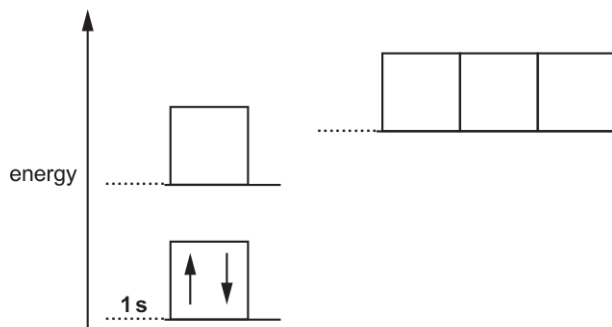


# Electron Structure

1. Electrons occupy orbitals which are arranged in energy levels.

In the diagram below, each box represents an orbital and each electron is shown as an arrow.

Label the sub-shells and add arrows to show how electrons occupy orbitals in an atom of **oxygen**.



[2]

2. Selenium is in the same group of the periodic table as sulfur.

- i. Complete the full electron configuration of a selenium atom.

$1s^2$  \_\_\_\_\_ [1]

- ii. Sodium selenide reacts with hydrochloric acid to form a toxic gas, **B**, with a relative molecular mass of 81.0.

Identify gas **B** and write an equation for this reaction.

Gas B \_\_\_\_\_

Equation \_\_\_\_\_ [2]

3. Barium nitride is formed when barium is heated with nitrogen.

- i. Complete the electron configuration of a nitride ion.

$1s^2$  \_\_\_\_\_ [1]

- ii. Solid barium nitride is reacted with water, forming an alkaline solution **A** and an alkaline gas **B**.

Identify **A** and **B**.

Write an equation, including state symbols, for the reaction.

**A**

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**B**

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**[4]**

4. This question is about the chemistry of the metals zinc, magnesium, aluminium and calcium.

Complete the electron configuration of a zinc atom.

1s<sup>2</sup>

.....

.....

**[1]**

5. The electrons in the second shell of a nitrogen atom are found in an s-orbital and three p-orbitals.

- i. State, in words, the 3D shape of an s-orbital and a p-orbital.

s-orbital .....

p-orbital .....

**[1]**

- ii. Describe the relative energies of the 2s orbital and **each** of the three 2p orbitals in a nitrogen atom.

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**[2]**

6. Group 2 elements are metals that react with oxygen and water.

Magnesium is oxidised when it burns in oxygen to form an ionic compound.

- i. Write the electron configuration, in terms of sub-shells, of a magnesium atom.

..... [1]

- ii. Explain what happens when magnesium is oxidised in terms of electron transfer.

..... [1]

- 7 Complete the electron configuration of a manganese atom.

1s<sup>2</sup>

..... [1]

8. Ytterbium, atomic number 70, is the first element in the Periodic Table to have the first four shells full.

- i. State the number of electrons in the **fourth** shell of ytterbium.

- ii. How many orbitals are there in the **third** shell of ytterbium?

- 9 i. Complete the electron configuration of a bromide **ion**.

1s<sup>2</sup>

..... [1]

- ii. A student adds a small volume of aqueous silver nitrate to an aqueous solution of bromide ions in a test-tube. The student then adds a similar volume of dilute aqueous ammonia to the same test-tube.

Describe what the student would see in the test-tube after the addition of aqueous ammonia.

----- [1]

- iii. Write an ionic equation for any precipitation reaction which occurs in the student's tests.

Include state symbols.

----- [1]

10. Bromine and mercury are the only two naturally occurring elements that are liquids at room temperature and pressure. Some physical properties of these two elements are given below.

	Appearance at room temperature	Melting point / °C	Boiling point / °C	Electrical conductivity of the liquid
<b>Bromine</b>	dark orange liquid	-7.2	58.8	very low
<b>Mercury</b>	shiny silver liquid	-38.8	356.7	good

Complete the full electron configuration of a bromine atom.

1s<sup>2</sup> -----

[1]

- 11(a). Europium, atomic number 63, has two isotopes, <sup>151</sup>Eu and <sup>153</sup>Eu.

Complete the table to show the number of protons, neutrons and electrons in the <sup>153</sup>Eu<sup>3+</sup> ion of europium.

	protons	neutrons	electrons
<sup>153</sup> Eu <sup>3+</sup>			

[1]

- (b). Atoms of europium have electrons in orbitals within the first five shells. The first three shells of europium are full.

Complete the table to show the number of electrons in the following regions of a europium atom.

	number of electrons
the 1s sub-shell	
a 3p orbital	
the 3 <sup>rd</sup> shell	

[3]

END OF QUESTION PAPER