Unit 4 · Classification of Elements

WORKSHEET

Full marks 33

Name _____ Class _____ Roll no. _____ Date _____ Marks _____ / 33

1 Key words [4]

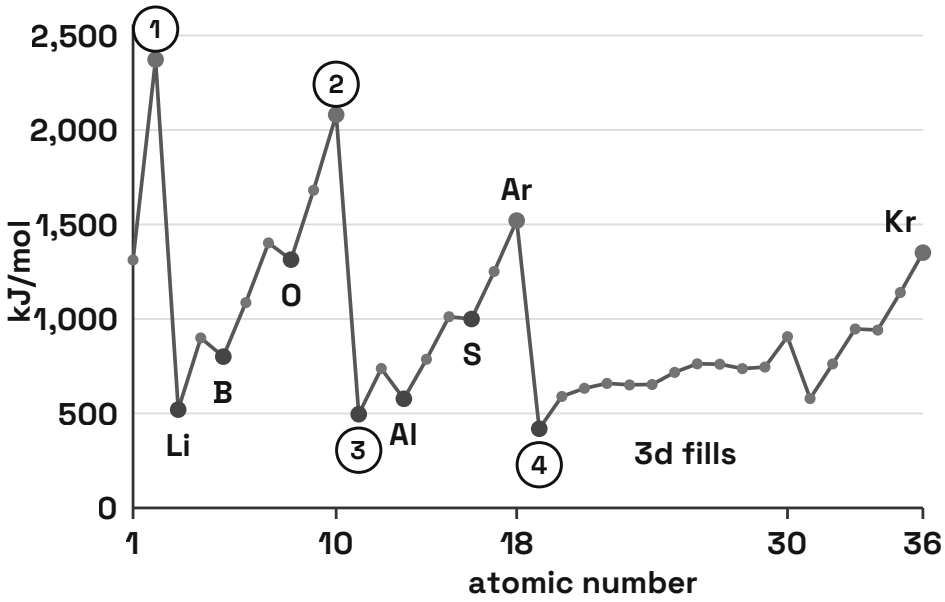
Fill in the blanks with words from the box. Two words in the box are not needed. Each blank carries 0.5 mark.

atomic numbers	**diagonal relationship**	**effective nuclear charge**	**electron affinity**
electronegativity	**groups**	**halogens**	**ionization energy**	**isoelectronic**	**periods**

The modern periodic law says that the properties of the elements are periodic functions of their _____. The vertical columns of the periodic table are called _____, and the elements of group 17 are the _____. Atoms and ions with the same number of electrons are _____. The net positive charge an outer electron actually feels from the nucleus is the _____. The minimum energy needed to remove one mole of electrons from one mole of isolated gaseous atoms is the first _____. The tendency of an atom in a molecule to attract the shared pair of electrons of a bond is its _____. Lithium resembles magnesium, the element diagonally below and to its right: this is the _____.

2 Label the graph [2]

The graph shows the first ionization energy of the elements against atomic number. Write the symbols of the elements at the points marked 1 to 4. Each carries 0.5 mark.



1. _____ 2. _____

3. _____ 4. _____

3 Multiple choice [5]

Choose the correct option for each of the following questions.

i. The modern periodic table arranges the elements in order of increasing: [1]

a. atomic mass
b. atomic number
c. number of neutrons
d. number of valence electrons

ii. Which of these elements is a metalloid? [1]

a. aluminium
b. silicon
c. phosphorus
d. sulphur

iii. An element has the configuration [Ne] $3s^2\ 3p^3$. Where is it in the periodic table? [1]

a. period 3, group 13, p-block
b. period 3, group 15, p-block
c. period 5, group 3, s-block
d. period 3, group 5, d-block

iv. Which of these isoelectronic species is the largest? [1]

a. Mg^{2+}
b. Na^{+}
c. F^{-}
d. O^{2-}

v. Which bond is the most polar? (Pauling electronegativity: C 2.55, N 3.04, O 3.44, F 3.98) [1]

a. C–O
b. C–F
c. N–O
d. C–N

4 Short answers [7]

Write short answers to the following questions.

a. The first ionization energy of magnesium is higher than that of aluminium, though aluminium comes after it in period 3. Why? [2]

b. Across the transition metals from chromium to copper the atomic radius hardly changes. Why? [2]

c. An element X has atomic number 35. Write its electronic configuration, give its period, group and block, and say whether it is a metal or a non-metal. [3]

5 Long answer [4]

Write a long answer to the following question.

Define electronegativity. On what two properties of an atom does it depend? How does it change across a period and down a group, and why? Arrange Na, Mg, Cl and F in order of increasing electronegativity.

6 Numerical problems [8]

Solve the following problems. Show your working. Use Slater's rules where needed, and take 1 eV per atom = 96.5 kJ/mol and $N_A = 6.022 \times 10^{23}\ \text{mol}^{-1}$.

a. Use Slater's rules to find the effective nuclear charge felt by [4]

i. a 3p electron of phosphorus (Z = 15);

ii. a 4s electron of calcium (Z = 20).

Answer:

b. [4]

i. The two nuclei in an iodine molecule, I_2, are 266 pm apart. Find the covalent radius of iodine.

ii. The first ionization energy of sodium is 496 kJ/mol. Find the energy needed to ionize one sodium atom, in eV and in joules.

iii. Using Pauling's values (Na 0.93, C 2.55, Cl 3.16), say whether the C–Cl and Na–Cl bonds are ionic, polar covalent or non-polar covalent.

Answer:

7 Think [3]

Fluorine is the most electronegative element, yet chlorine releases more energy than fluorine when it takes in an electron (349 against 328 kJ/mol). How can both be true?

8 Activity: The elements at home (not marked)

Find eight things at home made mainly of one element, or with one element you can name: foil, a copper wire, a pencil's "lead", an iron nail, a zinc-coated roofing sheet, the chlorine and sodium of table salt, a piece of jewelry. Use a periodic table to fill in the table.

Thing	Element	Symbol	Metal, non-metal or metalloid	Group	Period

Where in the table are most of your elements? Why do you think that is?