Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2019

# Single Award Science

Unit 4

**Booklet A**

**Foundation Tier**

**[GSA41]**

**MV18**

## Time

2 hours, plus your additional time allowance.

## Instructions to Candidates

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all** questions.

## Information for Candidates

The total mark for this paper is **30**.
Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.
Follow all health and safety instructions.
You may use a ruler and calculator if required.
The apparatus and materials required to complete the task(s) are provided.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

## Task 1

**1** When a metal is added to an acid, there is a change in temperature.
To investigate this, you are provided with three samples of metal filings (zinc, magnesium and iron) and hydrochloric acid.

**(a)** Carry out the procedure below and record your results in the table provided. [2 marks]

1. Use a measuring cylinder to measure 25 $cm^3$ of hydrochloric acid.
2. Pour the hydrochloric acid into the polystyrene cup which is inside a beaker.
3. Measure and record the initial temperature of the acid.
4. Add two level spatulas of zinc filings to the acid.
5. Stir the acid and metal gently.
6. Measure and record the highest temperature reached by the acid. (You are advised not to wait longer than 5 minutes.)
7. Repeat steps 1–6 for the magnesium and then the iron filings.
8. Complete the table by calculating the change in temperature.

A result for aluminium is already provided.

| **Metal** | **Initial temperature/°C** | **Highest temperature/°C** | **Change in temperature/°C** |
|---|---|---|---|
| Aluminium | **18** | **24** | **6** |
| Zinc | | | |
| Magnesium | | | |
| Iron | | | |

**(b)** When carrying out a scientific investigation risks or hazards need to be identified and steps taken to minimise any danger.

**(i)** For this investigation state **one** possible risk or hazard. [1 mark]

_____

_____

**(ii)** Describe **one** thing you did to minimise the danger. [1 mark]

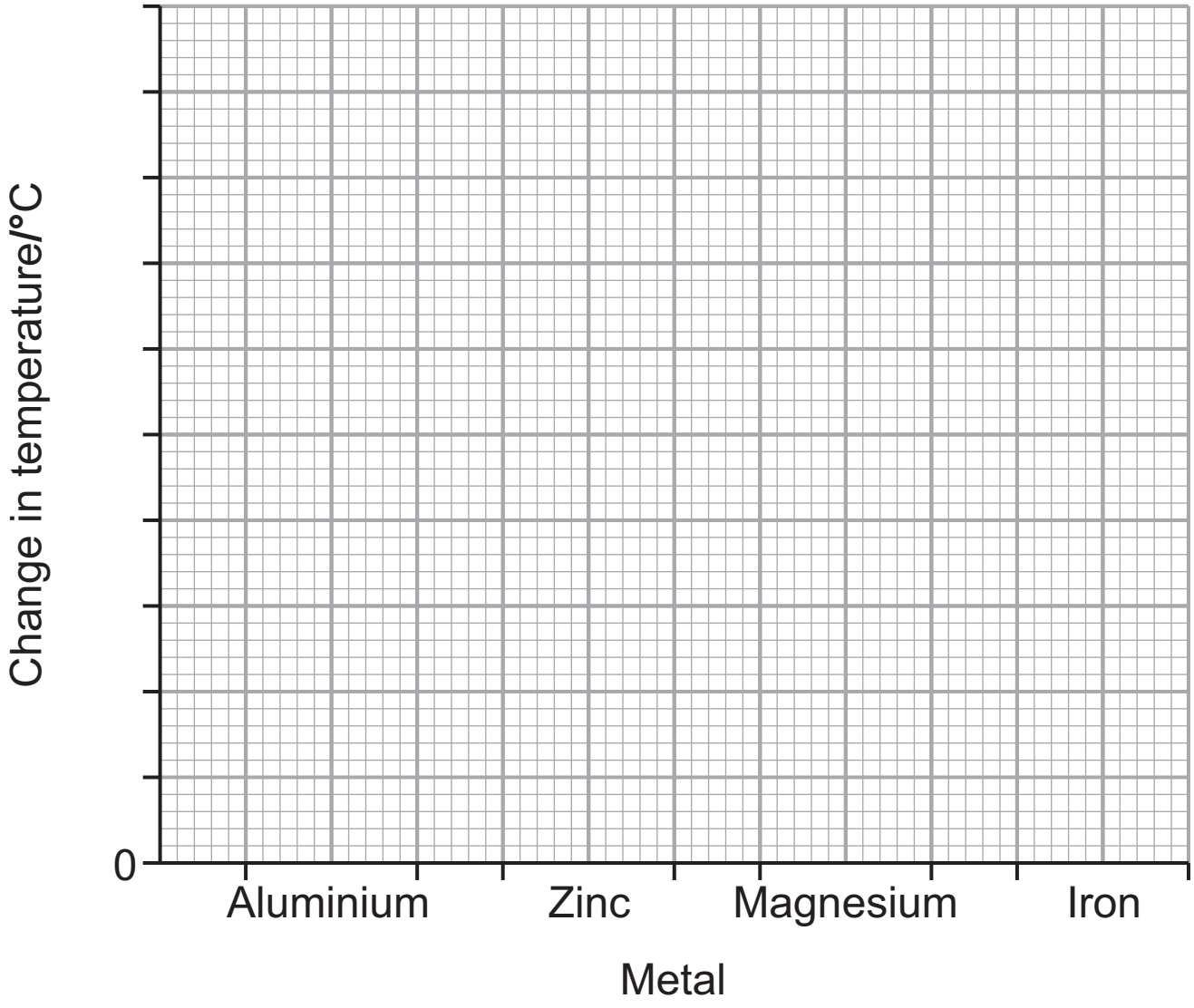
_____

_____

**(c) (i)** What affect did adding the metal have on the temperature of the acid? [1 mark]

_____

**(ii)** Use the results to draw a **bar chart** on the grid below.
You will need to add a suitable scale on the vertical axis (change in temperature). [3 marks]




**(iii)** Use **your** results to place the metals (**zinc**, **magnesium** and **iron**) in order of increasing reactivity. [1 mark]

_____ least reactive

_____ ↓

_____ most reactive

**(iv)** State **one** thing you could have done to increase the **reliability** of the results of this investigation. [1 mark]

_____

_____

**(d)** Polystyrene is an insulator, it does **not** allow heat to pass through it easily. Suggest why a polystyrene cup was used in this investigation. [1 mark]

_____

_____

**(e)** When carrying out an investigation it is important to produce accurate results.

**(i)** Suggest how stirring the acid before taking the temperature increased the accuracy of your results. [1 mark]

_____

_____

**(ii)** Name **one** piece of apparatus that could have been used to accurately measure the mass of metal added.

Circle the correct answer. [1 mark]

**balance**

**spatula**

**beaker**

**(f)** State **one** variable that was kept constant during this investigation to ensure that the results were valid (fair test). [1 mark]

_____

_____

**(g)** This investigation was repeated with **more** concentrated hydrochloric acid and aluminium. Suggest what effect, if any, this would have on how quickly the temperature changed.

Circle the correct answer. [1 mark]

**no effect**

**change more quickly**

**change more slowly**

**BLANK PAGE**

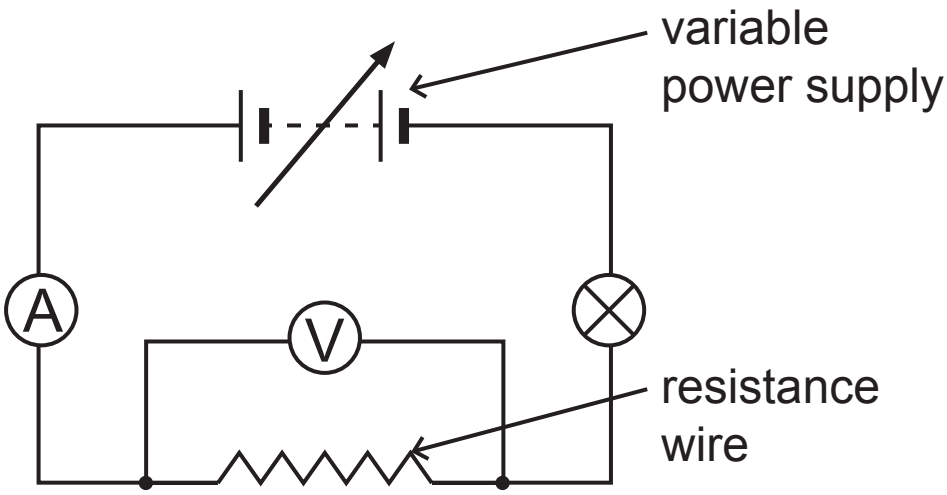
**(Questions continue overleaf)**

## Task 2

**2** Ohm's law states:

The current through a wire is directly proportional to the voltage across the wire, provided the temperature remains constant.

To prove Ohm's law you are provided with the circuit as shown in the diagram below.




**(a)** Carry out the investigation by following the method below. [2 marks]

1. Make sure the power supply is switched off.
2. Set the power supply to 2 V.
3. Switch on the power supply.
4. Use the table on page 9 to record the voltage and current shown by each **meter**. Record your results to **one** decimal place.
5. Switch off the power supply for one minute.
6. Turn the power supply to a higher value and repeat steps 3, 4 and 5. Collect five sets of results at different voltages.

**You should not exceed 10 V on the power supply.**

| Voltage/V | Current/A |
|---|---|
| 0.0 | 0.0 |
| | |
| | |
| | |
| | |
| | |

**(b) (i)** Name the meter that is connected in **series** with the resistance wire. [1 mark]

_____

**(ii)** Name the unit of current. [1 mark]

_____

**(iii)** State **one** risk when carrying out this experiment. Describe how you minimised this risk. [2 marks]

_____

_____

_____

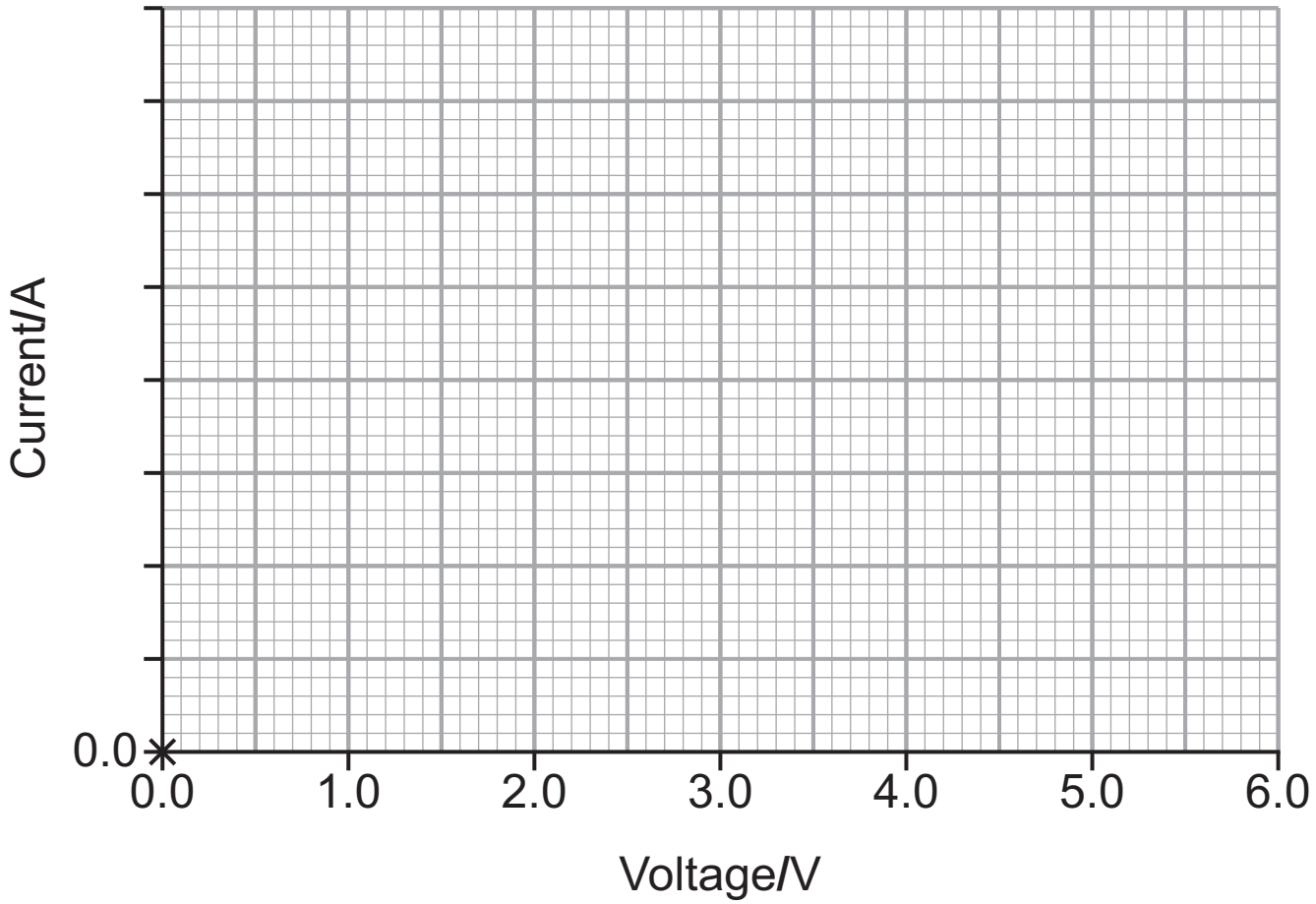
**(iv)** Apart from temperature, suggest **one** thing that was kept the same for the resistance wire, to make sure this was a fair test. [1 mark]

_____

**(c) (i)** Use the grid below to plot a **line** graph of your results. [4 marks]

Make sure that you:

- add a suitable scale to the vertical axis (current)
- plot your results
- draw a line of best fit.




**(ii)** State the trend shown by your results. [1 mark]

_____

_____

**(iii)** Are there any anomalous results in your investigation? Explain your answer. [1 mark]

_____

_____

**(d)** To prove Ohm's law, the temperature should be kept constant.

**(i)** What type of variable is temperature in this investigation?

Circle the correct answer. [1 mark]

**dependent**

**independent**

**controlled**

**(ii)** Suggest what was done in this investigation to try to keep the temperature constant. [1 mark]

_____

_____

**THIS IS THE END OF THE QUESTION PAPER**

| For Examiner's use only | |
|---|---|
| Question Number | Marks |
| 1 | |
| 2 | |
| Total Marks | |

## SYMBOLS OF SELECTED IONS

### Positive ions

| Name | Symbol |
|---|---|
| Ammonium | $NH_4^+$ |
| Chromium(III) | $Cr^{3+}$ |
| Copper(II) | $Cu^{2+}$ |
| Iron(II) | $Fe^{2+}$ |
| Iron(III) | $Fe^{3+}$ |
| Lead(II) | $Pb^{2+}$ |
| Silver | $Ag^+$ |
| Zinc | $Zn^{2+}$ |

### Negative ions

| Name | Symbol |
|---|---|
| Butanoate | $C_3H_7COO^-$ |
| Carbonate | $CO_3^{2-}$ |
| Dichromate | $Cr_2O_7^{2-}$ |
| Ethanoate | $CH_3COO^-$ |
| Hydrogencarbonate | $HCO_3^-$ |
| Hydroxide | $OH^-$ |
| Methanoate | $HCOO^-$ |
| Nitrate | $NO_3^-$ |
| Propanoate | $C_2H_5COO^-$ |
| Sulfate | $SO_4^{2-}$ |
| Sulfite | $SO_3^{2-}$ |

## SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

| Soluble |
|---|
| All sodium, potassium and ammonium salts |
| All nitrates |
| Most chlorides, bromides and iodides<br>EXCEPT silver and lead chlorides, bromides and iodides |
| Most sulfates EXCEPT lead and barium sulfates<br>Calcium sulfate is slightly soluble |

| Insoluble |
|---|
| Most carbonates<br>EXCEPT sodium, potassium and ammonium carbonates |
| Most hydroxides<br>EXCEPT sodium, potassium and ammonium hydroxides |
| Most oxides<br>EXCEPT sodium, potassium and calcium oxides which react with water |


**COUNCIL** FOR THE **CURRICULUM, EXAMINATIONS** AND **ASSESSMENT**
29 Clarendon Road, Clarendon Dock, Belfast BT1 3BG
Tel: +44 (0)28 9026 1200 Fax: +44 (0)28 9026 1234
Email: info@ccea.org.uk Web: www.ccea.org.uk

Rewarding Learning

New Specification

Rewarding Learning

# Data Leaflet

## Including the Periodic Table of the Elements

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

**Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations**

## gcse examinations

# chemistry

For first teaching from September 2017

# THE PERIODIC TABLE OF ELEMENTS

## Group

| 1 | 2 | | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 1 H Hydrogen 1 | | | | | | | | | | 4 He Helium 2 |
| 7 Li Lithium 3 | 9 Be Beryllium 4 | | | | | | | | | | | 11 B Boron 5 | 12 C Carbon 6 | 14 N Nitrogen 7 | 16 O Oxygen 8 | 19 F Fluorine 9 | 20 Ne Neon 10 |
| 23 Na Sodium 11 | 24 Mg Magnesium 12 | | | | | | | | | | | 27 Al Aluminium 13 | 28 Si Silicon 14 | 31 P Phosphorus 15 | 32 S Sulfur 16 | 35.5 Cl Chlorine 17 | 40 Ar Argon 18 |
| 39 K Potassium 19 | 40 Ca Calcium 20 | 45 Sc Scandium 21 | 48 Ti Titanium 22 | 51 V Vanadium 23 | 52 Cr Chromium 24 | 55 Mn Manganese 25 | 56 Fe Iron 26 | 59 Co Cobalt 27 | 59 Ni Nickel 28 | 64 Cu Copper 29 | 65 Zn Zinc 30 | 70 Ga Gallium 31 | 73 Ge Germanium 32 | 75 As Arsenic 33 | 79 Se Selenium 34 | 80 Br Bromine 35 | 84 Kr Krypton 36 |
| 85 Rb Rubidium 37 | 88 Sr Strontium 38 | 89 Y Yttrium 39 | 91 Zr Zirconium 40 | 93 Nb Niobium 41 | 96 Mo Molybdenum 42 | 98 Tc Technetium 43 | 101 Ru Ruthenium 44 | 103 Rh Rhodium 45 | 106 Pd Palladium 46 | 108 Ag Silver 47 | 112 Cd Cadmium 48 | 115 In Indium 49 | 119 Sn Tin 50 | 122 Sb Antimony 51 | 128 Te Tellurium 52 | 127 I Iodine 53 | 131 Xe Xenon 54 |
| 133 Cs Caesium 55 | 137 Ba Barium 56 | 139 La* Lanthanum 57 | 178 Hf Hafnium 72 | 181 Ta Tantalum 73 | 184 W Tungsten 74 | 186 Re Rhenium 75 | 190 Os Osmium 76 | 192 Ir Iridium 77 | 195 Pt Platinum 78 | 197 Au Gold 79 | 201 Hg Mercury 80 | 204 Tl Thallium 81 | 207 Pb Lead 82 | 209 Bi Bismuth 83 | 210 Po Polonium 84 | 210 At Astatine 85 | 222 Rn Radon 86 |
| 223 Fr Francium 87 | 226 Ra Radium 88 | 227 Ac† Actinium 89 | 261 Rf Rutherfordium 104 | 262 Db Dubnium 105 | 266 Sg Seaborgium 106 | 264 Bh Bohrium 107 | 277 Hs Hassium 108 | 268 Mt Meitnerium 109 | 271 Ds Darmstadtium 110 | 272 Rg Roentgenium 111 | 285 Cn Copernicium 112 | | | | | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 140 Ce Cerium 58 | 141 Pr Praseodymium 59 | 144 Nd Neodymium 60 | 145 Pm Promethium 61 | 150 Sm Samarium 62 | 152 Eu Europium 63 | 157 Gd Gadolinium 64 | 159 Tb Terbium 65 | 162 Dy Dysprosium 66 | 165 Ho Holmium 67 | 167 Er Erbium 68 | 169 Tm Thulium 69 | 173 Yb Ytterbium 70 | 175 Lu Lutetium 71 |
| 232 Th Thorium 90 | 231 Pa Protactinium 91 | 238 U Uranium 92 | 237 Np Neptunium 93 | 242 Pu Plutonium 94 | 243 Am Americium 95 | 247 Cm Curium 96 | 245 Bk Berkelium 97 | 251 Cf Californium 98 | 254 Es Einsteinium 99 | 253 Fm Fermium 100 | 256 Md Mendelevium 101 | 254 No Nobelium 102 | 257 Lr Lawrencium 103 |

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series

a
X
b

**a** = relative atomic mass (approx)
**x** = atomic symbol
**b** = atomic number