Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2019

Single Award Science

Unit 4

Booklet A

Higher Tier

[GSA43]

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 these. For this investigation state **one** possible risk or hazard and what you did to minimise the danger. [2 marks]

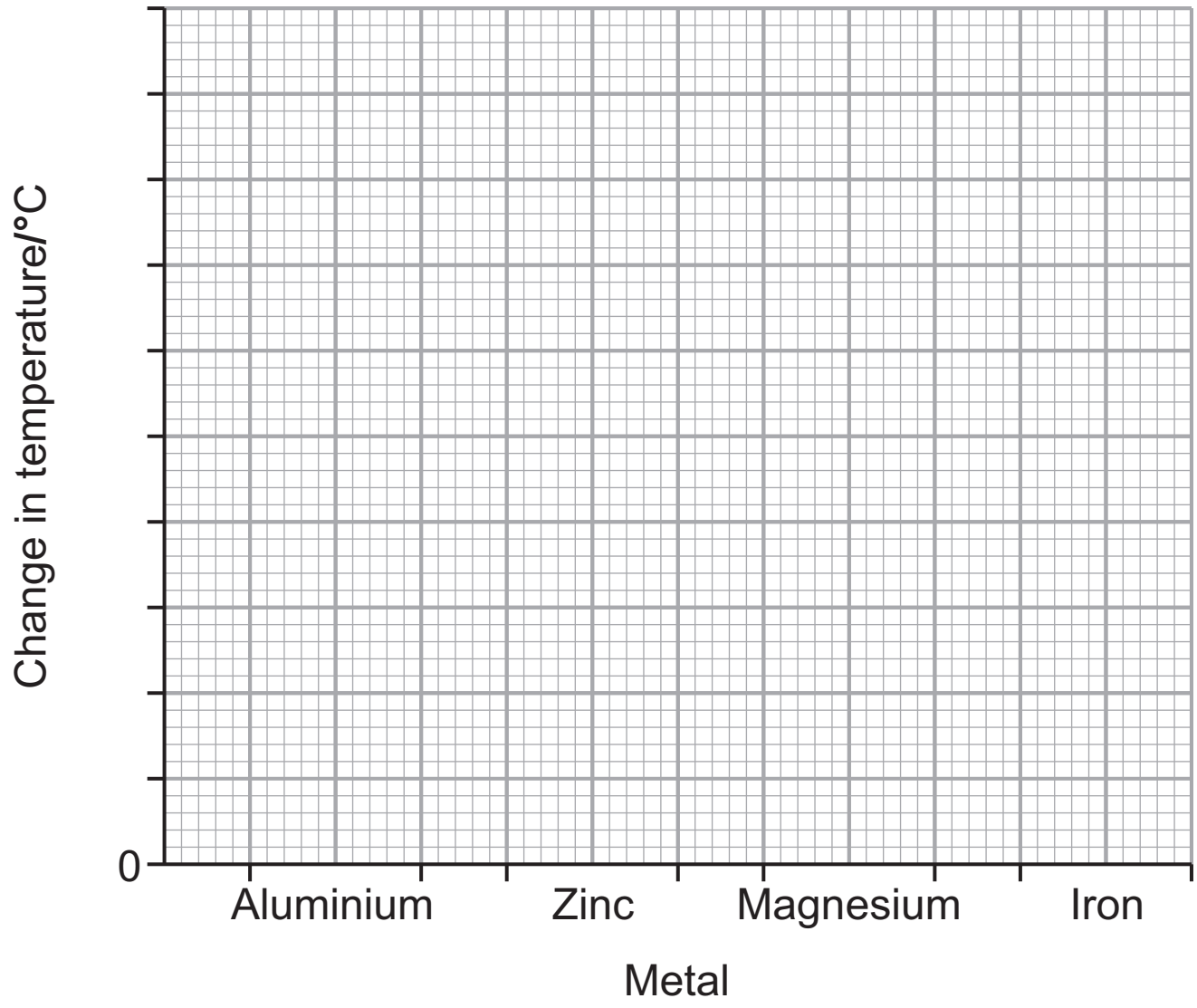
_____

_____

_____

_____

(c) (i) 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]



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

_____ least reactive

_____ ↓

_____ most reactive

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

_____

_____

(d) 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 measure the mass of metal added. [1 mark]

_____

(e) Variables in an investigation can be described as dependent, independent or controlled. Identify **two** controlled variables in this investigation. [2 marks]

1. _____

2. _____

(f) This investigation was repeated using aluminium and **more** concentrated hydrochloric acid. Suggest what effect, if any, this would have on how quickly the temperature changed. [1 mark]

_____

_____

(g) Why is it **not** important that the initial temperature is exactly the same **for each metal**? [1 mark]

_____

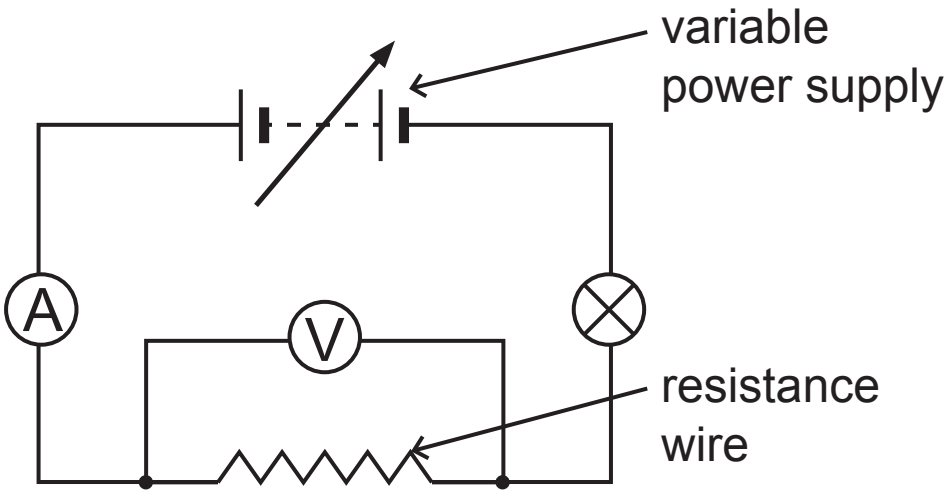
_____

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 7 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) Describe fully how the two meters are connected in this circuit. [2 marks]

_____

_____

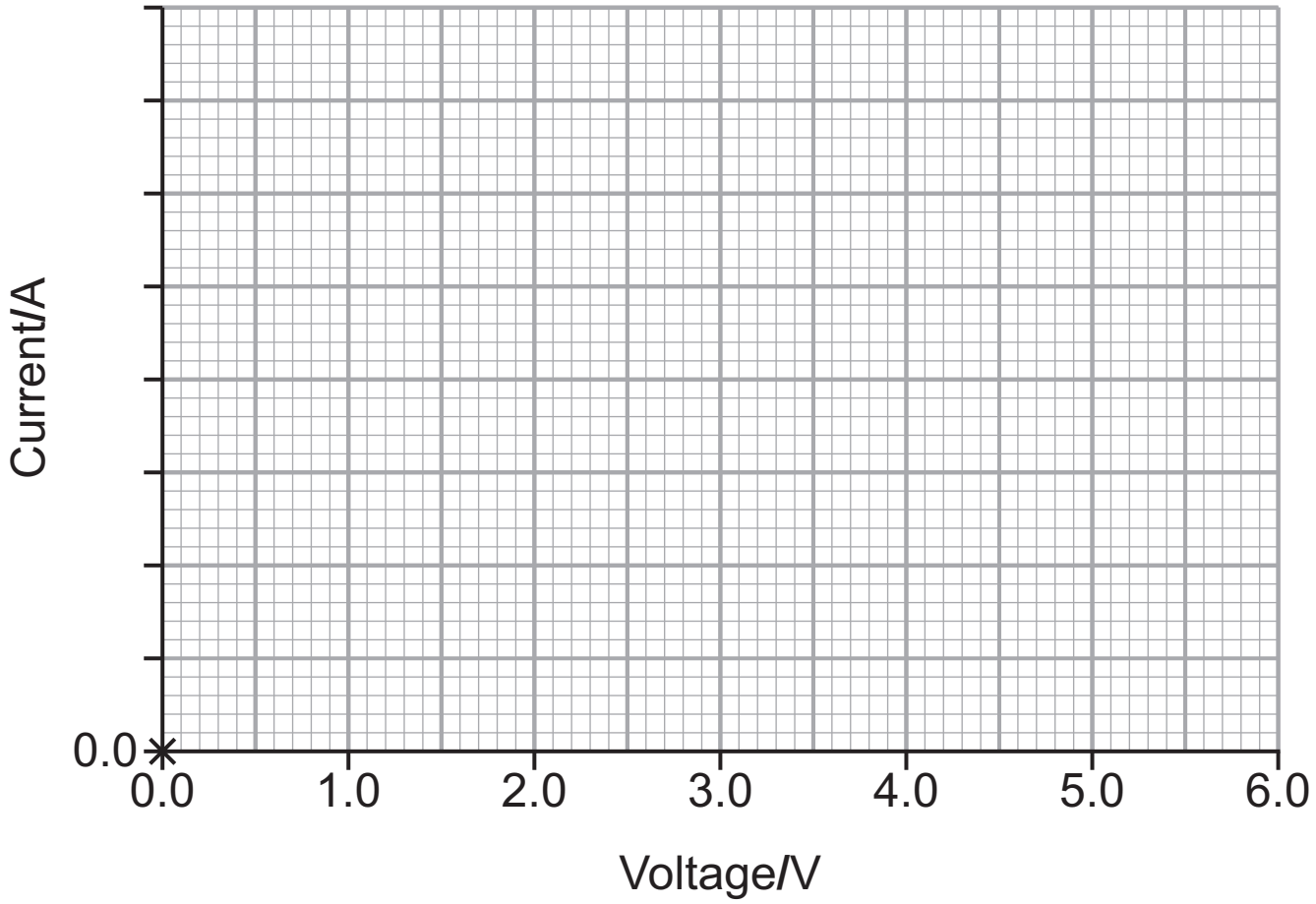
_____

(ii) Apart from temperature, suggest **two** things that were kept the same for the resistance wire, to make sure this was a fair test. [2 marks]

1. _____

2. _____

(c) (i) Use the grid below to plot and draw a line graph of your results. [4 marks]
You will need to add a scale to the vertical axis.



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

_____

_____

(iii) Do your results prove Ohm's law? Explain your answer. [1 mark]

_____

_____

(d) During the experiment the power supply was switched off after each set of readings. Explain fully, with reference to Ohm's law, why this was done. [2 marks]

(e) Name the dependent variable in this investigation. [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 EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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Rewarding Learning

New Specification

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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