



General Certificate of Secondary Education
2014

GCSE Physics

Unit 2

Higher Tier

[GPH22]

MONDAY 23 JUNE, MORNING

**MARK
SCHEME**

General Marking Instructions and Mark Grids

Introduction

Mark schemes are intended to ensure that the GCSE examination is 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 that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses

In marking the examination papers, examiners should be looking for a quality 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, the examiners should seek the guidance of the Supervising Examiner.

Positive marking

Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of 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.

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.

Types of mark scheme

Mark Schemes for 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.

| | | | AVAILABLE MARKS |
|---|--|-----|-----------------|
| 1 | (a) (i) Very close to legal limit (for adults), so smaller SAR for children or Children get a larger dose/children's skulls are thinner/children's bodies are still developing/children's brains are smaller/absorbs more energy/smaller body mass | [2] | |
| | (ii) Use an earphone/earpiece (to keep mobile phone far from head) | [1] | |
| (b) Refraction | Frequency Same Wavelength Decreases } lower or smaller Speed Decreases } | [3] | |
| (c) (i) Transverse | | [1] | |
| (ii) Vibrations/oscillate Perpendicular/at 90° to direction of energy transfer/wave direction | [1] [1] | [2] | |
| (iii) $\lambda = v/f$ (or equivalent) $\lambda = 3500/1.3$ ([1] for conversion from km to m) $\lambda = 2690$ (m) (If no/incorrect conversion from km/s, then maximum of [2]–[3]) | [1] [2] [1] | [4] | |
| (iv) Distance XY = 1.6 to 1.8 cm time interval = 1.28 to 1.44 s Period = 0.64 to 0.72 Frequency = $1/0.64$ or $1/0.72$ giving 1.39 to 1.56 (Hz) | [2] [1] [1] | [4] | |
| (d) (i) 150 minutes | | [1] | |
| (ii) Maximum time = $K \times SPF$ or $300 = K \times 30$ so $K = 10$ 120 minutes = $10 \times SPF$ so $SPF = 12$ | [1] [1] | | |
| Alternatively (if hours used) $5 = k \times 30$ so $K = 50/30 = 1.67$ 2 hours = $1.67 \times SPF$ so $SPF = 12$ | [1] [1] | [2] | 20 |
| 2 (a) (i) Diminished Inverted Real | [1] [1] [1] | [3] | |
| (ii) Ray from top of object • through optical centre undeviated to light sensitive surface • parallel to PA refracts to top of image on light sensitive surface • image correctly identified on light sensitive surface All rays ruled and at least ONE correct arrow (and no contradictions) | [1] [1] [1] [1] | [4] | |
| (iii) 25 ± 1 (mm) give [2] 22, 23, 27, 28 (mm) give [1] | | [2] | |

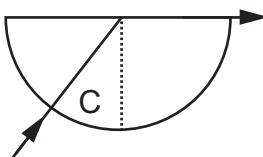
(b) (i) It is not a straight line [2] or doubling of values not present [2]
Is a curve [2] [2]

(ii) Calculations such as $5.5/20 = 0.28$ and $18/40 = 0.45$ [2]
Not a constant ratio $\frac{40}{20} = 2$ and $\frac{18}{5.5} = 3.3$ [1] [3]

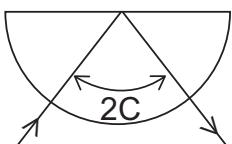
$20 \times 2 = 40$ $5.5 \times 2 = 11$

AVAILABLE MARKS

(c) Indicative content



Trace outline and mark normal
Mark centre of straight edge
Direct ray at curved edge of glass block/or at midpoint of straight edge
Move ray/increase angle
Until refracted ray emerges along edge
Critical angle is between incident ray and normal
Give credit for information on diagram



Trace outline
Mark centre of straight edge
Direct ray at curved edge of glass block/or at midpoint of straight edge
Move ray/increase angle
Until total internal reflection seen
Angle between incident and emergent is $2C$
Give credit for information on diagram

NB if ray is shown or mentioned as entering the block from straight edge give [0]

| Response | Mark |
|--|---------|
| Candidates describe in detail using good spelling, punctuation and grammar at least 5 of the points shown above and the precaution is clearly stated. 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 of the 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 of the 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] |

[6]

20

| | | | | AVAILABLE MARKS |
|---|-----|----------|---|-----------------------|
| 3 | (a) | (i) | Ammeter in series with wire Variable resistor in series with wire Voltmeter in parallel with wire If any one symbol wrong max [2] | [1] [1] [1] [3] |
| | | (ii) | To prevent the wire heating/allow wire to cool Heat affects the resistance Burning/safety [0] Fair test [0] | [1] [1] [2] |
| | | (iii) | Straight line graph through origin | [1] |
| | | (iv) | 60/80 of 12 9 (Ω) | [1] [1] [2] |
| | | (v) | $2 \times \text{length} = 2 \times 9 = 18$ } $\frac{1}{2} \times \text{area} = 2 \times 9 = 18$ } 36 Ω ecf from (iv) | [1] [1] [2] |
| | (b) | (i) | $P = IV$ or $I = P/V$ $960 = 240 \times I$ $I = 960/240 = 4$ (A) | [1] [1] [1] [3] |
| | | (ii) | $R = V/I$ or $P = V^2/R$ $= 240/4$ $960 = 240^2/R$ $= 60$ (Ω) $R = 240^2/960 = 57600/960 = 60$ (Ω) | [1] [1] [1] [3] |
| | (c) | | Elements joined in parallel A switch in series with at least one element Must be a working circuit | [1] [1] [2] |
| | (d) | Parallel | $\frac{1}{R} = \frac{1}{2} + \frac{1}{3} = \frac{5}{6}$ $R = \frac{6}{5} = 1.2$ Total resistance = $5 + 1.2 = 6.2$ (Ω) | [1] [1] [2] |
| | | | | 20 |

| 4 | (a) (i) Alternating (current) | [1] | AVAILABLE MARKS | |
|---|--|-----|-----------------|-----|
| | | | [1] | |
| | (ii) Direct (current) | [1] | | |
| | (b) (i) (Trace repeatedly) crosses time axis or (Trace repeatedly) changes from + to - | [1] | | |
| | (ii) The time or distance interval between peaks (or troughs) is constant [1] wavelength [0] | | | |
| | (iii) Line always on same side of time axis (must be correct before 2nd mark possible) but showing changing voltage | [1] | [1] | [2] |
| | (c) (i) Description: Spoke in salty water kicks outwards Copper wheel rotates/spins (Copper wheel rotates anticlockwise gets [2]/[2]) | [1] | [1] | [2] |
| | Explanation: [1] Current carrying spoke is in a magnetic field Experiences a force or force acts outwards or to right | [1] | [1] | [2] |
| | (ii) Wheel turns faster | [1] | | |
| | (iii) Wheel now rotates in opposite direction or clockwise or changes direction (ecf from (c)(i)) | [1] | | |
| | (d) (i) Primary coil = 480 turns Secondary coil = 160 turns | [1] | [1] | [2] |
| | (ii) $\frac{N_p}{N_s} = \frac{V_p}{V_s}$ | [1] | | |
| | $\frac{480}{160} = \frac{240}{V_s}$ | [4] | | |
| | $V_s = \frac{240}{3} = 80 \text{ (V)}$ | [1] | [6] | 20 |
| | Allow ecf from (i), i.e. an answer of 720 V | | | |
| | No formula – no marks unless subs correct | | | |
| | If formula – [2] per side of the turns ratio | | | |
| | Turns ratio $\frac{1}{3}$ or $\frac{3}{1}$ [1] if no further credit possible | | | |

| | | AVAILABLE MARKS |
|---|-----------------------------|-----------------|
| 5 (a) Indicative content | | |
| 1. Gases | Separate points | |
| 2. Hydrogen (and helium and dust) | gravity causes it to spiral | |
| 3. Gravity shrinks the gas cloud | pressure increases | |
| 4. A large clump forms at the centre | density increases | |
| 5. Centre heats up or temperature rises | | |
| 6. Nuclear fusion starts | | |
| Response | Mark | |
| Candidates describe in detail using good spelling, punctuation and grammar at least 5 points shown above and the precaution is clearly stated. 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 one 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] | |
| | | [6] |
| (b) (i) Order from the left: 4 1 2 3 | | [2] |
| Two in the correct order award [1] | | |
| (ii) Heat radiation/microwaves filling the Universe/space or it seen from all directions | | [1] |
| (iii) (CMBR is radiation) left over from an early stage in the development of the Universe or Big Bang | | [1] |
| (c) Keeps planets in orbit round a star or moon/comets etc – not satellites Pull stars into large collection – formation of galaxies. Provides the stability in stars (by countering the outward forces.) Pulls nebulae into stars/planetary systems. <i>This is about shaping the Universe/planetary atmospheres/planetary shapes so giving objects a weight is not acceptable.</i> | | [3] |
| (d) (i) Big Freeze – Universe will simply expand forever or galaxies gradually getting so far away that they fade in the distance [1] or then stars burn out and <u>everything gets cold and dark forever.</u> [1] | | |
| | 2nd mark | |
| (ii) Big Crunch – expansion would eventually stop [1] – gravity pulls galaxies back and the Universe would collapse [1] or to a singularity | | |
| (iii) Big Bounce – says the Universe repeatedly expands and collapses and then expands again [1] or another Big Bang | | [6] |

| | | | AVAILABLE MARKS |
|---------|--|---------------------|-----------------|
| 6 | (a) (i) 1 = crust 2 = mantle 3 = outer core 4 = inner core [1] each | Terms must be exact | [4] |
| | (ii) Crust or 1, Mantle or 2, Inner core or 4 Three given, one wrong, max [1]. Four given, [0] Crust and mantle give [1] Inner core worth [1] | | [2] |
| | (iii) Nickel | | [1] |
| | (iv) Lithosphere | | [1] |
| (b) | Tectonic activity means the Earth plates move Earthquake is due to them suddenly moving, jolt, jerk, lurch after being stuck | [1] [1] | [2] |
| (c) (i) | One or two plate(s) is/are moving or one goes under the other plate or subduction Magma molten rock is formed as they move against each other [1] This magma rises/released/erupts to the surface to form a volcano [1] | [1] [1] | |
| (ii) | Heat Friction | [2] | 15 |
| | | Total | 115 |
| | | | |