OCR
Oxford Cambridge and RSA

Accredited

# GCSE (9–1) Combined Science A (Physics) (Gateway Science)

**H**

## J250/11 Paper 11 (Higher Tier)

Sample Question Paper

## Date – Morning/Afternoon

Version 2

Time allowed: 1 hour 10 minutes

**You must have:**
- the Data Sheet

**You may use:**
- a scientific or graphical calculator
- a ruler

| | |
|---|---|
| First name | |
| Last name | |
| Centre number | |
| Candidate number | |

**INSTRUCTIONS**
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

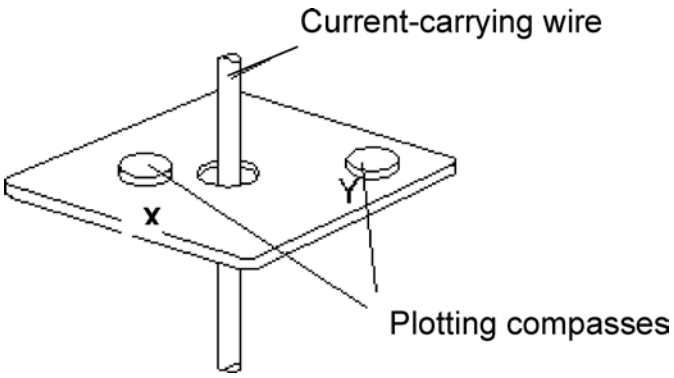
**INFORMATION**
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **20** pages.

## SECTION A

You should spend a maximum of 20 minutes on this section.

Answer **all** the questions.

**1** Plotting compasses are positioned at **X** and **Y** near to a current-carrying wire.




Compared to **Y**, the strength and direction shown on the compass, of the magnetic field at **X** is:

**A** The same strength and direction

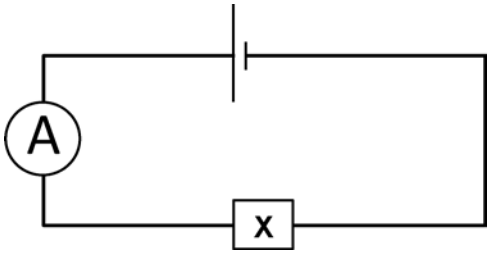
**B** The same strength and the opposite direction

**C** Weaker and the opposite direction

**D** Weaker and the same direction

Your answer ☐ **[1]**

**2** A circuit contains an unknown component **X** and the ammeter has a reading of 1 A.




The connections to the component are reversed and the ammeter reading changes to 0 A.

What type of component is **X**?

**A** Diode

**B** Light dependent resistor

**C** Thermistor

**D** Variable resistor

Your answer ☐ **[1]**

**3** Two forces act on an object in equilibrium.

Which statement describes the forces correctly?

**A** They are different in size, but have opposite directions.

**B** They are different in size, but have the same direction.

**C** They are equal in size, but have opposite directions.

**D** They are equal in size, but have the same direction.

Your answer ☐ **[1]**

**4** Complete the sentence.

A constant resultant force acting on an object, **cannot** change the object's …

**A** acceleration

**B** kinetic energy

**C** momentum

**D** velocity

Your answer ☐ **[1]**

**5** A beaker contains water with a mass of 540 g.

The specific latent heat of vaporisation of water is $2.26 \times 10^6$ J/kg.

How much energy is needed to convert all the water into steam?

**A** $1.22 \times 10^3$ J

**B** $1.22 \times 10^6$ J

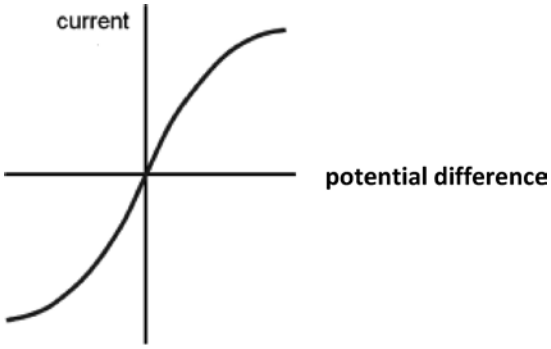
**C** $1.22 \times 10^9$ J

**D** $1.22 \times 10^{12}$ J

Your answer ☐ **[1]**

**6** The filament in a lamp heats up when electric current passes through it.

The graph shows how current changes with potential difference for this type of lamp.




Which row has the correct statements about this type of lamp?

| | Resistance | Current |
|---|---|---|
| **A** | Decreases as temperature increases | Directly proportional to potential difference |
| **B** | Decreases as temperature increases | Not directly proportional to potential difference |
| **C** | Increases as temperature increases | Directly proportional to potential difference |
| **D** | Increases as temperature increases | Not directly proportional to potential difference |

Your answer ☐ **[1]**

**7** A ball has a kinetic energy of 100 J.

What is the kinetic energy if the speed of the ball is doubled?

**A** 25 J

**B** 50 J

**C** 200 J

**D** 400 J

Your answer ☐ **[1]**

**8** A car and driver with a total mass of 1000 kg is travelling at 20 m/s.

The driver applies the brake and the car comes to a stop in 4 seconds.

What is the mean force on the car during braking?

**A** 12.5 N

**B** 200 N

**C** 5 000 N

**D** 80 000 N

Your answer ☐ **[1]**

**9** The current in a 12 Ω resistor is 9.0 A.

How much charge flows in 2 minutes?

**A** 108 C

**B** 720 C

**C** 1 080 C

**D** 12 960 C

Your answer ☐ **[1]**

**10** A piece of metal has a volume of $2.0 \times 10^{-5}$ $m^3$ and a density of $8.0 \times 10^3$ $kg/m^3$.

What is its mass?

**A** $1.6 \times 10^{-1}$ kg

**B** $1.6 \times 10^{3}$ kg

**C** $2.5 \times 10^{-3}$ kg

**D** $4.0 \times 10^{-2}$ kg

Your answer ☐ **[1]**

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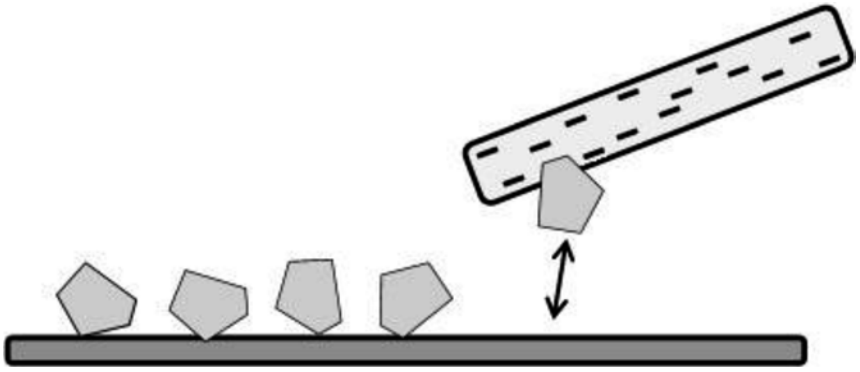
**TURN OVER FOR THE NEXT QUESTION**

## SECTION B

Answer **all** the questions.

**11** Some small pieces of paper are on a surface.

A negatively charged rod is held near to the paper.



**(a) (i)** State what is meant by the term **negatively charged**?

..... **[1]**

**(ii)** A negatively charged rod made of another type of plastic is brought near to the pieces of paper.

Why is the plastic rod able to keep the negative charge?

..... **[1]**

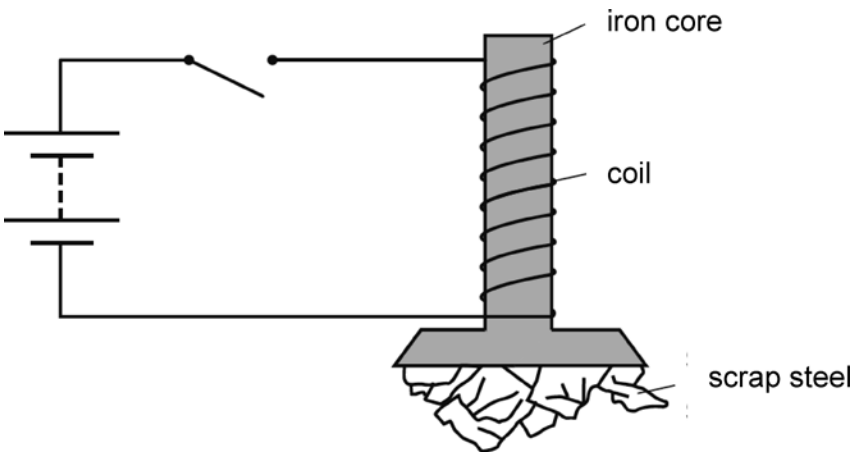
**(iii)** Explain why the pieces of paper move towards the charged rod.

.....

.....

..... **[3]**

**12*** The diagram shows a simple circuit diagram for an electromagnet used to pick up scrap steel.




When the switch is closed, the scrap steel is attracted to the electromagnet.

Explain why this happens.

What modifications could be made to the apparatus to pick up even more steel?

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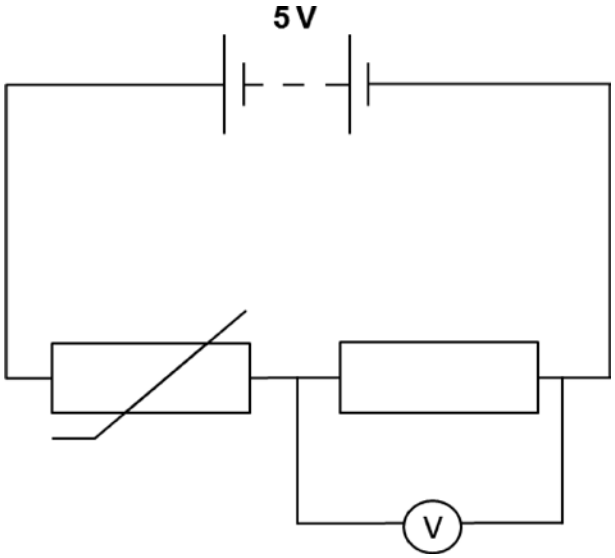
..... **[6]**

**13** The circuit below is set up.

At room temperature, a current of 2 mA flows through the thermistor of resistance 1000 Ω.




**(a)** Calculate the power dissipated in the thermistor.

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Answer = .....W **[3]**

**(b)** What is the resistance of the fixed resistor in the circuit?

Show your working.

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Answer = .....Ω **[3]**

**(c)** The thermistor is cooled in iced water.

Explain how this changes the reading on the voltmeter.

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..... **[2]**

**14** Police guidance on air rifles states:

'Any rifle that fires a pellet with an energy that is below 16 Joules may be held without a licence'.

A paintball gun fires a pellet of mass $3 \times 10^{-3}$ kg at a velocity of 90 m/s.

**(a)** Use a calculation to justify why a licence is **not** needed to hold this gun.

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.....

..... **[2]**

**(b) (i)** What is the momentum of the pellet when it leaves the paintball gun?

Show your working and give the unit.

.....

.....

Answer = ..... Unit ..... **[3]**

**(ii)** The mean force of air resistance on the pellet is 0.26 N.

Calculate the horizontal distance travelled by the pellet after it is fired from the gun.

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..... **[3]**

**(c)** Describe an experiment to calculate the density of the paintball pellet.

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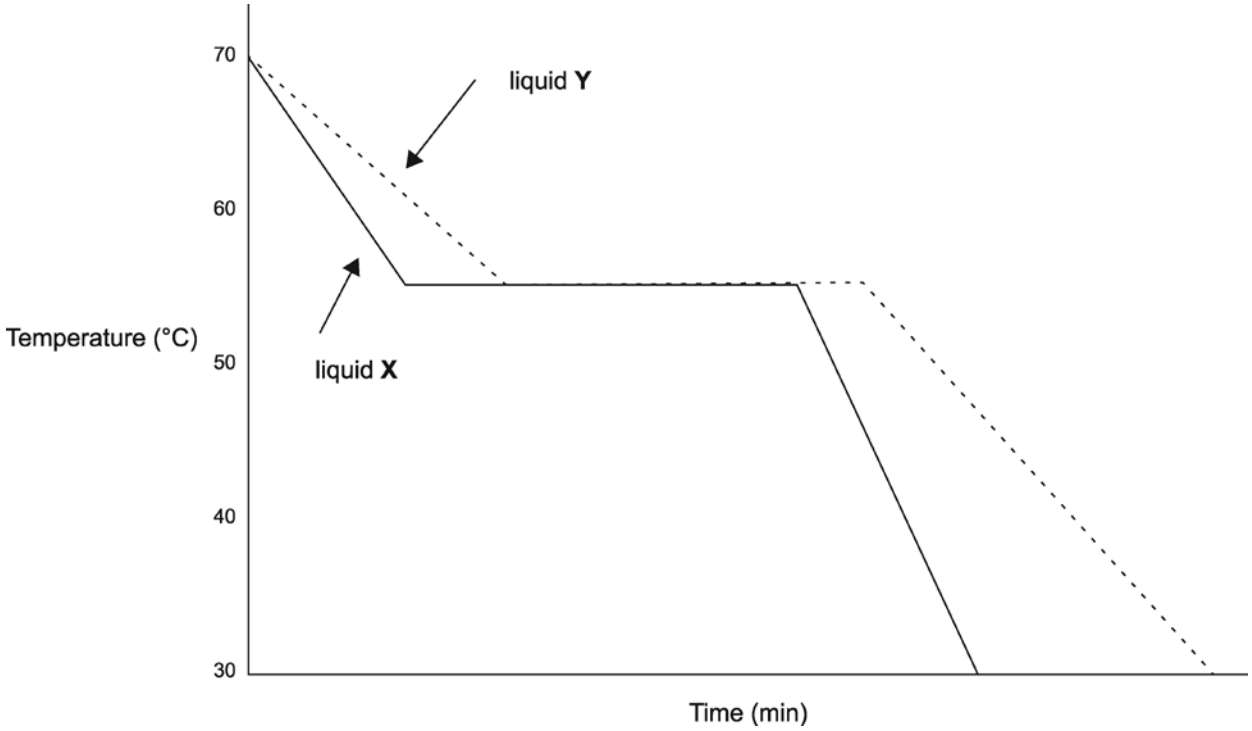
..... **[4]**

**15** Two beakers are filled with equal masses of liquids **X** and **Y** at the same temperature.

The beakers are allowed to cool and the temperatures of the liquids are monitored over time.

The graph shows the results.




**(a)** Using the graph, compare what happens to liquids **X** and **Y** at 55 °C.

Suggest what is happening to the liquid at this temperature

.....

.....

..... **[3]**

**(b)** A student argues that liquids **X** and **Y** are the same substance.

State what evidence there is to support this.

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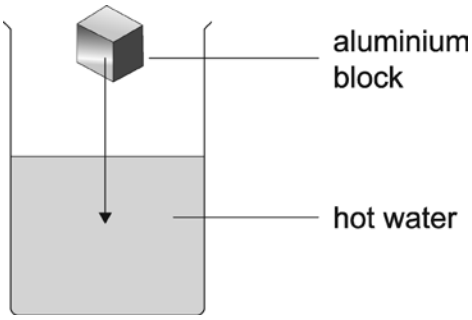
..... **[1]**

**(c)** A beaker contains hot water.

The student wants to calculate the thermal energy lost by the hot water when she puts a cold aluminium block into the water.




What information will she need to make this calculation?

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..... **[3]**

**(d)** **(i)** The volume of the aluminium block is $8.0 \times 10^{-6}$ $m^3$ and its density is 2712 $kg/m^3$.

Calculate the mass of the aluminium block.

Show your working.

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Answer = .....kg **[2]**

**(ii)** After the aluminium block had been added to water in **(c)**, the temperature of the water increased from 5 °C to 18 °C

Calculate the amount of energy gained by the water.

- The specific heat capacity of aluminium is $0.9 \times 10^3$ J/kg°C.

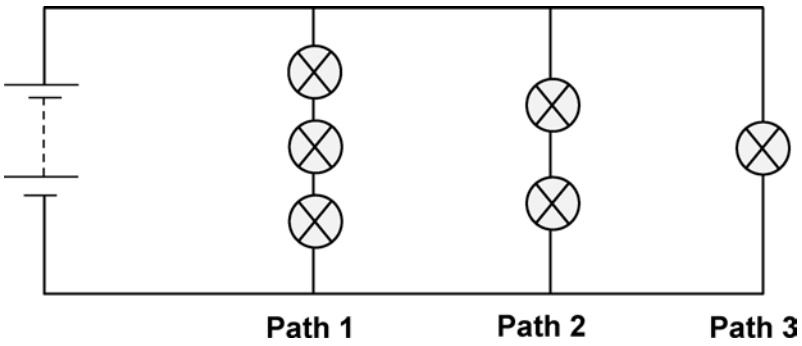
Show your working.

.....

..... **[3]**

Answer = ..... J

**16** The diagram shows a circuit containing six identical lamps.




**(a)** Explain why the bulb on **Path 3** is the brightest bulb.

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..... **[2]**

**(b) (i)** Place an **X** on the diagram where the current is the greatest in the circuit. **[1]**

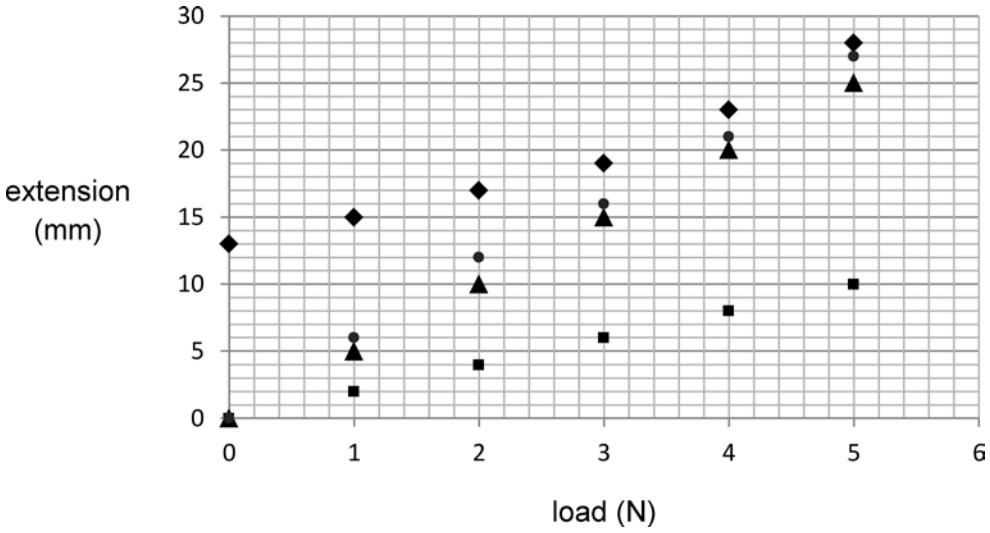
**(ii)** Place a **Y** on the diagram where the current is the least **[1]**

**17** The graph below shows the results of an experiment to investigate the effect of load on extension of rubber bands.

The experiment was done by four groups of students as indicated by the symbols:

◆ Group 1 ● Group 2 ▲ Group 3 ■ Group 4

A graph was plotted from the results.




**(a)** Use the graph to comment on any errors made in the experiment.

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..... **[1]**

**(b)** Suggest why Groups **2** and **4** have different results.

.....

..... **[1]**

**(c)** How could Group **3** develop their experiment to show plastic deformation in their rubber band?

.....

..... **[1]**

**END OF QUESTION PAPER**

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**…day June 20XX – Morning/Afternoon**

**GCSE (9–1) COMBINED SCIENCE A (PHYSICS) (GATEWAY SCIENCE)**
**J250/11 Paper 11 (Higher Tier)**

**SAMPLE MARK SCHEME**

**Duration:** 1 hour 10 minutes

**MAXIMUM MARK 60**

**This document consists of 16 pages**

## MARKING INSTRUCTIONS

### PREPARATION FOR MARKING

### SCORIS

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *scoris assessor Online Training*; *OCR Essential Guide to Marking*.

2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are posted on the RM Cambridge Assessment Support Portal http://www.rm.com/support/ca

3. Log-in to scoris and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

   YOU MUST MARK 10 PRACTICE AND 10 STANDARDISATION RESPONSES BEFORE YOU CAN BE APPROVED TO MARK LIVE SCRIPTS.

### MARKING

1. Mark strictly to the mark scheme.

2. Marks awarded must relate directly to the marking criteria.

3. The schedule of dates is very important. It is essential that you meet the scoris 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.

4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the scoris messaging system.

5. Work crossed out:
   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks
   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)
   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The scoris **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**
   If you have any questions or comments for your Team Leader, use the phone, the scoris messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

    Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance.
    Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer. Once the level is located, award the higher or lower mark:

    **The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.
    **The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

    **In summary:**

    **The skills and science content determines the level.**
    **The communication statement determines the mark within a level.**

11. Annotations

| Annotation | Meaning |
|---|---|
| **DO NOT ALLOW** | Answers which are not worthy of credit |
| **IGNORE** | Statements which are irrelevant |
| **ALLOW** | Answers that can be accepted |
| ( ) | Words which are not essential to gain credit |
| __ | Underlined words must be present in answer to score a mark |
| **ECF** | Error carried forward |
| **AW** | Alternative wording |
| **ORA** | Or reverse argument |

12. Subject-specific Marking Instructions

**INTRODUCTION**

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9–1) in Combined Science A (Gateway Science):

| | Assessment Objective |
|---|---|
| **AO1** | **Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.** |
| **AO1.1** | Demonstrate knowledge and understanding of scientific ideas. |
| **AO1.2** | Demonstrate knowledge and understanding of scientific techniques and procedures. |
| **AO2** | **Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.** |
| **AO2.1** | Apply knowledge and understanding of scientific ideas. |
| **AO2.2** | Apply knowledge and understanding of scientific enquiry, techniques and procedures. |
| **AO3** | **Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.** |
| **AO3.1** | Analyse information and ideas to interpret and evaluate. |
| **AO3.1a** | Analyse information and ideas to interpret. |
| **AO3.1b** | Analyse information and ideas to evaluate. |
| **AO3.2** | Analyse information and ideas to make judgements and draw conclusions. |
| **AO3.2a** | Analyse information and ideas to make judgements. |
| **AO3.2b** | Analyse information and ideas to draw conclusions. |
| **AO3.3** | Analyse information and ideas to develop and improve experimental procedures. |
| **AO3.3a** | Analyse information and ideas to develop experimental procedures. |
| **AO3.3b** | Analyse information and ideas to improve experimental procedures. |

## SECTION A

| Question | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|
| 1 | C | 1 | 2.1 | |
| 2 | A | 1 | 1.2 | |
| 3 | C | 1 | 1.1 | |
| 4 | A | 1 | 1.1 | |
| 5 | B | 1 | 2.1 | |
| 6 | D | 1 | 3.1a | |
| 7 | D | 1 | 2.1 | |
| 8 | C | 1 | 2.1 | |
| 9 | C | 1 | 2.1 | |
| 10 | A | 1 | 2.1 | |

## SECTION B

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 11 | (a) | (i) | Gain of electrons to become negative (1) | 1 | 1.1 | |
| | | (ii) | The charge cannot flow / the charge is static (1) | 1 | 1.1 | |
| | | (iii) | Rod induces charge onto paper (1)<br>Charge at the top of the paper is opposite in charge to the rod (1)<br>They attract one another as they have opposite charges (1) | 3 | 3 x 2.1 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 12* | | | Please refer to the marking instructions on page 3 of this mark scheme for guidance on how to mark this question.<br><br>**Level 3 (5–6 marks)**<br>**Complete explanation of how an electromagnet works AND suggestions of multiple improvements to the design with reasons.**<br><br>*There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.*<br><br>**Level 2 (3–4 marks)**<br>**Explanation for why the steel is attracted AND a suggestion of an improvement.**<br><br>*There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*<br><br>**Level 1 (1–2 marks)**<br>**Simple description of how a magnetic field is induced in an electromagnet.**<br><br>*There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.*<br><br>**0 marks**<br>*No response or no response worthy of credit.* | **6** | **2 x 3.3b**<br>**2.2**<br>**3 x 1.2** | **AO3.3b: Suggestions of improvements to the design**<br><br>• Improvements to include iron core/more coils/more current through the wire/ greater surface area of plate<br>• Idea of how these improvements increase the strength of the electromagnet<br><br>**AO2.2: Explanation of how this electromagnet works**<br><br>• Plate acts as a magnet<br>• Scrap-steel lost quickly when the switch is opened as the electromagnet is only a temporary magnet<br>• Links loss of current and magnetic field and loss of induced magnetism in coil<br><br>**AO1.2: Simple description of how a magnetic field is induced in an electromagnet**<br><br>• Closed switch allows current to flow / **ORA**<br>• Current so magnetic field formed around wire/ solenoid<br>• Magnetic field so attraction between core and steel<br>• Core acts as a magnet |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| | | | | | | Induced magnetism in core |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 13 | (a) | | Recall that power (P) = $I^2R$ (1)<br>Convert quoted current in mA to 0.002A (1)<br>Power = $0.002^2$ x 1000 = 0.004 W (1) | 3 | 1.1<br>2.1<br>2.1 | <br><br>**ALLOW** 4 mW |
| | (b) | | p.d across thermistor = 1000 x 0.002 = 2 V (1)<br>p.d across resistor = 3 V (1)<br>Resistance = 3/0.002 = 1 500 Ω (1) | 3 | 2.1<br>2.2<br>2.1 | |
| | (c) | | Resistance of the thermistor increases (1)<br>Therefore takes a bigger share of the potential difference / voltmeter reading is lower (1) | 2 | 1.2<br>1.2 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 14 | (a) | | ½ $mv^2$ /0.5 x $3x10^{-3}$ x $90^2$ / 12.2 J (1)<br>12.2 J is less than 16 J (1) | 2 | 2 x 3.1b | |
| | (b) | (i) | Use of momentum = mass x velocity / 3 x $10^{-3}$ x 90 (1)<br>0.27 (1)<br>kgm/s (1) | 3 | 2 x 2.1<br><br><br>1.1 | |
| | | (ii) | work done = force x distance (1)<br>KE = WD / 12.2 = 0.26 x distance (1)<br>d= 47 m (1) | 3 | 1.1<br>2.1<br>2.1 | correct numerical answer gains all three marks |
| | (c) | | Idea of a method e.g. use of measuring cylinder containing water/use of Archimedes can to measure volume (1)<br><br>Measurement of mass (1)<br><br>Measurement of volume (1)<br><br>Use of mass ÷ volume (1) | 4 | 4 x 1.2 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 15 | (a) | | They stay at 55 °C for the same amount of time (1)<br>X (solidifies) before Y (1)<br>At 55 °C both X and Y solidify / freeze (1) | 3 | 3.1b<br>3.2b<br>3.2b | |
| | (b) | | Same temperature for solidification/freezing (1) | 1 | 3.2b | |
| | (c) | | Specific heat capacity (of water) (1)<br>Mass of hot water (1)<br>Temperature change (1) | 3 | 3 x 1.2 | **ALLOW** initial and final temperatures |
| | (d) | (i) | Rearrange and apply density = mass/volume<br>(Mass = $2712 \times 8.0 \times 10^{-6}$) (1)<br>0.02 kg (1) | 2 | 2 x 2.1 | |
| | | (ii) | Change in temperature = 13 °C (1)<br>Use of $E = mc\Delta\theta$<br>$E = 0.02 \times 0.9 \times 10^3 \times 13$ (1)<br>E = 234 (J) (1) | 3 | 3 x 2.1 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 16 | (a) | | Any two from:<br><br>It has the lowest resistance (1)<br>Voltage is not shared (1)<br>Highest current (1) | 2 | 2 x 1.2 | **ALLOW** the lamp has the highest voltage (across it)<br>**ALLOW** reverse argument<br>Idea that resistance linked to bulb brightness |
| | (b) | (i) | X placed anywhere on either side of cell but not on Paths 1, 2 or 3 (1) | 1 | 1.2 | |
| | | (ii) | Y placed anywhere on Path 1 (1) | 1 | 1.2 | |

| Question | | | Answer | Marks | AO element | Guidance |
|---|---|---|---|---|---|---|
| 17 | (a) | | Error – group 1 measured length not extension (1) | 1 | 3.1b | |
| | (b) | | Rubber bands not identical / did not have same dimensions (1) | 1 | 3.2b | **ALLOW** bands had different lengths/widths/thickness (cross-sectional) area **not just** 'bands were different' |
| | (c) | | More load needs to be added until the relationship is no longer linear (1) | 1 | 3.3b | |

## Summary of updates

| Date | Version | Change |
|---|---|---|
| May 2018 | 2 | We've reviewed the look and feel of our papers through text, tone, language, images and formatting. For more information please see our assessment principles in our "Exploring our question papers" brochures on our website |