Questions are for both separate science and combined science students unless indicated in the question

Q1.

Copper is extracted from metal ores.

Chalcopyrite is a metal ore containing a compound with the formula $CuFeS_2$

(a) $CuFeS_2$ reacts with oxygen to produce copper(II) sulfate and iron(II) sulfate.

Complete the equation for this reaction.

You should balance the equation.

Need 8 O
$O_2 \times 4$

$$CuFeS_2 + 4\ O_2 \rightarrow CuSO_4 + FeSO_4$$

(2)

(b) Calculate the percentage by mass of copper in $CuFeS_2$

Relative atomic masses (A_r): S = 32 Fe = 56 Cu = 63.5

$M_r\ (CuFeS_2) = 63.5 + 56 + (2 \times 32)$

$= 183.5\ g\ mol^{-1}$

Mass of Cu $= 1 \times 63.5\ g\ mol^{-1}$

% Cu $= \frac{63.5}{183.5} \times 100\% = 34.6\%$

Percentage by mass = 34.6 %

(3)

(c) Describe a test to show the presence of copper(II) ions in a solution of copper(II) sulfate.

Give the result of the test. **(chemistry only)**

Test Add NaOH (aq) Flame test

Result Blue precipitate Green flame

(2)

(d) Copper can be extracted from low-grade ores by bioleaching.

Describe what is meant by bioleaching. **(HT only)**

The use of bacteria to produce leachate solutions that contain copper compounds.

(2)

(Total 9 marks)

Q2.

This question is about groups in the periodic table.

The elements in Group 1 become more reactive going down the group.

Rubidium is below potassium in Group 1.

(a) Rubidium and potassium are added to water.

Predict **one** observation you would see that shows that rubidium is more reactive than potassium.

Rubidium would show more vigorous bubbling and have a brighter flame.

(1)

(b) Explain why rubidium is more reactive than potassium.

Rubidium's outer electron shell is further from the nucleus so there is less electrostatic attraction between the nucleus and the outer electron and more shielding so the outer electron is more easily lost making Rubidium more reactive.

(3)

(c) Complete the equation for the reaction of rubidium with water.

You should balance the equation.

$$2\,Rb + 2\,H_2O \rightarrow 2\,RbOH + H_2$$

(3)

Group 1

$Rb \rightarrow Rb^+$

$H_2O \rightarrow H^+ + OH^-$

Rb^+OH^- $\quad$ $H^+\,H^+$ ← Need 2 H atoms!

$RbOH$ $\quad$ H_2

The noble gases are in Group 0.

(d) Which is a correct statement about the noble gases?

Tick (✓) **one** box.

The noble gases all have atoms with eight electrons in the outer shell.	☐
The noble gases have boiling points that increase going down the group.	✓
The noble gases have molecules with two atoms.	☐
The noble gases react with metals to form ionic compounds.	☐

(1)

(e) The table below shows information about the three isotopes of neon.

Mass number	Percentage abundance (%)
20	90.48
21	0.27
22	9.25

Calculate the relative atomic mass (A_r) of neon.

Give your answer to 3 significant figures.

$A_r = \frac{(20 \times 90{\cdot}48) + (21 \times 0{\cdot}27) + (22 \times 9{\cdot}25)}{100}$

$= \frac{1809{\cdot}6 + 0{\cdot}0567 + 2{\cdot}035}{100}$ $= 20{\cdot}1877$

$= 20{\cdot}2$ 3 s.f.

Relative atomic mass (3 significant figures) = 20·2

(3)

(Total 11 marks)