.

Types of mark schemes

Mark schemes for tasks or questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

- 1 (a) (i) Longitudinal [1]
- (ii) 100 vibrations in 1 second [1]
 1 vibration in $1/100 = 0.01$ s [1] [2]
 Sight of 0.01s is worth 2 marks, 100 vibrations in 1 second is worth 1 mark if no further working
- (b) (i) 2 wavelengths = 50 cm [1]
 Wavelength = 25 cm [1] [2]
 1 mark can be awarded if two wavelengths identified as 50 cm if no further working
- (ii) $v = f\lambda$ or $f = v/\lambda$ [1]
 Frequency = $10/0.25$ [1] for each sub. [2]
 = 40 (Hz) [1] [4]
 Allow ecf for λ from (b)(i)
- (c) Half the amplitude [1]
 One complete wave shown [1] [2]
 These are independent marks and may be awarded separately
- (d) Speed decreases [1]
 Wavelength decreases [1]
 Frequency stays the same [1] [3]
 If more than one tick on row do not award mark for that row
- (e) (i) A = X-ray B = Microwave C = Radio 1 mark each [3]
- (ii) Short wavelength/higher frequency/more energy/
 more penetrating/more ionising [1]
 Any one statement give 1 mark
- (f) **Indicative content:**
 Ultrasound has a frequency greater than 20 kHz
 The ultrasound is reflected
 So that the echo can be detected
 The time between the emitted and reflected ultrasound
 The speed of ultrasound in water
 Distance = $\frac{1}{2} \times \text{Round Trip Time} \times \text{speed}$ or $d = \frac{S \times t}{2}$

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar 5 or more points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good spelling, punctuation and grammar at least 3 or 4 points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to 1 or 2 of the main points shown above using satisfactory spelling, punctuation and grammar. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit	[0]

5 or more points give 6 marks, 3 or 4 points award 4 marks,
 1 or 2 points award 2 marks

[6]

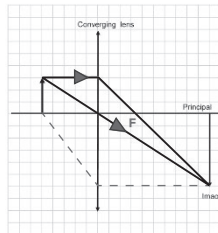
AVAILABLE
MARKS

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- 2 (a) (i) A virtual image cannot be projected on a screen
or rays of light appear to come from it or
appear to pass through it
Imaginary give 0 [1]
- (ii) Any **three** from following ([1] each): [3]
Erect
Same size as object
Same distance behind mirror as object is in front
Laterally inverted

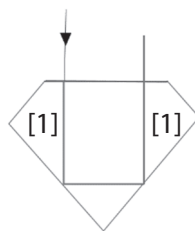
- (iii) Angle of reflection at B = 55° [2]
Sight of 35° give 1 mark

- (b) (i) Two rays [2]
- (ii) Arrows [1]
- (iii) Object marked [1]
- (iv) Focus marked (accept LHS) [1]
between 3 and 4 divs inclusive



- (c) (i) Long sight or hypermetropia [1]
- (ii) Eyeball cannot be made thick enough or lens too weak
or eyeball too short [1]
- (iii) Converging (or convex) lens [1]
- (iv) Two rays converge [1]
and meet at a point behind retina or appear to meet [1] [2]
- (v) Rays less divergent after lens [1]
and converges and meet on the retina [1] [2]

- (d) (i) Diagram completed [2]



No refraction at entry and exit. Two 90 degree reflections

- (ii) Light travelling from
diamond/glass to air
high ref index to low ref index [1]
more dense to less dense
Any one of these for 1 mark
- The angle of incidence greater than critical angle [1] [2]

AVAILABLE
MARKS

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3 (a) Indicative content

1. (Free) electrons
2. Electrons move opposite to conventional current or negative to positive
3. Conductors have free electrons
4. Insulators do not have free electrons
5. Electrons (charge carriers) collide with atoms (+ve ions)
6. Electrons (charge carriers) pass some of their kinetic energy on to the atoms
7. Atoms vibrate and generate heat
8. Resistance increases as the current increases.

Response	Mark
Candidates describe in detail using good spelling, punctuation and grammar at least 5 points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[5]–[6]
Candidates describe in detail using good spelling, punctuation and grammar at least 3 points shown above. The form and style are of a high standard and specialist terms are used appropriately at all times.	[3]–[4]
Candidates make some reference to 1 or 2 points shown above. The form and style are of a satisfactory standard and they have made some reference to specialist terms.	[1]–[2]
Response not worthy of credit	[0]

5 or more points award 6 marks, 3 or 4 points award 4 marks, 1 or 2 points award 2 marks

[6]

(b) (i) Voltage = 6 V

[1]

(ii) $R = V/I$ (or alternative arrangement)

[1]

$$R = \frac{6}{2}$$

[1]

Possible ecf from (i) for voltage

$$R = 3 \text{ } (\Omega)$$

[1]

[3]

(iii) $Q = I \times T$

[1]

$$Q = 2 \times 30$$

[1]

No ecf since the current is given

$$Q = 60 \text{ (C)}$$

[1]

[3]

(c) (i) $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{3}{6} + \frac{1}{2}$ [1]

$$R = 2 \Omega$$
 [1]

1 mark for the equation

1 mark for the number substitution

1 mark for the answer

[3]

(ii) Total $R = 2 + 2 = 4 \text{ } \Omega$ [1]

$$I = \frac{V}{R} = \frac{12}{4}$$

$$= 3A$$

V across parallel circuit = 6V
V across $2 \text{ } \Omega = 6 \text{ V}$ [1]

$$I = \frac{6}{2} [1] = 3A [1]$$

[1]

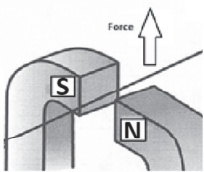
[3]

- (d) (i) $I = \frac{P}{V}$ (or alternative arrangement) [1]
- $I = \frac{2250}{240}$ [1]
- $I = 9.4$ (A) [1]

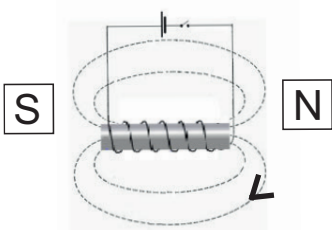
(ii) Select fuse rating of 13 A [1] [4]

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4 (a) (a) N and S poles marked [1]



(b) (i) N and S marked [1]



If you see conflicting arrows give 0

(ii) Magnetic field direction is N → S. [1]

(c) (i) (Soft) Iron [1]

(ii)

Action	Observation (A to D)
The switch in the circuit connected to coil A is closed and left closed.	A
The switch in the circuit connected remains closed.	C
The switch in the circuit connected to coil A is now opened and left open.	A
The switch in the circuit connected to coil A is open and closed repeatedly.	D

[4]

- (d) (i) $N_p/N_s = V_p/V_s$ [1]
- $3000/250 = 240/V_s$ [1]
- $V_s = 20$ V [1] [3]
- The second line is worth 2 marks since it assumes the turns ratio

(ii) 10 steps [1]

$20/10 = 2$ V Allow ecf for V from (i) [1] [2]

			AVAILABLE MARKS
	(iii) Reverse direction periodically	[1] [1]	[2]
	(iv) Power IN = Power OUT $240 \times I = 4 \times 6$ $I = 0.1 \text{ (A)}$	[1] [1]	[2]
5	(a) 2. the eventual formation of neutrons and protons; 1. the rapid expansion and cooling of the Universe; 4. after further expansion and cooling, the temperature had dropped sufficiently to allow atoms of hydrogen to form; 3. further expansion and cooling allowed nuclei to form; If first and last correct award 1 mark		[3]
	(b) (i) thermal expansion and gravity (accept radiation pressure in place of thermal expansion) (any order, [1] each)		[2]
	(ii) Red giant → White dwarf → Black dwarf Three correct names wrong order give 1 mark		[3]
	(c) (i) They are moving away or universe/space is expanding		[1]
	(ii) Cosmic microwave background (accept CMBR)		[1]
	(iii) It is the remnant/afterglow of Big Bang		[1]
	(d) Time = distance/speed $= 1.05 \times 10^{17} / 3 \times 10^8 = 3.5 \times 10^8 \text{ (s)}$ Distance = 11 (ly) (nearest whole number) or 1 ly = speed × time $= 3 \times 10^8 \times 3.15 \times 10^7 = 9.45 \times 10^{15} \text{ (m)}$ No. of ly = $1.05 \times 10^{17} / 9.45 \times 10^{16} = 11.11$ (years) Distance = 11 (ly) (nearest whole number)	[1] [1] [1]	[3]
			14
	Total		100