

	INDIAN SCHOOL AL WADI AL KABIR		
Class: XI	DEPARTMENT OF SCIENCE -2026-27 SUBJECT: CHEMISTRY		DATE: 07/08/2026
WORKSHEET NO. 3 WITH ANSWERS	TOPIC: CLASSIFICATION OF ELEMENTS AND PERIODICITY IN PROPERTIES		A4 FILE FORMAT
CLASS & SEC:	NAME OF THE STUDENT:		ROLL NO.

Multiple choice questions

- The symbol of an element with atomic number 120 as per IUPAC will be
 (A) unb
 (B) unt
 (C) ubn
 (D) uun
- General outer electronic configuration of *f-block* elements is
 (A) $(n-2) f^{1-14} (n-1) d^{10} ns^2$
 (B) $(n-2) f^{1-10} (n-1) d^{0-1} ns^2$
 (C) $(n-2) f^{1-14} (n-1) d^{0-1} ns^2$
 (D) $(n-2) f^{1-14} (n-1) d^{0-1} np^2$
- The increasing order of effective nuclear charge in Na, Al, Mg and Si atoms
 (A) $Na < Mg < Si < Al$
 (B) $Na < Mg < Al < Si$
 (C) $Mg < Na < Al < Si$
 (D) $Na = Mg = Al = Si$
- The order of screening effect of electrons of s, p, d and f orbitals of a given shell of an atom on its outer shell electrons is
 (A) $s > p > d > f$
 (B) $f > d > p > s$
 (C) $p < d < s > f$
 (D) $f > p > s > d$

5. The group number, number of valence electrons, and valency of an element with the atomic number 15, respectively, are:
 (A) 16, 5 and 2
 (B) 15, 5 and 3
 (C) 16, 6 and 3
 (D) 15, 6 and 2
6. Consider the isoelectronic series: K^+ , S^{2-} , Cl^- and Ca^{2+} , radii of the ions decrease as
 (A) $Ca^{2+} < K^+ > Cl^- > S^{2-}$
 (B) $Cl^- > S^{2-} > K^+ > Ca^{2+}$
 (C) $S^{2-} > Cl^- > K^+ > Ca^{2+}$
 (D) $K^+ > Ca^{2+} > S^{2-} > Cl^-$
7. The maximum covalency of boron is
 (A) 4
 (B) 6
 (C) 2
 (D) 8
8. Which of the following elements has the highest second ionisation energy?
 (A) Calcium
 (B) Magnesium
 (C) Sodium
 (D) Potassium
9. An element X belongs to the 4th period and 15th group of the periodic table. Which of the following statements is true?
 (A) It has a filled s-orbital and a partially filled d-orbital.
 (B) It has filled s- and p- orbitals and a partially filled d- orbital.
 (C) It has filled s- and p- and a half-filled d-orbital.
 (D) It has a half-filled p-orbital and filled s and d orbitals

Assertion Reason type questions

- (A) Both *Assertion* and *Reason* are correct and *Reason* is the correct explanation of *Assertion*.
 (B) Both *Assertion* and *Reason* are correct but *Reason* is not the correct explanation of *Assertion*.
 (C) *Assertion* is correct and *Reason* is wrong.
 (D) *Assertion* is wrong and *Reason* is correct.

10. **Assertion:** Generally, ionisation enthalpy increases from left to right in a period.
Reason: When successive electrons are added to orbitals at the same principal quantum level, the shielding effect of the inner core of electrons does not increase much to compensate for the increased attraction of the electron to the nucleus.
11. **Assertion:** The first ionisation enthalpy of aluminium is lower than that of magnesium.
Reason: The ionic radius of aluminium is smaller than that of magnesium.
12. **Assertion:** The smaller the size of an atom, the greater is the electronegativity.
Reason: Electronegativity refers to the tendency of an atom to share electrons with other atoms
13. **Assertion:** Mg^{2+} and F^- are isoelectronic species.
Reason: Both Mg^{2+} and F^- ions contain the same number of electrons.
14. **Assertion:** The p-Block Elements comprise those belonging to Groups 13 to 18.
Reason: The last electron of the elements of Groups 13 to 18 enters the d orbital.

Short answer type questions (2M)

15. How do atomic radii vary in a group and a period?
16. State the modern periodic law.
17. Determine the position of an element in the periodic table whose atomic number is 32.
18. Name the factors which affect the ionisation enthalpy of an element.

Short answer type questions (3M)

19. What are isoelectronic species? Give any 4 examples.
20. The first ionisation enthalpy of magnesium is higher than that of sodium. On the other hand, the second ionisation enthalpy of sodium is very much higher than that of magnesium. Explain.
21. Arrange the following as stated:
(i) N_2 , O_2 , F_2 , Cl_2 (Increasing order of bond dissociation energy)
(ii) F , Cl , Br , I (Increasing order of electron gain enthalpy)
(iii) F_2 , N_2 , Cl_2 , O_2 (Increasing order of bond length)
22. Consider the following species:
 N^{3-} , O^{2-} , F^- , Na^+ , Mg^{2+} and Al^{3+}
(i) What is common to them?
(ii) Arrange them in the order of increasing ionic radii.
23. I. Indicate the group and the block of the elements with the following valence shell electronic configurations:
(i) $3s^2 3p^3$ (ii) $3d^{10} 4s^2$
II. Explain the following:
(i) Electronegativity of elements increases on moving from left to right in the periodic table.

- (ii) Ionisation enthalpy decreases in a group from top to bottom

Long answer type questions (5M)

24. What is the cause of the periodicity in the properties of the elements? How do the following properties vary in (a) a group and (b) in a period:

- (i) electronegativity
- (ii) ionisation enthalpy
- (iii) Atomic size

25. Give reasons for the following statements:

- (i) Ionisation enthalpy of O is less than that of N.
- (ii) $[\text{AlF}_6]^{3-}$ is known but $[\text{BF}_6]^{3-}$ is not.
- (iii) Electron gain enthalpy of F is less negative than that of Cl.

Passage based questions (4M)

26. The following is a case-based question. Read the passage carefully and answer the questions that follow.

The Periodic Classification of Elements explains the systematic arrangement of elements in the periodic table based on their properties. It traces the development from early classification attempts, like Dobereiner's Triads and Newlands' Law of Octaves, to Mendeleev's Periodic Table, where elements were organised by atomic mass but had anomalies. Based on atomic numbers (Moseley's contribution), the modern periodic table resolved these issues and highlighted periodicity in properties due to repeating electronic configurations. Key periodic trends include a decrease in atomic radius across a period and an increase down a group, an increase in ionisation energy and electronegativity while decreasing down a group, and the opposite trends for metallic character. This classification provides a structured framework for understanding the properties and reactivity of elements. Answer the following questions:

- (i) (a) Predict the formula of the stable binary compound that might be formed by an element with atomic number 114 and fluorine.
- (b) The ionisation enthalpy of nitrogen is more than that of oxygen. Give a reason.
- (ii) The electron affinity values of elements A, B, C and D are respectively -135 , -60 , -200 and -348 kJ mol^{-1} . The outer electronic configuration of element B is:
 - (A) $3s^2 3p^5$
 - (B) $3s^2 3p^3$
 - (C) $3s^2 3p^4$
 - (D) $3s^2 3p^2$
- (iii) The ionic radii of N^{3-} , O^{2-} , F^- and Na^+ follow the order:
 - (A) $\text{N}^{3-} > \text{O}^{2-} > \text{F}^- > \text{Na}^+$
 - (B) $\text{N}^{3-} > \text{Na}^+ > \text{O}^{2-} > \text{F}^-$
 - (C) $\text{Na}^+ > \text{O}^{2-} > \text{N}^{3-} > \text{F}^-$
 - (D) $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{N}^{3-}$

OR

The three elements X, Y and Z are in the third period of the periodic table. The oxides of X, Y and Z is basic, amphoteric and acidic. The correct order of the atomic numbers of X, Y and Z is:

- (A) $X < Z < Y$
- (B) $Z < Y < X$

- (C) $X < Y < Z$
 (D) $Y < X < Z$

ANSWER KEY

1.	(C) ubn
2.	(C) $(n-2) f^{1-14} (n-1) d^{0-1} ns^2$
3.	(B) $Na < Mg < Al < Si$
4.	(A) $s > p > d > f$
5.	(B) 15, 5 and 3
6.	(C) $S^{2-} > Cl^- > K^+ > Ca^{2+}$
7.	(A) 4
8.	(C) Sodium
9.	(D) It has a half-filled p-orbital and filled s and d orbitals
10.	(A) Both Assertion and Reason are correct, and Reason correctly explains Assertion.
11.	(B) Both Assertion and Reason are correct, but Reason is not the correct explanation.
12.	(C) Assertion is correct, Reason is wrong.
13.	(A) Both Assertion and Reason are correct, and Reason correctly explains Assertion.
14.	(C) Assertion is correct, Reason is wrong.
15.	Down a group: Atomic radius increases due to the addition of new electron shells and an increase in the shielding effect. Across a period (left to right): Atomic radius decreases because effective nuclear charge increases.
16.	The physical and chemical properties of elements are periodic functions of their atomic numbers.
17.	Electronic configuration: $[Ar] 3d^{10} 4s^2 4p^2$ • Period: 4 • Group: 14 • Block: p-block
18.	• Atomic size • Effective nuclear charge • Shielding effect • Electronic configuration (stability of half-filled and filled subshells) • Penetration effect
19.	Isoelectronic species are atoms or ions having the same number of electrons. Examples: • F^- • O^{2-} • Na^+ • Mg^{2+}
20.	First IE: Mg has a smaller atomic radius and higher effective nuclear charge than Na, so its first ionisation enthalpy is higher. Second IE: After losing one electron, Na^+ has the stable noble gas configuration (Ne). Removing another electron requires breaking this stable configuration, so the second IE

	is extremely high. In Mg^+, the second electron is still in the 3s orbital, making it easier to remove than from Na^+.
21.	(i) $\text{F}_2 < \text{O}_2 < \text{Cl}_2 < \text{N}_2$ (ii) $\text{I} < \text{Br} < \text{F} < \text{Cl}$ (iii) $\text{N}_2 < \text{O}_2 < \text{F}_2 < \text{Cl}_2$
22.	(i) Common feature All are isoelectronic species (10 electrons). (ii) Increasing ionic radii $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-} < \text{N}^{3-}$
23.	I. (i) $3s^2 3p^3$ - Group: 15 - Block: p-block (ii) $3d^{10} 4s^2$ - Group: 12 - Block: d-block II. (i) Electronegativity increases across a period because effective nuclear charge increases and atomic size decreases. (ii) Ionisation enthalpy decreases down a group because atomic size and shielding increase.
24.	The periodicity in the properties of elements is due to the periodic repetition of similar valence shell electronic configurations as the atomic number increases. Since elements with similar valence electronic configurations have similar chemical properties, these properties recur at regular intervals in the periodic table. (i) Electronegativity - Down a group: Electronegativity decreases because the atomic size increases and the shielding effect increases, reducing the attraction between the nucleus and the bonding electrons. - Across a period: Electronegativity increases from left to right due to an increase in effective nuclear charge and a decrease in atomic size, which increases the attraction for shared electrons. (ii) Ionisation Enthalpy - Down a group: Ionisation enthalpy decreases because the outermost electron is farther from the nucleus and is more effectively shielded by inner electrons, making it easier to remove. - Across a period: Ionisation enthalpy generally increases because the effective nuclear charge increases while the atomic size decreases, resulting in a stronger attraction between the nucleus and the outermost electron. (iii) Atomic Size - Down a group: Atomic size increases due to the addition of new electron shells and increased shielding effect. - Across a period: Atomic size decreases from left to right because the effective nuclear charge increases while the number of electron shells remains the same, pulling the electrons closer to the nucleus.

25.	(i) IE of O is lower than N because O has one paired electron in a p orbital, causing electron-electron repulsion. Nitrogen has the more stable half-filled p^3 configuration. (ii) Al can expand its octet using vacant 3d orbitals, forming $[AlF_6]^{3-}$. Boron has no vacant d orbitals, so $[BF_6]^{3-}$ is not formed. (iii) This is because when an electron is added to F, the added electron goes to the smaller $n = 2$ quantum level and suffers significant repulsion from the other electrons present in this level. For the $n = 3$ quantum level (Cl), the added electron occupies a larger space and the electron-electron repulsion is much less. Therefore, its electron gain enthalpy is less negative than chlorine's.
26.	(i) (a) Element with atomic number 114 belongs to Group 14. Answer: XF_4 (b) Nitrogen has a stable half-filled $2p^3$ configuration. Oxygen has one paired electron in the 2p orbital, making electron removal easier. Hence nitrogen has higher ionisation enthalpy. (ii) (B) $3s^2 3p^3$ (iii) (A) $N^{3-} > O^{2-} > F^- > Na^+$ OR (C) $X < Y < Z$

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