



GCSE to A' Level Transition

Bridging Task Questions

You should attempt all question in this booklet but please be aware that towards the second half of the booklet, the questions become harder and you will be expected to do some research on the relevant topics.

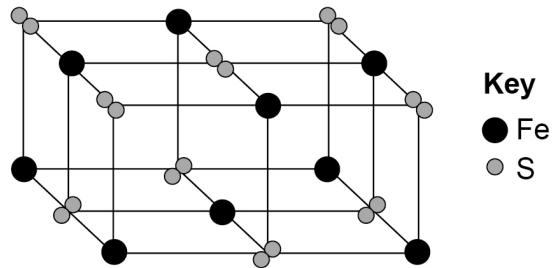
Good luck and stick with it!

1.1 This question is about metals and metal compounds.

Iron pyrites is an ionic compound.

Figure 1 shows a structure for iron pyrites.

Figure 1



Determine the formula of iron pyrites.

Use Figure 1.

[1 mark]

1.2 An atom of iron is represented as ${}_{26}^{56}\text{Fe}$

Give the number of protons, neutrons and electrons in this atom of iron.

[3 marks]

Number of protons _____

Number of neutrons _____

Number of electrons _____

1.3 Iron is a transition metal.

Sodium is a Group 1 metal.

Give **two** differences between the properties of iron and sodium.

[2 marks]

1 _____

2 _____

1.4

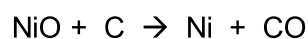
Nickel is extracted from nickel oxide by reduction with carbon.

Explain why carbon can be used to extract nickel from nickel oxide.

[2 marks]

1.5

An equation for the reaction is:



Calculate the percentage atom economy for the reaction to produce nickel.

Relative atomic masses (A_r): C = 12 Ni = 59

Relative formula mass (M_r): NiO = 75

Give your answer to 3 significant figures.

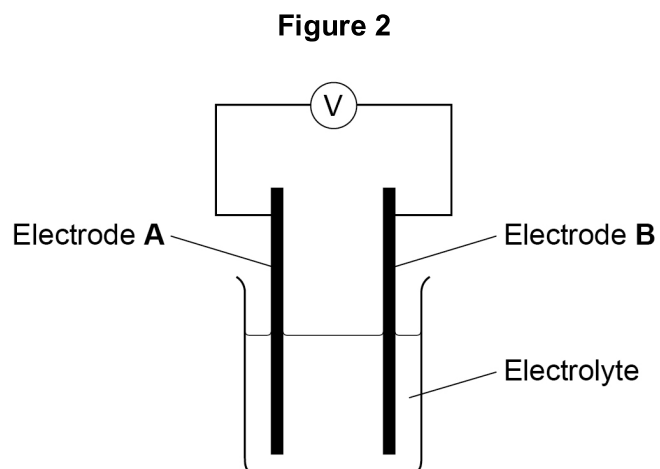
[3 marks]

Percentage atom economy = _____ %

2

Chemical reactions can produce electricity.

Figure 2 shows a simple cell.



Which of these combinations would **not** give a zero reading on the voltmeter in **Figure 2**?

[1 mark]

Tick **one** box.

Electrode A	Electrode B	Electrolyte	
Copper	Copper	Sodium chloride solution	<input type="checkbox"/>
Zinc	Zinc	Water	<input type="checkbox"/>
Copper	Zinc	Sodium chloride solution	<input type="checkbox"/>
Copper	Zinc	Water	<input type="checkbox"/>

This question is about chemicals in fireworks.

Coloured flames are produced because of the metal ions present in fireworks.

*Do not write
outside the
box*

3.1 What colour flame would sodium ions produce?

[1 mark]

3.2 Name a metal ion that would produce a green flame.

[1 mark]

3.3 Some fireworks contain a mixture of metal ions.

Why is it difficult to identify the metal ions from the colour of the flame?

[1 mark]

The compounds in fireworks also contain non-metal ions.

A scientist tests a solution of the chemicals used in a firework.

3.4 Silver nitrate solution and dilute nitric acid are added to the solution.

A cream precipitate forms.

Which ion is shown to be present by the cream precipitate?

[1 mark]

3.5 Describe a test to show the presence of sulfate ions in the solution.

Give the result of the test if there are sulfate ions in the solution.

[3 marks]

Test _____

Result _____

4 Methylated spirit is a useful product made from a mixture of substances.

Table 1 shows the mass of the substances in a sample of methylated spirit.

Table 1

Substance	Mass in grams
Ethanol	265.5
Methanol	23.3
Pyridine	3.0
Methyl violet	1.5

4.1 What name is given to a useful product such as methylated spirit?

[1 mark]

4.2 Calculate the percentage by mass of methanol in methylated spirit.

Use **Table 1**.

[2 marks]

Percentage = _____ %

Methylated spirit contains ethanol and is available cheaply.

Methylated spirit also contains:

- pyridine which has a very unpleasant smell
- methyl violet which makes the mixture purple.

4.3 Suggest why pyridine and methyl violet are added to ethanol to make methylated spirit.

[1 mark]

4.4 Suggest **one** use of methylated spirit.

[1 mark]

4.5 Describe how ethanol is produced from sugar solution.

Give the name of this process.

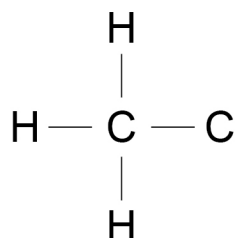
[3 marks]

4.6 **Figure 2** shows part of the displayed formula for ethanol.

Complete **Figure 2**.

[1 mark]

Figure 2



4.7 Name the gas produced when sodium is added to ethanol.

[1 mark]

4.8 Methanol is used to produce methanoic acid.

What type of substance reacts with methanol to produce methanoic acid?

[1 mark]

Answer **all** questions in this section.

This question is about electron configuration.

5.1 Give the full electron configuration of an Al atom and of a Cr^{3+} ion.

[2 marks]

Al atom _____

Cr^{3+} ion _____

5.2 Deduce the formula of the ion that has a charge of 2+ with the same electron configuration as krypton.

[1 mark]

5.3 Deduce the formula of the compound that contains 2+ ions and 3- ions that both have the same electron configuration as argon.

[1 mark]

- 6 This question is about a white solid, MHCO_3 , that dissolves in water and reacts with hydrochloric acid to give a salt.



A student was asked to design an experiment to determine a value for the M_r of MHCO_3 . The student dissolved 1464 mg of MHCO_3 in water and made the solution up to 250 cm^3 .

25.0 cm^3 samples of the solution were titrated with $0.102 \text{ mol dm}^{-3}$ hydrochloric acid. The results are shown in **Table 1**.

Table 1

	Rough	1	2	3
Initial burette reading / cm^3	0.00	10.00	19.50	29.25
Final burette reading / cm^3	10.00	19.50	29.25	38.90
Titre / cm^3	10.00	9.50	9.75	9.65

- 6.1 Calculate the mean titre and use this to determine the amount, in moles, of HCl that reacted with 25.0 cm^3 of the MHCO_3 solution.

[3 marks]

- 6.2 Calculate the amount, in moles, of MHCO_3 in 250 cm^3 of the solution. Then calculate the experimental value for the M_r of MHCO_3 . Give your answer to the appropriate number of significant figures.

[3 marks]

7

7.1

Explain how ions are accelerated, detected and have their abundance determined in a time of flight (TOF) mass spectrometer.

[3 marks]

7.2

Calculate the mass, in kg, of a single $^{52}\text{Cr}^+$ ion.
Assume that the mass of a $^{52}\text{Cr}^+$ ion is the same as that of a ^{52}Cr atom.

(The Avogadro constant $L = 6.022 \times 10^{23} \text{ mol}^{-1}$)

[1 mark]

7.3

In a TOF mass spectrometer the kinetic energy (KE) of a $^{52}\text{Cr}^+$ ion was $1.269 \times 10^{-13} \text{ J}$

Calculate the velocity of the ion using the equation.

$$\text{KE} = \frac{1}{2}mv^2$$

(m = mass/kg and v = velocity/ ms^{-1})

[2 marks]
