AP CHEMISTRY • EXERCISE SHEET

1.5 Atomic Structure and Electron Configuration

Name: _____ Class: _____ Date: _____ **Total: 13 marks**

Objective

Build the skills to answer exam questions on **atomic structure and electron configuration**.

You must be able to:

- describe an atom as a nucleus of protons and neutrons with **electrons** 电子 in shells
- write an **electron configuration** 电子排布 by filling lowest-energy subshells first
- recall the filling order (including $4s$ before $3d$)
- check that the superscripts sum to the electron count

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

■ Filling order

Electrons fill from lowest energy up: $1s$ $2s$ $2p$ $3s$ $3p$ $4s$ $3d\ldots$ Each s holds 2, each p holds 6, each d holds 10.

■ Writing a configuration

Oxygen (8 electrons): $1s^2\ 2s^2\ 2p^4$. Sodium (11): $1s^2\ 2s^2\ 2p^6\ 3s^1$.

■ Check the sum

The superscripts must add to the total electron count. For sodium, $2+2+6+1=11$.

2 Practice

Now apply the methods above.

2.1 Write the electron configuration of oxygen (8 electrons). [2]

2.2 Which subshell fills first, $4s$ or $3d$? [1]

2.3 The configuration $1s^2\ 2s^2\ 2p^6\ 3s^1$ has how many electrons? [1]

2.4 What holds the electrons to the nucleus? [1]

3 Exam-style questions

3.1 In an atom, the electrons are held to the nucleus by [1]

- **A** gravity
- **B** Coulombic (electrostatic) attraction
- **C** magnetism
- **D** friction

3.2 The electron configuration of neon (10 electrons) is [1]

- **A** $1s^2\ 2s^2\ 2p^6$
- **B** $1s^2\ 2s^2\ 2p^4$
- **C** $1s^2\ 2s^4\ 2p^4$
- **D** $1s^2\ 2s^2\ 2p^8$

3.3 Consider the element magnesium (12 electrons).

(a) Write its electron configuration. [2]

(b) State how many electrons are in its outer ($3s$) shell. [1]

3.4 An atom has the configuration $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^4$.

(a) Find the total number of electrons. [2]

(b) State whether inner-shell or outer-shell electrons are harder to remove. [1]

4 Go further

You are ready for more on this subtopic:

- work through the interactive **1.5 Atomic Structure and Electron Configuration** lesson on the **Learn** page;
- read the **Atomic Structure and Properties** section of the AP Chemistry handout on the **Know** page for the full explanation and worked diagrams.

Solutions

2.1 $1s^2\ 2s^2\ 2p^4$.

2.2 $4s$.

2.3 11.

2.4 Coulombic (electrostatic) attraction.

3.1 B —Coulombic attraction.

3.2 A —$1s^2\ 2s^2\ 2p^6$ $(2 + 2 + 6 = 10)$.

3.3 (a) $1s^2\ 2s^2\ 2p^6\ 3s^2$. (b) 2.

3.4 (a) $2 + 2 + 6 + 2 + 4 = 16$. (b) Inner-shell electrons.