



**General Certificate of Secondary Education  
2021–2022**

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**Single Award Science: Physics**

**Unit 3**

**Higher Tier**

**[GSA32]**

**TUESDAY 7 JUNE, MORNING**

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**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 Single Award Science

Candidates must:

- AO1** Demonstrate knowledge and understanding of scientific ideas, scientific techniques and procedures;
- AO2** Apply knowledge, skills 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.

### ***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.

### ***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.

### **Levels of response**

Tasks and questions requiring candidates to respond in extended writing are marked in terms of levels of response. In deciding which level of response to award, examiners should look for the 'best fit' bearing in mind that weakness in one area may be compensated for by strength in another. In deciding which mark within a particular level to award to any response, examiners are expected to use their professional judgement. The following guidance is provided to assist examiners.

- **Threshold performance:** Response which just merits inclusion in the level and should be awarded a mark at or near the bottom of the range.
- **Intermediate performance:** Response which clearly merits inclusion in the level and should be awarded a mark at or near the middle of the range.
- **High performance:** Response which fully satisfies the level description and should be awarded a mark at or near the top of the range.

### **Quality of written communication**

Quality of written communication is taken into account in assessing candidates' responses to all tasks and questions that require them to respond in extended written form. These tasks and questions are marked on the basis of levels of response. The description for each level of response includes reference to the quality of written communication.

For conciseness, quality of written communication is distinguished within levels of response as follows:

Level 1: Quality of written communication is basic.

Level 2: Quality of written communication is good.

Level 3: Quality of written communication is excellent.

In interpreting these level descriptions, examiners should refer to the more detailed guidance provided below:

**Level 1 (Basic):** The candidate makes only a limited selection and use of an appropriate form and style of writing. The organisation of material may lack clarity and coherence. There is little use of specialist vocabulary. Presentation, spelling, punctuation and grammar may be such that intended meaning is not clear.

**Level 2 (Good):** The candidate makes a reasonable selection and use of an appropriate form and style of writing. Relevant material is organised with some clarity and coherence. There is some use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are sufficiently competent to make meaning clear.

**Level 3 (Excellent):** The candidate successfully selects and uses the most appropriate form and style of writing. Relevant material is organised with a high degree of clarity and coherence. There is widespread and accurate use of appropriate specialist vocabulary. Presentation, spelling, punctuation and grammar are of a sufficiently high standard to make meaning clear.

### **COVID-19 Context**

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021–2022 only.

|   |         |                                                                                                                                             |     |   |
|---|---------|---------------------------------------------------------------------------------------------------------------------------------------------|-----|---|
| 1 | (a) (i) | Radiation                                                                                                                                   | [1] | 6 |
|   | (ii)    | Hot liquid rises                                                                                                                            | [1] |   |
|   | (b) (i) | The wax melts                                                                                                                               | [1] |   |
|   | (ii)    | 136 – 20 [1]<br>116 s [1]                                                                                                                   | [2] |   |
|   | (iii)   | Any value greater than 136 s                                                                                                                | [1] |   |
| 2 | (a) (i) | As speed increases, stopping distance increases                                                                                             | [1] | 8 |
|   | (ii)    | Line always above [1]<br>same shape [1]                                                                                                     | [2] |   |
|   | (iii)   | Stopping distance = 36 m [1]<br>thinking distance = 12 m [1]                                                                                | [2] |   |
|   | (b)     | Increases thinking distance [1]<br>increases stopping distance [1]                                                                          | [2] |   |
|   | (c)     | Seat belts keep passengers in seat/airbags reduce impact with steering wheel/side impact bars keep shell intact/crumple zones absorb energy | [1] |   |
|   |         |                                                                                                                                             |     |   |

### 3 (a) Indicative content

- coal, oil and gas (any 2)
- burner = fuel produces heat
- boiler = heat turns water into steam
- turbine = steam drives it
- generator has a magnet + coil
- relative movement between magnet and coil
- chemical to heat
- heat to kinetic
- kinetic to electrical

|          | Response                                                                                                                                                                                                                                                                                                                    | Mark    |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>A</b> | Candidates must use appropriate specialist terms throughout to describe fully how electricity is made inside a fossil fuel power station (using <b>at least 6</b> of the above points). They use good spelling, punctuation and grammar and the form and style are of a high standard.                                      | [5]–[6] |
| <b>B</b> | Candidates use some appropriate specialist terms to partially describe how electricity is made inside a fossil fuel power station (using <b>3 to 5</b> of the above points). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.                                 | [3]–[4] |
| <b>C</b> | Candidates describe how electricity is made inside a fossil fuel power station (using <b>1 to 2</b> of the above points). However, these are not in a logical sequence. They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of a limited standard. | [1]–[2] |
| <b>D</b> | Response not worthy of credit.                                                                                                                                                                                                                                                                                              | [0]     |

[6]

(b) Any named renewable source [1]

fossil fuels are running out/cause air pollution [1]

[2]

8

4 (a) (i) Vertical up arrow

[1]

(ii) Current is a flow of electrons [1]

electrons are negatively charged [1]

repelled from negative to positive [1]

[3]

(b) 5 points plotted correctly [2]

(4 points [1])

line of best fit [1]

[3]

(c) Type of material/length of wire/temperature of wire

[1]

8

|       |                                                                                                                                                                            |     | AVAILABLE MARKS |
|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----------------|
| 5     | (a) (i) As frequency increases, efficiency increases [1]<br>before decreasing from 94%/0.75 MHz [1]                                                                        | [2] | 5               |
|       | (ii) Higher input voltages are less efficient                                                                                                                              | [1] |                 |
|       | (b) Increases voltage/decreases current [1]<br>less energy/heat lost in transmission increase [1]                                                                          | [2] |                 |
| 6     | (a) (i) Converting cm to m/5 × 20 cm = 1m [1]<br>converting g to kg/500 g = 0.5 kg [1]<br>0.5 × 10 × 1 [2]<br>5 [3]                                                        | [3] | 10              |
|       | (ii) Joules                                                                                                                                                                | [1] |                 |
|       | (b) Energy cannot be created or destroyed/total remains constant [1]<br>energy can be changed from one type to another [1]<br>potential energy is changed into kinetic [1] | [3] |                 |
|       | (c) (i) 500 N to the left/backwards                                                                                                                                        | [1] |                 |
|       | (ii) Accelerates forward                                                                                                                                                   | [1] |                 |
|       | (iii) Steady speed                                                                                                                                                         | [1] |                 |
| 7     | (a) (i) Red-shift                                                                                                                                                          | [1] | 9               |
|       | (ii) B, C, A                                                                                                                                                               | [1] |                 |
|       | (iii) A                                                                                                                                                                    | [1] |                 |
|       | (b) (i) $4 \times (3 \times 10^8) \times (3.15 \times 10^7)$ [1]<br>$3.78 \times 10^{16}$ m [2]                                                                            | [2] |                 |
|       | (ii) 4 years                                                                                                                                                               | [1] |                 |
|       | (c) Singularity/single point [1]<br>expansion/inflation [1]<br>gravity pulled matter together [1]                                                                          | [3] |                 |
| 8     | (a) 50 days                                                                                                                                                                | [1] | 6               |
|       | (b) Technetium-99m [1]<br>only gamma can pass through body tissue [1]<br>short half-life causes less damage inside patient [1]                                             | [3] |                 |
|       | (c) Atoms lose/gain electrons [1]<br>to become charged [1]                                                                                                                 | [2] |                 |
| Total |                                                                                                                                                                            |     | 60              |