

Exercise-1

▶ Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

Section (A) : Development of Periodic Table, Period, Group and Block

- A-1.▶** Atomic weight of Cl = 35.5 and of I = 127. According to Doeberiner triad rule, atomic. weight of Br will be:
 (1) 80.0 (2) 162.5 (3) 81.25 (4) 91.5
- A-2.** The atomic volume was chosen as the basis of periodic classification of elements by :
 (1) Niels Bohr (2) Mendeleev (3) Lothar Maeyer (4) Newlands
- A-3.** How many periods and vertical columns are there in the long form of the periodic table?
 (1) 8, 12 (2) 6, 8 (3) 7, 18 (4) 6, 18
- A-4.▶** An element has atomic number 37. The block and group of this element are respectively :
 (1) s and 1st (2) p and 17th (3) s and 2nd (4) p and 13th
- A-5.** What is the characteristic valence shell electron configuration of 11th group metals ?
 (1) $ns^2 np^6$ (2) $(n-1)d^2 ns^2$ (3) $nd^9 ns^2$ (4) $(n-1)d^{10} ns^1$
- A-6.▶** There are 10 neutrons in the nucleus of the elements ${}^{29}_{19}\text{M}^{19}$. It belongs to :
 (1) f-block (2) s-block (3) d-block (4) None of these
- A-7.** Pt, Ni, Au and Ti belongs to :
 (1) f-block (2) d-block (3) p-block (4) s-block
- A-8.** Which of the following element is a metalloid ?
 (1) Bi (2) Sn (3) Ge (4) C
- A-9.** Which one of the following statements related to the modern periodic table is **incorrect** ?
 (1) The p-block has 6 columns, because a maximum of 6 electrons can occupy all the orbitals in a p-subshell.
 (2) The d-block has 8 columns, because a maximum of 8 electrons can occupy all the orbitals in a d-subshell.
 (3) Each block contains a number of columns equal to the number of electrons that can occupy that subshell.
 (4) The block indicates value of azimuthal quantum number (l) for the last subshell that received electrons in building up the electronic configuration.

Section (B) : Shielding Effect & Z_{eff}

- B-1.▶** 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 :
 (1) $s > p > d > f$ (2) $f > d > p > s$ (3) $p < d < s > f$ (4) $f > p > s > d$
- B-2.** Which of the following is/are generally true regarding effective nuclear charge (Z_{eff}) :
 (1) It increases on moving left to right in a period.
 (2) It remains almost constant on moving top to bottom in a group.
 (3) For isoelectronic species, as Z increases, Z_{eff} decreases.
 (4) Both (1) and (2).
- B-3.** Among following species which of them have maximum Z_{eff}

- (1) Sn (2) Sn^{4+} (3) In (4) In^+

B-4. From the given set of species, point out the species from each set having highest Z_{eff}

- (a) O^{2-} , F^- , Na^+ (b) Li, Be, Na (c) He, Li^+ , H^-
- | | | | | | | | |
|-----|---------------|----|---------------|-----|-----------------|----|--------------|
| | a | b | c | | a | b | c |
| (1) | Na^+ | Be | Li^+ | (2) | O^{2-} | Li | H^- |
| (3) | F^- | Na | He | (4) | Na^+ | Be | He |

Section (C) : Oxidation states & Inert pair effect

- C-1.** The atomic number of an element which can not show the oxidation state of +3 is-
 (1) 13 (2) 32 (3) 33 (4) 17
- C-2.** The most common oxidation state of an element is -2. The number of electrons present in its outer most shell is -
 (1) 2 (2) 4 (3) 6 (4) 8
- C-3.▲** Most stable oxidation state of gold is :
 (1) +1 (2) +3 (3) +2 (4) zero
- C-4.** Which can have both +ve and -ve oxidation states?
 (1) F (2) I (3) Na (4) He
- C-5.▲** The oxidation state of nitrogen varies from :
 (1) -3 to +5 (2) 0 to +5 (3) -3 to 1 (4) +3 to +5
- C-6.** Which metal exhibits more than one oxidation states?
 (1) Na (2) Mg (3) Al (4) Fe
- C-7.▲** Electrons of which subshell do not participate in bonding due to inert pair effect?
 (1) 6s (2) 6p (3) 5d (4) 4f
- C-8.** Thallium shows different oxidation states because :
 (1) of its high reactivity (2) of inert pair of electrons
 (3) of its amphoteric nature (4) it is a transition metal
- C-9.** In which of the following elements, +3 oxidation state is more stable than +5 ?
 (1) P (2) As (3) N (4) Bi
- C-10.▲** Which of the following is correct order of stability :
 (1) $\text{Tl}^{3+} > \text{Bi}^{3+}$ (2) $\text{PbO}_2 > \text{PbO}$ (3) $\text{BiI}_5 < \text{BiF}_5$ (4) $\text{Sn}^{2+} = \text{Ge}^{2+}$

Section (D) : Atomic and Ionic Radius

- D-1.▲** The atom larger in size as compared to oxygen is :
 (1) F (2) He (3) Ne (4) none of these
- D-2.** Which of the following has the largest ionic radius ?
 (1) Na^+ (2) Cs^+ (3) Ca^+ (4) Mg^+
- D-3.** Which one of the following is the smallest in size ?
 (1) N^{3-} (2) O^{2-} (3) F^- (4) Na^+
- D-4.** In which pair, the second atom is larger than first :

- (1) Br, Cl (2) Na, Mg (3) Sr, Ca (4) N, P

D-5. Which of the following order of radii is correct ?

- (1) $\text{Li} < \text{Be} < \text{Mg}$ (2) $\text{O}^+ < \text{O}^{2-} < \text{N}^{3-}$ (3) $\text{O} < \text{F} < \text{Ne}$ (4) $\text{Na}^+ > \text{F}^- > \text{O}^{2-}$

D-6. Among Cl^- , F^- , Br^- and I^- the correct order of decreasing atomic radii is :

- (1) $\text{I}^- > \text{F}^- > \text{Cl}^- > \text{Br}^-$ (2) $\text{I}^- > \text{Br}^- > \text{Cl}^- > \text{F}^-$ (3) $\text{F}^- > \text{Br}^- > \text{Cl}^- > \text{I}^-$ (4) $\text{F}^- > \text{Cl}^- > \text{Br}^- > \text{I}^-$

D-7. Atomic radii of F & Ne in Angstrom are respectively given by :

- (1) 0.72, 1.60 (2) 1.60, 1.60 (3) 0.72, 0.72 (4) 1.60, 0.72.

D-8. Match list – I with list – II and select the correct answer using the codes given below –

List – I	List – II
Ion	Radius
(I) Li^+	(a) 216
(II) Na^+	(b) 195
(III) Br^-	(c) 60
(IV) I^-	(d) 95

Codes :

	I	II	III	IV		I	II	III	IV
(1)	a	b	d	c	(2)	b	c	a	d
(3)	c	d	b	a	(4)	d	c	b	a

Section (E) : Ionisation Energy

E-1. The first ionisation energy in eV of N & O are respectively given by :

- (1) 14.6, 13.6 (2) 13.6, 14.6 (3) 13.6, 13.6 (4) 14.6, 14.6

E-2. Which electronic configuration of neutral atoms will have the highest first ionisation energy ?

- (1) $1s^2 2s^2 2p^4$ (2) $1s^2 2s^2 2p^3$ (3) $1s^2 2s^2 2p^2$ (4) $1s^2 2s^2 2p^1$

E-3. The first ionization energy is smallest for the atom with electronic configuration :

- (1) $ns^2 np^6$ (2) $ns^2 np^4$ (3) $ns^2 np^5$ (4) $ns^2 np^3$

E-4. The first ionisation energy will be maximum for :

- (1) Be (2) He (3) Li (4) Fe

E-5. Which of the following is incorrect ?

- (1) 1st ionisation energy of Li > 1st ionisation energy of Be
 (2) 1st ionisation energy of Li < 1st ionisation energy of Be
 (3) 1st ionisation energy of Li > 1st ionisation energy of Na
 (4) 1st ionisation energy of He > 1st ionisation energy of Ne

E-6. The first ionisation energy of Na, Mg, Al and Si are in the order :

- (1) $\text{Na} < \text{Mg} < \text{Al} < \text{Si}$ (2) $\text{Na} < \text{Al} < \text{Mg} < \text{Si}$ (3) $\text{Mg} < \text{Na} < \text{Al} < \text{Si}$ (4) $\text{Si} < \text{Mg} < \text{Al} < \text{Na}$

E-7. Ionisation energy :

- (1) increases with an increase in atomic radii.
 (2) is independent of atomic radii.
 (3) decreases with an increase in atomic radii.
 (4) remains constant with an increase or decrease in atomic radii.

E-8. Which of the following orders are correct for the ionization energies ?

- (i) $\text{Ba} < \text{Sr} < \text{Ca}$ (ii) $\text{S}^{2-} < \text{S} < \text{S}^{2+}$ (iii) $\text{C} < \text{O} < \text{N}$ (iv) $\text{Mg} < \text{Al} < \text{Si}$
 (1) i, ii and iv (2) i, iii and iv (3) i, ii and iii (4) i, ii, iii and iv

Section (F) : Electron gain enthalpy (Electron affinity)

- F-1.** Electron affinity is a :
 (1) Relative strength to attract the shared electron pair
 (2) Necessary energy required to remove the electron from the ultimate orbit
 (3) Energy released when an electron is added to the outermost shell
 (4) Energy released when an electron is added to the inner shell
- F-2.** Second electron affinity of an element is :
 (1) Always exothermic
 (2) Endothermic for few elements
 (3) Exothermic for few elements
 (4) Always endothermic
- F-3.** The correct order of electron affinity is :
 (1) $\text{Be} < \text{B} < \text{C} < \text{N}$ (2) $\text{Be} < \text{N} < \text{B} < \text{C}$ (3) $\text{N} < \text{Be} < \text{C} < \text{B}$ (4) $\text{N} < \text{C} < \text{B} < \text{Be}$
- F-4.** For electron affinity of halogens which of the following is correct ?
 (1) $\text{Br} > \text{F}$ (2) $\text{F} > \text{Cl}$ (3) $\text{Br} < \text{Cl}$ (4) $\text{F}^- > \text{I}$
- F-5.** In which case the energy released is minimum?
 (1) $\text{Cl} \rightarrow \text{Cl}^-$ (2) $\text{P} \rightarrow \text{P}^-$ (3) $\text{N} \rightarrow \text{N}^-$ (4) $\text{C} \rightarrow \text{C}^-$
- F-6.** Which of the following configuration will have least electron affinity
 (1) ns^2np^5 (2) ns^2np^2 (3) ns^2np^3 (4) ns^2np^4
- F-7.** Which of the following will have the most negative electron gain enthalpy and which the least negative ?
 (1) F, Cl (2) Cl, F (3) S, Cl (4) Cl, P

Section (G) : Electronegativity

- G-1.** Following the Mulliken scale, what parameters are required to evaluate electronegativity ?
 (1) Only electronegativity (2) Only electron affinity
 (3) Electron affinity and ionization energy (4) Ionic potential and electronegativity
- G-2.** The electronegativity values of C, N, O and F :
 (1) increase from carbon to fluorine.
 (2) decrease from carbon to fluorine.
 (3) increase up to oxygen and is minimum at fluorine.
 (4) is minimum at nitrogen and then increase continuously.
- G-3.** The electronegativity of the following elements increases in the order :
 (1) $\text{C} < \text{N} < \text{Si} < \text{P}$ (2) $\text{N} < \text{Si}, < \text{C} < \text{P}$ (3) $\text{Si} < \text{P} < \text{C} < \text{N}$ (4) $\text{P} < \text{Si} < \text{N} < \text{C}$
- G-4.** Which element has the highest electronegativity?
 (1) F (2) He (3) Ne (4) Na
- G-5.** Increasing order of electronegativity is :
 (1) $\text{Bi} < \text{P} < \text{S} < \text{Cl}$ (2) $\text{P} < \text{Bi} < \text{S} < \text{Cl}$ (3) $\text{C} > \text{F} > \text{N} > \text{O}$ (4) $\text{F} > \text{O} > \text{N} > \text{C}$
- G-6.** The outer most electronic configuration of the most electronegative atom is :
 (1) $ns^2 np^5$ (2) $ns^2 np^6$ (3) $ns^2 np^4$ (4) $ns^2 np^3$
- G-7.** Which of the following is affected by the stable electron configuration of an atom ?
 (i) Electronegativity (ii) Ionisation energy (iii) Electron affinity
 Correct answer is :
 (1) only electronegativity (2) only ionisation potential
 (3) electron affinity and ionisation energy both (4) all of the above

Exercise-2

Marked Questions may have for Revision Questions.

OBJECTIVE QUESTIONS

- According to modern periodic law the elements with similar chemical and physical properties repeat at regular intervals when the elements are arranged in order of :
 (1) decreasing atomic number. (2) increasing atomic weight.
 (3) increasing atomic number. (4) decreasing atomic weight.
- Which one of the following pairs of atomic numbers represents elements belonging to the same group?
 (1) 13 and 31 (2) 11 and 20 (3) 14 and 33 (4) 12 and 30
- Which of the following pairs of elements belongs to representative group of elements in the periodic table?
 (1) Aluminium and Magnesium (2) Chromium and Zinc
 (3) Argentum and Astatine (4) Lanthanum and Thorium
- In the general electronic configuration $(n-2)f^{1-14}(n-1)d^{0-1}ns^2$, if value of $n = 7$ the configuration will be :
 (1) lanthenides (2) actinides (3) transition elements (4) none of these
- In the periodic table, where are non-metals located?
 (1) Between groups II A and III A (2) On the lower left hand side
 (3) On the upper left hand side (4) On the upper right hand side
- Element with electronic configuration as $[\text{Ar}]^{18} 3d^5 4s^1$ is placed in :
 (1) IA, s-block (2) VIA, s-block (3) VIB, s-block (4) VIB, d-block
- Atomic number of Pd is 46. In the same group the atomic number of elements placed above and below Pd will be :
 (1) 37, 67 (2) 28, 78 (3) 39, 69 (4) 18, 28
- The statement that is not correct for the periodic classification of elements is :
 (1) In d-block elements, the last electron enters in $(n-1)d$ sub-shell.
 (2) non-metallic elements are lesser in number than metallic elements.
 (3) the third period contains 8 elements and not 18 as 4th period contains.
 (4) for transition elements the d-subshells are filled with electrons monotonically with increase in atomic number.
- The atomic numbers of the metallic and non-metallic elements which are liquid at room temperature respectively are :
 (1) 55, 87 (2) 33, 87 (3) 35, 80 (4) 80, 35
- The number of d-electrons in Fe^{2+} is not equal to that of the :
 (1) d-electrons in Fe (Atomic number = 26) (2) p-electrons in Ne (Atomic number = 10)
 (3) p-electrons in Cl^- (Atomic number = 17) (4) d-electrons in Co^{3+} (Atomic number = 27)
- Which of the following have higher z_{eff} than Fluorine.
 (1) Cl (2) O (3) F⁻ (4) none of these

12. The oxidation number that iron does not exhibit in its common compounds or in its elemental state is -
 (1) 0 (2) +1 (3) +2 (4) +3
13. Which of the following can show +7 oxidation state?
 (1) Mn (2) F (3) In (4) N
14. Which of following does not exist :
 (1) TiI_3 (2) PbF_4 (3) Both (1) and (2) (4) None of these
15. Elements of which period show maximum inert pair effect :
 (1) 3 (2) 4 (3) 5 (4) 6
16. Select correct statement about radius of an atom.
 (1) Values of Vander Waal's radii are larger than those of covalent radii because the Vander Waal's forces are much weaker than the forces operating between atoms in a covalently bonded molecule.
 (2) The metallic radii are smaller than the vander Wall's radii, since the bonding forces in the metallic crystal lattice are much stronger than the vander Wall's forces.
 (3) Both are correct.
 (4) None is correct.
17. The smallest among these species is :
 (1) lithium (2) lithium ion (3) hydrogen (4) helium
18. In the ions P^{3-} , S^{2-} and Cl^- the increasing order of size is :
 (1) $\text{Cl}^- < \text{S}^{2-} < \text{P}^{3-}$ (2) $\text{P}^{3-} < \text{S}^{2-} < \text{Cl}^-$ (3) $\text{S}^{2-} < \text{Cl}^- < \text{P}^{3-}$ (4) $\text{S}^{2-} < \text{P}^{3-} < \text{Cl}^-$
19. Which series of elements should have nearly the same atomic radii ?
 (1) Na, K, Rb (2) Fe, Co, Ni (3) Li, Be, B (4) F, Cl, Br
20. Which of the following has largest radius -
 (1) $1s^2, 2s^2, 2p^6, 3s^2$ (2) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$
 (3) $1s^2, 2s^2, 2p^6, 3s^2, 3p^2$ (4) $1s^2, 2s^2, 2p^6, 3s^2, 3p^5$
21. Arrange the following in order of increasing atomic radii Na, Si, Al, Ar
 (1) $\text{Na} < \text{Si} < \text{Al} < \text{Ar}$ (2) $\text{Si} < \text{Al} < \text{Na} < \text{Ar}$ (3) $\text{Ar} < \text{Al} < \text{Si} < \text{Na}$ (4) $\text{Na} < \text{Al} < \text{Si} < \text{Ar}$
22. Consider the isoelectronic series : K^+ , S^{2-} , Cl^- and Ca^{2+} , the radii of the ions decrease as :
 (1) $\text{Ca}^{2+} > \text{K}^+ > \text{Cl}^- > \text{S}^{2-}$ (2) $\text{Cl}^- > \text{S}^{2-} > \text{K}^+ > \text{Ca}^{2+}$
 (3) $\text{S}^{2-} > \text{Cl}^- > \text{K}^+ > \text{Ca}^{2+}$ (4) $\text{K}^+ > \text{Ca}^{2+} > \text{S}^{2-} > \text{Cl}^-$
23. Which of the following statement is incorrect for the isoelectronic species ?
 (1) They have same number of electrons.
 (2) Their ionic radii decrease with increase in nuclear charge.
 (3) They have different number of protons.
 (4) None of these
24. The first ionisation potential of Al is smaller than that of Mg because :
 (1) the atomic size of Al > Mg. (2) the atomic size of Al < Mg.
 (3) Al has one unpaired electron in 3p-orbital. (4) Mg has incompletely filled 3s-orbital.
25. Which among the following element have lowest value of first ionisation energy ?
 (1) Pb (2) Sn (3) Si (4) C

26. Which of the following isoelectronic ion has the highest 1st ionization energy ?
 (1) Na⁺ (2) F⁻ (3) Mg²⁺ (4) O²⁻.
27. The first ionization energy of O is less than that of N because :
 (1) the former is more electronegative than later one.
 (2) the former has partially filled electron configuration while later one has half filled electron configuration.
 (3) the former is bigger than that of later one.
 (4) the former has less electron affinity than that of later one.
28. Among the following elements (whose electronic configuration is give below) the one having the highest ionisation energy is :
 (1) [Ne] 3s² 3p³ (2) [Ne] 3s² 3p⁴ (3) [Ne] 3s² 3p⁵ (4) [Ne] 3s²
29. Which of the following is the **correct** order of ionisation energy ?
 (i) Be⁺ > Be (ii) Be > Be⁺ (iii) C > Be (iv) B > Be
 (1) ii, iii (2) iii, iv (3) i, iii (4) None of these
30. With reference to ionisation potential which one of the following sets is correct
 (1) Li > K > B (2) B > Li > K (3) Cs > Li > K (4) Cs < Li < K
31. Which represents alkali metals (i.e. 1 group metals) based on (IE)₁ and (IE)₂ values ?
- | | (IE) ₁ | (IE) ₂ | | (IE) ₁ | (IE) ₂ |
|-------|-------------------|-------------------|-------|-------------------|-------------------|
| (1) X | 100 | 110 | (2) Y | 95 | 120 |
| (3) Z | 195 | 500 | (4) M | 200 | 250 |
32. The successive ionization energies for an unknown element are :
 IE₁ = 899 kJ/mol IE₂ = 1757 kJ/mol.
 IE₃ = 14,847 kJ/mol. IE₄ = 17, 948 kJ/mol.
 To which family in the periodic table does the unknown element most likely belong ?
 (1) Carbon family (2) Boron family
 (3) Alkaline earth metal family (4) Nitrogen family
33. The correct order of second ionisation potential for the given element is :
 (1) C > N > O > F (2) O > N > F > C (3) O > F > N > C (4) F > O > N > C
34. Element X, Y and Z have atomic numbers 19, 37 and 55 respectively. Which of the following statements is true :
 (1) Their ionisation potential would increase with the increasing atomic number
 (2) 'Y' would have an ionisation potential in between those of 'X' and 'Z'.
 (3) 'Z' would have the highest ionisation potential
 (4) 'Y' would have the highest ionisation potential
35. The order of first electron affinity of O, S and Se is :
 (1) O > S > Se (2) S > Se > O (3) Se > O > S (4) S > O > Se
36. The electron affinity values for the halogens shown the following trend :
 (1) F < Cl > Br > I (2) F < Cl < Br < I (3) F > Cl < Br < I (4) F > Cl > Br > I

37. In the process $\text{Cl (g)} + e^- \xrightarrow{\Delta H} \text{Cl}^-(\text{g})$, ΔH is :
 (1) positive (2) negative (3) zero (4) none of these
38. In which of the following processes energy is liberated ?
 (1) $\text{O}^- + e^- \longrightarrow \text{O}^{2-}$ (2) $\text{Cl} \longrightarrow \text{Cl}^+ + e^-$ (3) $\text{Cl} + e^- \longrightarrow \text{Cl}^-$ (4) $\text{Ne} + e^- \longrightarrow \text{Ne}^-$
39. Which of the following orders is incorrect ?
 (1) $\text{F} > \text{N} > \text{C} > \text{Si} > \text{Ga}$ – non –metallic character. (2) $\text{F} > \text{Cl} > \text{O} > \text{N}$ – oxidising property.
 (3) $\text{C} < \text{Si} > \text{P} > \text{N}$ – electron affinity value. (4) None of these.
40. Electron gain enthalpy is positive when :
 (1) O^- is formed from O (2) O^{2-} is formed from O^- .
 (3) O^+ is formed from O (4) electron affinity is always a negative value
41. Electron addition would be easier in :
 (1) S (2) S^+ (3) S^- (4) S^{2+}
42. The elements having very high ionization enthalpy but zero electron gain enthalpy is :
 (1) H (2) F (3) He (4) Be
43. Which one of the following statements is incorrect ?
 (1) Greater is the nuclear charge, greater is the negative electron gain enthalpy.
 (2) Nitrogen has almost zero electron gain enthalpy.
 (3) Electron gain enthalpy decreases from fluorine to iodine in the group.
 (4) Chlorine has highest electron gain enthalpy.
44. If x , y and z are electronegativity, ionisation potential and electron-affinity respectively. Then the electron affinity (z) in the terms of electronegativity (x) and ionisation potential (y) will be :
 (1) $z = \frac{x+y}{2}$ (2) $z = \frac{x-y}{2}$ (3) $z = \frac{x^2 - y^2}{2}$ (4) $z = 2x - y$
45. Which one is not correct statement ?
 (1) IE(I) of He is maximum among all elements. (2) $E_{\text{a}}(\text{I})$ for noble gases is zero/positive.
 (3) Electronegativity is maximum for fluorine. (4) IE(I) for nitrogen is less than that of oxygen.
46. As one move down the group from top to bottom then which one among the following will not be observed?
 (1) Ionisation energy increases (2) Electron affinity decreases
 (3) Electronegativity decreases (4) Atomic radius increases
47. Fluorine has the highest electronegativity among the $ns^2 np^5$ group on the Pauling scale, but the electron affinity of fluorine is less than that of chlorine because :
 (1) the atomic number of fluorine is less than that of chlorine.
 (2) fluorine being the first member of the family behaves in an unusual manner.
 (3) chlorine can accommodate an electron better than fluorine by utilising its vacant $3d$ -orbital.
 (4) small size, high electron density and an increased electron repulsion makes addition of an electron to fluorine less favourable than that in the case of chlorine.
48. Which of the following have no unit ?
 (1) electronegativity (2) electron affinity (3) ionisation energy (4) excitation potential

Exercise-3



PART - I : JEE (MAIN) / AIEEE PROBLEMS (PREVIOUS YEARS)

OFFLINE JEE-MAIN

- Arrange Ce^{+3} , La^{+3} , Pm^{+3} and Yb^{+3} in increasing order of their ionic radii. [AIEEE-2002, 3/225]
 (1) $\text{Yb}^{+3} < \text{Pm}^{+3} < \text{Ce}^{+3} < \text{La}^{+3}$ (2) $\text{Ce}^{+3} < \text{Yb}^{+3} < \text{Pm}^{+3} < \text{La}^{+3}$
 (3) $\text{Yb}^{+3} < \text{Pm}^{+3} < \text{La}^{+3} < \text{Ce}^{+3}$ (4) $\text{Pm}^{+3} < \text{La}^{+3} < \text{Ce}^{+3} < \text{Yb}^{+3}$.
- According to the periodic law of elements, the variation in properties of elements is related to their : [AIEEE-2003, 3/225]
 (1) atomic masses (2) nuclear masses
 (3) atomic numbers (4) nuclear neutron-proton number
- Which one of the following groupings represents a collection of isoelectronic species? [AIEEE-2003, 3/225]
 (At. nos. : Cs-55, Br-35)
 (1) Na^+ , Ca^{2+} , Mg^{2+} (2) N^{3-} , F^- , Na^+ (3) Be , Al^{3+} , Cl^- (4) Ca^{2+} , Cs^+ , Br .
- Which one of the following ions has the highest value of ionic radius ? [AIEEE-2004, 3/225]
 (1) Li^+ (2) B^{3+} (3) O^{2-} (4) F^-
- The formation of the oxide ion $\text{O}^{2-}_{(g)}$ requires first an exothermic and then an endothermic step as shown below :

$$\text{O}_{(g)} + e^- \rightarrow \text{O}^-_{(g)} ; \Delta H^\circ = -142 \text{ kJmol}^{-1}$$

$$\text{O}^-_{(g)} + e^- \rightarrow \text{O}^{2-}_{(g)} ; \Delta H^\circ = 844 \text{ kJmol}^{-1}$$
 This is because : [AIEEE-2004, 3/225]
 (1) oxygen is more electronegative.
 (2) oxygen has high electron affinity.
 (3) O^- ion will tend to resist the addition of another electron.
 (4) O^- ion has comparatively larger size than oxygen atom.
- In which of the following arrangements the order is NOT according to the property indicated against it ? [AIEEE-2005, 3/225]
 (1) $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Na}^+ < \text{F}^-$ – increasing ionic size
 (2) $\text{B} < \text{C} < \text{N} < \text{O}$ – increasing first ionisation enthalpy
 (3) $\text{I} < \text{Br} < \text{F} < \text{Cl}$ – increasing electron gain enthalpy (with negative sign)
 (4) $\text{Li} < \text{Na} < \text{K} < \text{Rb}$ – increasing metallic radius
- Which of the following factors may be regarded as the main cause of lanthanide contraction ? [AIEEE 2005, 4½ / 225]
 (1) Greater shielding of 5d electrons by 4f electrons.
 (2) Poorer shielding of 5d electron by 4f electrons.
 (3) Effective shielding of one of 4f electrons by another in the sub-shell.
 (4) Poor shielding of one of 4f electron by another in the sub-shell.
- The lanthanide contraction is responsible for the fact that : [AIEEE-2005, 3/225]
 (1) Zr and Y have about the same radius (2) Zr and Nb have similar oxidation state
 (3) Zr and Hf have about the same radius (4) Zr and Zn have same oxidation state.
- The increasing order of the first ionization enthalpies of the elements B, P, S and F (lowest first) is : [AIEEE-2006, 4/220]
 (1) $\text{F} < \text{S} < \text{P} < \text{B}$ (2) $\text{P} < \text{S} < \text{B} < \text{F}$ (3) $\text{B} < \text{P} < \text{S} < \text{F}$ (4) $\text{B} < \text{S} < \text{P} < \text{F}$

10.  Lanthanoid contraction is caused due to : [AIEEE-2006, 4/220]
 (1) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
 (2) the appreciable shielding on outer electrons by 5f electrons from the nuclear charge
 (3) the same effective nuclear charge from Ce to Lu
 (4) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge
11. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence. [AIEEE-2007, 3/120]
 (1) $\text{SiX}_2 \ll \text{GeX}_2 \ll \text{SnX}_2 \ll \text{PbX}_2$ (2) $\text{PbX}_2 \ll \text{SnX}_2 \ll \text{GeX}_2 \ll \text{SiX}_2$
 (3) $\text{GeX}_2 \ll \text{SiX}_2 \ll \text{SnX}_2 \ll \text{PbX}_2$ (4) $\text{SiX}_2 \ll \text{GeX}_2 \ll \text{PbX}_2 \ll \text{SnX}_2$
12. The set representing the correct order of ionic radius is : [AIEEE-2009, 4/144]
 (1) $\text{Na}^+ > \text{Li}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$ (2) $\text{Li}^+ > \text{Na}^+ > \text{Mg}^{2+} > \text{Be}^{2+}$
 (3) $\text{Mg}^{2+} > \text{Be}^{2+} > \text{Li}^+ > \text{Na}^+$ (4) $\text{Li}^+ > \text{Be}^{2+} > \text{Na}^+ > \text{Mg}^{2+}$
13. The correct sequence which shows decreasing order of the ionic radii of the elements is : [AIEEE-2010, 4/144]
 (1) $\text{Al}^{3+} > \text{Mg}^{2+} > \text{Na}^+ > \text{F}^- > \text{O}^{2-}$ (2) $\text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+} > \text{O}^{2-} > \text{F}^-$
 (3) $\text{Na}^+ > \text{F}^- > \text{Mg}^{2+} > \text{O}^{2-} > \text{Al}^{3+}$ (4) $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+} > \text{Al}^{3+}$
14. The correct order of electron gain enthalpy with negative sign of F, Cl, Br and I, having atomic number 9, 17, 35 and 53 respectively, is: [AIEEE 2011, 4/120]
 (1) $\text{F} > \text{Cl} > \text{Br} > \text{I}$ (2) $\text{Cl} > \text{F} > \text{Br} > \text{I}$ (3) $\text{Br} > \text{Cl} > \text{I} > \text{F}$ (4) $\text{I} > \text{Br} > \text{Cl} > \text{F}$
15. The increasing order of the ionic radii of the given isoelectronic species is : [AIEEE-2012, 4/144]
 (1) Cl^- , Ca^{2+} , K^+ , S^{2-} (2) S^{2-} , Cl^- , Ca^{2+} , K^+ (3) Ca^{2+} , K^+ , Cl^- , S^{2-} (4) K^+ , S^{2-} , Ca^{2+} , Cl^-
16.  Which of the following represents the correct order of increasing first ionization enthalpy for Ca, Ba, S, Se and Ar ? [JEE(Main)-2013, 4/120]
 (1) $\text{Ca} < \text{S} < \text{Ba} < \text{Se} < \text{Ar}$ (2) $\text{S} < \text{Se} < \text{Ca} < \text{Ba} < \text{Ar}$
 (3) $\text{Ba} < \text{Ca} < \text{Se} < \text{S} < \text{Ar}$ (4) $\text{Ca} < \text{Ba} < \text{S} < \text{Se} < \text{Ar}$
17. The first ionisation potential of Na is 5.1 eV. The value of electron gain enthalpy of Na^+ will be : [JEE(Main)-2013, 4/120]
 (1) -2.55 eV (2) -5.1 eV (3) -10.2 eV (4) +2.55 eV
18. The ionic radii (in Å) of N^{3-} , O^{2-} and F^- are respectively : [JEE(Main)-2015, 4/120]
 (1) 1.36, 1.40 and 1.71 (2) 1.36, 1.71 and 1.40
 (3) 1.71, 1.40 and 1.36 (4) 1.71, 1.36 and 1.40
19. Which of the following atoms has the highest first ionization energy ? [JEE(Main)-2016, 4/120]
 (1) Na (2) K (3) Sc (4) Rb
20. The group having isoelectronic species is : [JEE(Main)-2017, 4/120]
 (1) O^- , F^- , Na, Mg^+ (2) O^{2-} , F^- , Na, Mg^{2+} (3) O^- , F^- , Na^+ , Mg^{2+} (4) O^{2-} , F^- , Na^+ , Mg^{2+}

ONLINE JEE-MAIN

1. Which of the following series correctly represents relation between the elements from X to Y ?
 $\text{X} \rightarrow \text{Y}$ [JEE(Main) 2014 Online (11-04-14), 4/120]
 (1) ${}^3\text{Li} \rightarrow {}^{19}\text{K}$ Ionization enthalpy increases (2) ${}^9\text{F} \rightarrow {}^{35}\text{Br}$ Electron gain enthalpy
 (3) ${}^6\text{C} \rightarrow {}^{32}\text{Ge}$ Atomic radii increases (4) ${}^{18}\text{Ar} \rightarrow {}^{54}\text{Xe}$ Noble character increases

2. Similarity in chemical properties of the atoms of elements in a group of the periodic table is most closely related to : **[JEE(Main) 2014 Online (12-04-14), 4/120]**
 (1) atomic numbers (2) atomic masses
 (3) number of principal energy levels (4) number of valence electrons
3. Which of the following arrangements represents the increasing order (smallest to largest) of ionic radii of the given species O^{2-} , S^{2-} , N^{3-} , P^{3-} ? **[JEE(Main) 2014 Online (15-04-14), 4/120]**
 (1) $O^{2-} < N^{3-} < S^{2-} < P^{3-}$ (2) $O^{2-} < P^{3-} < N^{3-} < S^{2-}$
 (3) $N^{3-} < O^{2-} < P^{3-} < S^{2-}$ (4) $N^{3-} < S^{2-} < O^{2-} < P^{3-}$
4. Which one of the following has largest ionic radius ? **[JEE(Main) 2014 Online (19-04-14), 4/120]**
 (1) Li^+ (2) O^{2-} (3) B^{3+} (4) F^-
5. In the long form of the periodic table, the valence shell electronic configuration of $5s^2 5p^4$ corresponds to the element present in : **[JEE(Main) 2015 Online (10-04-15), 4/120]**
 (1) Group 17 and period 6 (2) Group 17 and period 5
 (3) Group 16 and period 6 (4) Group 16 and period 5
6. The following statements concern elements in the periodic table. Which of the following is true? **[JEE(Main) 2016 Online (10-04-16), 4/120]**
 (1) The Group 13 elements are all metals.
 (2) All the elements in Group 17 are gases.
 (3) Elements of Group 16 have lower ionization enthalpy values compared to those of Group 15 in the corresponding periods.
 (4) For Group 15 elements, the stability of +5 oxidation state increases down the group.
7. Consider the following ionization enthalpies of two elements 'A' and 'B' **[JEE(Main) 2017 Online (08-04-17), 4/120]**

Element	Ionization enthalpy (kJ/mol)		
	1 st	2 nd	3 rd
A	899	1757	14847
B	737	1450	7731

Which of the following statements is correct ?

- (1) Both 'A' and 'B' belong to group-1 where 'B' comes below 'A'.
 (2) Both 'A' and 'B' belong to group-2 where 'A' comes below 'B'.
 (3) Both 'A' and 'B' belong to group-2 where 'B' comes below 'A'.
 (4) Both 'A' and 'B' belong to group-1 where 'A' comes below 'B'.
8. The electronic configuration with the highest ionization enthalpy is :
 (1) $[Ne] 3s^2 3p^1$ (2) $[Ne] 3s^2 3p^2$ (3) $[Ne] 3s^2 3p^3$ (4) $[Ar] 3d^{10} 4s^2 4p^3$

PART - II : JEE (ADVANCED) / IIT-JEE PROBLEMS (PREVIOUS YEARS)

1. The incorrect statement among the following is : **[JEE- 1997(Cancelled), 2/200]**

- (A) the first ionization energy of Al is less than first ionization energy of Mg.
 (B) the second ionization energy of Mg is greater than second ionization energy of Na.
 (C) the first ionization energy of Na is less than first ionization energy of Mg.
 (D) the third ionization energy of Mg is greater than third ionization energy of Al.

2. **Assertion** : F atom has a less negative electron affinity than Cl atom. [JEE-1998, 2/200]
Reason : Additional electrons are repelled more effectively by 3p electrons in Cl atom than by 2p electrons in F atom.
 (A) Both Assertion and Reason are true, and Reason is the correct explanation of Assertion.
 (B) Both Assertion and Reason are true, but Reason is not correct explanation of Assertion.
 (C) Assertion is true but Reason is false.
 (D) Assertion is false but Reason is true.
3. The correct order of radii is : [JEE-2000, 1/35]
 (A) $N < Be < B$ (B) $F^- < O^{2-} < N^{3-}$ (C) $Na < Li < K$ (D) $Fe^{3+} < Fe^{2+} < Fe^{+4}$
4. **Assertion** : The first ionization energy of Be is greater than that of B. [JEE-2000, 1/35]
Reason : 2p orbital is lower in energy than 2s.
 (A) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.
 (B) Both Assertion and Reason are true but Reason is not correct explanation of Assertion.
 (C) Assertion is true but Reason is false.
 (D) Assertion is false but Reason is true.
5. The set representing the correct order of first ionization potential is : [JEE-2001, 1/35]
 (A) $K > Na > Li$ (B) $Be > Mg > Ca$ (C) $B > C > N$ (D) $Ge > Si > C$
6. Identify the least stable ion amongst the following : [JEE-2002, 3/90]
 (A) Li^- (B) Be^- (C) B^- (D) C^-
7. **Statement-1** : Pb^{4+} compounds are stronger oxidizing agents than Sn^{4+} compounds [JEE-2008, 3/163]
Statement-2 : The higher oxidation states for the group 14 elements are more stable for the heavier members of the group due to 'inert pair effect'.
 (A) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1.
 (B) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1.
 (C) Statement-1 is True, Statement-2 is False
 (D) Statement-1 is False, Statement-2 is True

Answers

EXERCISE - 1

A-1. (3)	A-2. (3)	A-3. (3)	A-4. (1)	A-5. (4)
A-6. (4)	A-7. (2)	A-8. (3)	A-9. (2)	B-1. (1)
B-2. (4)	B-3. (2)	B-4. (1)	C-1. (2)	C-2. (3)
C-3. (4)	C-4. (2)	C-5. (1)	C-6. (4)	C-7. (1)
C-8. (2)	C-9. (4)	C-10. (3)	D-1. (3)	D-2. (2)
D-3. (4)	D-4. (4)	D-5. (2)	D-6. (2)	D-7. (1)
D-8. (3)	E-1. (1)	E-2. (2)	E-3. (2)	E-4. (2)
E-5. (1)	E-6. (2)	E-7. (3)	E-8. (3)	F-1. (3)
F-2. (4)	F-3. (2)	F-4. (3)	F-5. (3)	F-6. (3)
F-7. (4)	G-1. (3)	G-2. (1)	G-3. (3)	G-4. (1)
G-5. (1)	G-6. (1)	G-7. (3)		

EXERCISE - 2

1. (3)	2. (1)	3. (1)	4. (2)	5. (4)
6. (4)	7. (2)	8. (4)	9. (4)	10. (3)
11. (4)	12. (2)	13. (1)	14. (1)	15. (4)
16. (3)	17. (3)	18. (1)	19. (2)	20. (1)
21. (2)	22. (3)	23. (4)	24. (3)	25. (2)
26. (3)	27. (2)	28. (3)	29. (3)	30. (2)
31. (3)	32. (3)	33. (3)	34. (2)	35. (2)
36. (1)	37. (2)	38. (3)	39. (4)	40. (2)
41. (4)	42. (3)	43. (3)	44. (4)	45. (4)
46. (1)	47. (4)	48. (1)		

EXERCISE - 3

PART - I

OFFLINE JEE-MAIN

1. (1)	2. (3)	3. (2)	4. (3)	5. (3)
6. (2)	7. (4)	8. (3)	9. (4)	10. (4)
11. (1)	12. (1)	13. (4)	14. (2)	15. (3)
16. (3)	17. (2)	18. (3)	19. (3)	20. (4)

ONLINE JEE-MAIN

1. (3)	2. (4)	3. (1)	4. (2)	5. (4)
6. (3)	7. (3)	8. (3)		

PART - II

1. (B)	2. (C)	3. (B)	4. (C)	5. (B)
6. (B)	7. (C)			