

AQA – Amount of substance – A2 Chemistry P1

1. June/ 2020/Paper_1/No.2

0 2

This question is about the isotopes of chromium.

0 2 . 1

Give the meaning of the term relative atomic mass.

[2 marks]

0 2 . 2

A sample of chromium containing the isotopes ^{50}Cr , ^{52}Cr and ^{53}Cr has a relative atomic mass of 52.1

The sample contains 86.1% of the ^{52}Cr isotope.

Calculate the percentage abundance of each of the other two isotopes.

[4 marks]

Abundance of ^{50}Cr _____ % Abundance of ^{53}Cr _____ %

0 2 . 3

State, in terms of the numbers of fundamental particles, **one** similarity and **one** difference between atoms of ^{50}Cr and ^{53}Cr

[2 marks]

Similarity _____

Difference _____

The sample of chromium is analysed in a time of flight (TOF) mass spectrometer.

0 2 . 4

Give **two** reasons why it is necessary to ionise the isotopes of chromium before they can be analysed in a TOF mass spectrometer.

[2 marks]

1 _____

2 _____

0 2 . 5

A $^{53}\text{Cr}^+$ ion travels along a flight tube of length 1.25 m
The ion has a constant kinetic energy (KE) of 1.102×10^{-13} J

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

m = mass of the ion / kg

v = speed of ion / m s^{-1}

Calculate the time, in s, for the $^{53}\text{Cr}^+$ ion to travel down the flight tube to reach the detector.

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

[5 marks]

Time _____ s

2. June/ 2019/Paper_1/No.6

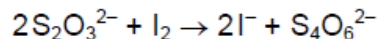
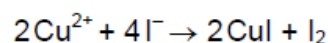
0 6

A student does an experiment to determine the percentage of copper in an alloy.

The student

- reacts 985 mg of the alloy with concentrated nitric acid to form a solution (all of the copper in the alloy reacts to form aqueous copper(II) ions)
- pours the solution into a volumetric flask and makes the volume up to 250 cm³ with distilled water
- shakes the flask thoroughly
- transfers 25.0 cm³ of the solution into a conical flask and adds an excess of potassium iodide
- uses exactly 9.00 cm³ of 0.0800 mol dm⁻³ sodium thiosulfate (Na₂S₂O₃) solution to react with all the iodine produced.

The equations for the reactions are



0 6 . 1

Calculate the percentage of copper by mass in the alloy.

Give your answer to the appropriate number of significant figures.

[6 marks]

% copper _____

0 6 . 2 Suggest **two** ways that the student could reduce the percentage uncertainty in the measurement of the volume of sodium thiosulfate solution, using the same apparatus as this experiment. **[2 marks]**

1 _____

2 _____

0 6 . 3 State the role of iodine in the reaction with sodium thiosulfate. **[1 mark]**

0 6 . 4 Give the full electron configuration of a copper(II) ion. **[1 mark]**

0 6 . 5 Copper(I) iodide is a white solid.
Explain why copper(I) iodide is white. **[2 marks]**

0 6 . 6 Iodine vaporises easily.

Calculate the volume, in cm^3 , that 5.00 g of iodine vapour occupies at 185°C and 100 kPa

The gas constant $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

Give your answer to 3 significant figures.

[4 marks]

Volume _____ cm^3