Q1.(a) Nickel is a metal with a high melting point.

(i) State the block in the Periodic Table that contains nickel.

.....

(1)

(ii) Explain, in terms of its structure and bonding, why nickel has a high melting point.

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(2)

(iii) Draw a labelled diagram to show the arrangement of particles in a crystal of nickel.
In your answer, include at least six particles of each type.

(2)

(iv) Explain why nickel is ductile (can be stretched into wires).

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(1)

(b) Nickel forms the compound nickel(II) chloride ($NiCl_2$).

(i) Give the full electron configuration of the Ni^{2+} ion.

.....

(1)

(ii) Balance the following equation to show how anhydrous nickel(II) chloride can be obtained from the hydrated salt using $SOCl_2$
Identify **one** substance that could react with both gaseous products.

.....$NiCl_2.6H_2O(s)$ + ... $SOCl_2(g)$ ⟶ .....$NiCl_2(s)$ + ...$SO_2(g)$ + ...$HCl(g)$

Substance .....

(2)
(Total 9 marks)

Q2. (a) (i) Complete the electronic configuration of aluminium.

$1s^2$ .....

(ii) State the block in the Periodic Table to which aluminium belongs.

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(2)

(b) Describe the bonding in metals.

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(2)

(c) Explain why the melting point of magnesium is higher than that of sodium.

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(3)

(d) Explain how metals conduct electricity.

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(2)
(Total 9 marks)

Q3. (a) State the meaning of the term *first ionisation energy* of an atom.

.....

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(2)

(b) Complete the electron arrangement for the Mg^{2+} ion.

$1s^2$ .....

(1)

(c) Identify the block in the Periodic Table to which magnesium belongs.

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(1)

(d) Write an equation to illustrate the process occurring when the **second** ionisation energy of magnesium is measured.

.....

(1)

(e) The Ne atom and the Mg^{2+} ion have the same number of electrons. Give **two** reasons why the first ionisation energy of neon is lower than the third ionisation energy of magnesium.

Reason 1 .....

Reason 2 .....

(2)

(f) There is a general trend in the first ionisation energies of the Period 3 elements, Na – Ar

(i) State and explain this general trend.

Trend …….....

Explanation .....

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(ii) Explain why the first ionisation energy of sulphur is lower than would be predicted from the general trend.

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(5)
(Total 12 marks)

Q4. The elements phosphorus, sulfur, chlorine and argon are in the p block of the Periodic Table.

(a) State why these elements are classified as p block elements.

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(1)

(b) State the trend in atomic radius from phosphorus to chlorine and explain the trend.

Trend .....

Explanation .....

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(3)

(c) In terms of structure and bonding, explain why sulfur has a higher melting point than phosphorus.

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(3)

(d) In terms of atomic structure, explain why the van der Waals' forces in liquid argon are very weak.

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(2)
(Total 9 marks)

Q5. The element rubidium exists as the isotopes ^{85}Rb and ^{87}Rb

(a) State the number of protons and the number of neutrons in an atom of the isotope ^{85}Rb

Number of protons .....

Number of neutrons .....

(2)

(b) (i) Explain how the gaseous atoms of rubidium are ionised in a mass spectrometer

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(2)

(ii) Write an equation, including state symbols, to show the process that occurs when the **first** ionisation energy of rubidium is measured.

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(1)

(c) The table shows the first ionisation energies of rubidium and some other elements in the same group.

Element	sodium	potassium	rubidium
First ionisation energy / kJ mol^{-1}	494	418	402

State **one** reason why the first ionisation energy of rubidium is lower than the first ionisation energy of sodium.

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(1)

(d) (i) State the block of elements in the Periodic Table that contains rubidium.

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(1)

(ii) Deduce the full electron configuration of a rubidium atom.

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(1)

(e) A sample of rubidium contains the isotopes ^{85}Rb and ^{87}Rb only.
The isotope ^{85}Rb has an abundance 2.5 times greater than that of ^{87}Rb

Calculate the relative atomic mass of rubidium in this sample.
Give your answer to one decimal place.

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(3)

(f) By reference to the relevant part of the mass spectrometer, explain how the abundance of an isotope in a sample of rubidium is determined.

Name of relevant part .....

Explanation .....

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(2)

(g) Predict whether an atom of ^{88}Sr will have an atomic radius that is larger than, smaller than or the same as the atomic radius of ^{87}Rb. Explain your answer.

Atomic radius of ^{88}Sr compared to ^{87}Rb .....

Explanation .....

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(3)
(Total 16 marks)