Self Practice Paper (SPP)

1. The elements which exhibit both vertical and horizontal similarities are :
(1) inert gas elements (2) representative elements
(3) transition elements (4) none of these

2. Of the following pairs, the one containing examples of metalloid elements is :
(1) B and Al (2) Ga and Ge (3) Al and Si (4) As and Sb

3. Which of the following is the wrong statement ?
(1) All the actinide elements are radioactive.
(2) Alkali and alkaline earth metals are s-block elements.
(3) Pnicogens and halogens are p-block elements.
(4) The first member of the lanthanide series is lanthanum.

4. Atomic number of 15, 33, 51 represents the following family :
(1) carbon family (2) nitrogen family (3) oxygen family (4) None of these

5. In a given energy level, the order of penetration effect of different orbitals is :
(1) f < p < d < s (2) s < p < d < f (3) f < d < p < s (4) s = p = d = f

6. Which of the following is correct order of Z_{eff} :
(1) $I^- > I > I^+$ (2) $Mg^{2+} > Na^+ > F^-$ (3) $P^{5+} < P^{3+}$ (4) Li > Be >B

7. In Sodium atom on 3s electron the screening is due to :
(1) $3s^2$, $3p^6$ (2) $4s^1$ (3) $1s^2$, $2s^2$, $2p^6$ (4) $3s^1$

8. Which of the following elements can have negative oxidation states.
(1) Al (2) Ca (3) Fe (4) B

9. What is correct order of reducing capacity :
(1) $Ye^{2+} > Sn^{2+} > Pb^{2+}$ (2) $Ye^{2+} < Sn^{2+} < Pb^{2+}$ (3) $Ye^{2+} \approx Sn^{2+} \approx Pb^{2+}$ (4) $Pb^{2+} > Ye^{2+} > Sn^{2+}$

10. Inert pair effect is observed in elements of which block :
(1) s (2) p (3) d (4) f

11. Which of the following order of radii is correct :
(1) Li < Be < Mg (2) $H^+ < Li^+ < H^-$ (3) O < F < Ne (4) Li < Na < K < Cs < Rb

12. The lanthanide contraction refers to :
(1) radius of the series. (2) valence electrons of the series.
(3) the density of the series. (4) electronegativity of the series.

13. Which of the following statement is correct with respect to the property of elements in the carbon family with an increase in atomic number, their :
(1) Atomic size increases (2) Ionization energy increases
(3) Metallic character decreases (4) Stability of + 4 oxidation state increases

14. Which group of atoms have nearly same atomic radius :
(1) Na, K, Rb, Cs (2) Li, Be, B, C (3) Fe, Co, Mn (4) F, Cl, Br, I

15. The incorrect order of radius is/are :
(1) $Cu^- > Cu > Cu^+$ (2) $Sc^{3+} > K^+ > S^{2-}$ (3) Ni < Cu < Zn (4) All of these

16. The second ionization enthalpies of elements are always higher than their first ionization enthalpies because:
(1) cation formed always have stable half filled or completely filled valence shell electron configuration.
(2) it is easier to remove electron from cation.
(3) ionization is an endothermic process.
(4) the cation is smaller than its parent atom.

17. A large difference between the third and fourth ionization energies indicates the presence of :
(1) 4 valence electrons in an atom (2) 5 valence electrons in an atom
(3) 3 valence electrons in an atom (4) 2 valence electrons in an atom

18. The ionization enthalpy will be highest when the electron is to be removed from ..... if other factors are equal :
(1) s-orbital (2) p-orbital (3) d-orbital (4) f-orbital

19. The atomic number of Vanadium (V), Chromium (Cr), Manganese (Mn) and Iron (Fe) are respectively 23, 24, 25 and 26 which one of these may be expected to have the highest second Ionization enthalpy.
(1) V (2) Cr (3) Mn (4) Fe

20. For which of the following species 2^{nd} IE < 1^{st} IE
(1) Be (2) Ne (3) Na^+ (4) None of these

21. With reference to 1^{st} IP which are correct.
(1) Li < C (2) O < N (3) Be < N < Ne
(1) a, b only (2) b, c only (3) a, c only (4) a, b & c

22. Values of 1^{st} four ionisaiton energies (kJ/mol) of an element are respectively 496, 4563, 6913, 9541 ; the electronic configuration of that element can be.
(1) $1s^2, 2s^1$ (2) $1s^2\ 2s^2\ 2p^1$ (3) $1s^2, 2s^2, 2p^6\ 3s^1$ (4) (3) and (2) both

23. Which one of the following statements is correct ?
(1) The elements having large negative values of electron gain enthalpy generally act as strong oxidising agents.
(2) The elements having low values of ionisation enthalpies act as strong reducing agents.
(3) The formation of $S^{2-}(g)$ from S(g) is an endothermic process.
(4) All of these.

24. For magnitude of electron gain enthalpy of chalcogens and halogens, which of the following options is correct?
(1) Br > F (2) S > F (3) O < Cl (4) S < Se

25. The correct order of electron gain enthalpy (most endothermic first and most exothermic last) is :
(1) Be < B < C < N (2) Be < N < B < C (3) N < Be < C < B (4) N < C < B < Be

26. $\frac{N_0}{2}$ atoms of X (g) are converted into X^- (g) by absorbing E_1 energy. $2N_0$ atoms of X (g) are converted into $X^-(g)$ by releasing E_2 energy. Calculate ionisation enthalpy and electron gain enthalpy of X(g) per atom.

(1) I.E. = $\frac{2E_1}{N_0}$, $\Delta_{eq}H = -\frac{E_2}{2N_0}$ (2) I.E. = $-\frac{E_2}{2N_0}$, $\Delta_{eq}H = \frac{2E_1}{N_0}$

(3) I.E. = $\frac{E_1}{2N_0}$, $\Delta_{eq}H = -\frac{E_2}{2N_0}$ (4) I.E. = $\frac{N_0}{2E_1}$, $\Delta_{eq}H = -\frac{2N_0}{E_2}$

27. The formation of the oxide ion, $O^{2-}(g)$, from oxygen atom requires first an exothermic and then an endothermic step as shown below :

$O(g) + e^- \longrightarrow O^-(g)$; $\Delta_{eg}H = -141$ kJmol^{-1}

$O^-(g) + e^- \longrightarrow O^{2-}(g)$; $\Delta_{eg}H = +780$ kJmol^{-1}

Thus process of formation of O^{2-} in gas phase is unfavourable even though O^{2-} is isoelectronic with neon. It is due to the fact that :

(1) oxygen is more electronegative.
(2) addition of electron in oxygen results in larger size of the ion.
(3) electron repulsion outweighs the stability gained by achieving noble gas configuration.
(4) O^- ion has comparatively smaller size than oxygen atom.

28. The properties which are not common to both groups 1 and 17 elements in the periodic table are :

(1) Elelctropositive character increase down the gorups.
(2) Reactivity decrease from top to bottom in these groups.
(3) Atomic radii increase as the atomic number increase.
(4) Electronegativity decrease on moving down a group.

29. The correct set of decreasing order of electronegativity is :

(1) Li, H, Na (2) Na, H,Li (3) H, Li, Na (4) Li, Na, H

30. Which of the following is most electronegative in p-block elements

(1) Oxygen (2) Chlorine (3) Fluorine (4) Phosphorus

31. The IP_1, IP_2, IP_3, IP_4 and IP_5 of an element are 7.1, 14.3, 34.5, 46.8, 162.2 eV respectively. The element is likely to be

(1) Na (2) Si (3) F (4) Ca

32. IE_1 and IE_2 of Mg are 178 and 348 K, cal mol^{-1}. The enthalpy required for the reaction $Mg \longrightarrow Mg^{2+} + 2e^-$ is

(1) +170 K. cal (2) +526 K.cal (3) –170 K.cal (4) –526 K.cal

33. The correct order of decreasing first ionization energy is :

(1) Si > Al > Mg > Na (2) Si > Mg > Al > Na (3) Al > Si > Mg > Na (4) none of these

34. In which of the following configuration, there will be large difference between second and third ionisation energies ?

(1) $1s^2, 2s^2, 2p^6, 3s^1$ (2) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$ (3) $1s^2, 2s^2, 2p^6, 3s^2, 3p^6$ (4) $1s^2, 2s^2, 2p^6, 3s^2$

35. Elements which occupied position in the Lother Maeyer curve, on the peaks, were :

(1) Alkali metals (2) Highly electro positive elements
(3) Elements having large atomic volume (4) All

36. Which of the following is not isoelectronic series ?

(1) Cl^-, P^{3-}, Ar (2) N^{3-}, Ne, Mg^{2+} (3) B^{3+}, He, Li^+ (4) F^-, S^{2-}, N^{3-}

37. Correct orders of 1st ionisation energies are :

(i) Li < B < Be < C (ii) O < N < F (iii) Be < N < Ne

(1) (i), (ii) (2) (ii),(iii) (3) (i),(iii) (4) (i),(ii),(iii)

38. Which is a true statement ?

(1) Larger is the value of ionisation energy easier is the formation of cation.
(2) Larger is the value of electron affinity easier is the formation of anion.
(3) Larger is the value of ionisation energy as well as electron affinity the smaller is the electronegativity of atom.
(4) Larger is the Z_{eff} larger is the size of atom.

39. $\overset{1}{H}C \equiv \overset{2}{C} - \overset{3}{C}H = \overset{4}{C}H - \overset{5}{C}H_3$ Which carbon atom will show minimum electronegativity :

(1) Fifth (2) Third (3) First (4) Second

40. Arrange F, C, N, O in the decreasing order of electronegativity :

(1) O > F > N > C (2) F > N > C > O (3) C > F > N > O (4) F > O > N > C

41. Among O,C,F,Cl,Br the correct order of increasing atomic radii is :

(1) F < O < C < Cl < Br (2) F < C < O < Br < Cl

(3) F < Cl < Br < O < C (4) C < O < F < Cl < Br

42. The values of IE(I), IE(II), IE(III), and IE(IV),of an atom are respectively 7.5 eV, 25.6 eV, 48.6 eV and 170.6 eV. The electronic configuration of the atom will be :

(1) $1s^2, 2s^2, 2p^6, 3s^1$ (2) $1s^2, 2s^2, 2p^6, 3s^2, 3p^1$

(3) $1s^2, 2s^2, 2p^6, 3s^2, 3p^3$ (4) $1s^2, 2s^2, 2p^6, 3s^2$

43. The first (IE_1) and second (IE_2) ionization energies (kJ/mol) of a few elements designated by Roman numerals are given below. Which of these would be an alkali metal ?

	IE_1	IE_2		IE_1	IE_2
(1) I	2372	5251	(2) II	520	7300
(3) III	900	1760	(4) IV	680	7800

44. In the formation of a chloride ion, from as isolated gaseous chlorine atom, 3.8 eV energy is released, which would be qual to :

(1) Electron affinity of Cl^- (2) Ionisation potential of Cl

(3) Electronegativity of Cl (4) Ionisation potential of Cl^-

45. Ionisation potential of Na would be numerically the same as :

(1) electron affinity of Na^+ (2) electronegativity of Na^+

(3) electron affinity of He (4) ionisation potential of Mg

SPP Answers

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

SPP Solutions

2. As and Sb behave as metals as well as nonmetals because they form cations (M^{3+}) and anions (M^{3-}). Their oxides and hydroxides react with acid as well as base forming corresponding salts.

3. The first member of the lanthanide series is Cerium (Z= 58).

4. $Z = 15 = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^3$; so element belongs to p-block. Thus its group number will be 10 + 2 + 3 = 15.
$Z = 33 = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^{10}\ 4s^2\ 4p^3$; so element belongs to p-block. Thus its group number will be 10 + 2 + 3 = 15.
$Z = 51 = [Kr]^{36}\ 4d^{10}\ 5s^2\ 5p^3$; so element belongs to p-block. Thus its group number will be 10 + 2 + 3 = 15.
Hence, all these elements belongs to 15^{th} group i.e. nitrogen family.

5. The order of penetration effect of different orbitals depends upon the different energies of the various sub-shells for the same energy level, e.g., electrons in s-subshell will have lowest energy and thus will be closest to the nucleus and will have highest penetration power, while p-subshell electrons will penetrate the electron cloud to lesser extent and so on.

11. Atomic radius increases on moving top to bottom in a group due to increasing number of shells. However, it decreasing on moving left to right in a period due to increasing Z_{eff} and addition of electrons to the same shell.
For H; cation is smaller than parent atom while anion is bigger than parent atom. H^- and Li^+ are isoelectronic species. So, ionic size $\propto \frac{1}{\text{nuclear charge}}$. Hence the correct order is $H^+ < Li^+ < H^-$.

12. Due to 4f-orbital electrons (poor shielding effect), there is increase in effective nuclear charge which leads to the contraction of the size of atoms. This is called lanthanide contraction.

16. As elements are ionized, the proton to electron ratio increases, so the attraction between valence shell electron and nucleus increases and as a result the size decreases. Therefore, the removal of electron from smaller cation requires higher energy. Hence the second ionisation enthalpy is greater than its first ionisation enthalpy.

17. For possible $ns^2\ np^1$ configuration, the removal of fourth electron will be possibly from an inert gas electron configuration. So there will be high jump in the fourth ionisation enthalpy than the third ionisation enthalpy which will take place from ns^1 electron configuration.

18. The increasing order of 1st ionisation energy is f < d < p < s because of the increasing order of the penetration of the electrons as f < d < p < s if all other factors are same.

23. The elements having large negative values of electron gain enthalpy generally act as strong oxidising agents. E.g. Halogens.
(2) The elements having low values of ionisation enthalpies act as strong reducing agents.E.g. Alkali metals.
(3) The formation of $S^{2-}(g)$ from S(g) is an endothermic process. ($\Delta_{eg}H_1$ = small negative value, $\Delta_{eg}H_2$ = large positive value).

24. Order of $\Delta_{eg}H$ for halogens : Cl > F > Br > I & Order of $\Delta_{eg}H$ for chalcogens : S > Se > Te > Po > O.
Cl and F have the highest and IInd highest values in Modern periodic table.

25. Be and N has $1s^2\ 2s^2$ and $1s^2\ 2s^2\ 2p^3$ stable configurations respectively. So addition of extra electron is difficult in their valence shell. The atomic size of C is smaller than B and also C has higher nuclear charge; so addition of electron will be easier in C than B.

26. $X(g) \longrightarrow X^+(g) + e^-$

If I.E. is ionisation enthalpy, then

$\therefore \quad \frac{N_0}{2}$ (I.E.) = E_1

$\therefore \quad$ I.E. = $\frac{2E_1}{N_0}$

$X(g) + e^- \longrightarrow X^-(g)$

If $\Delta_{eg}H$ is electron gain enthalpy, then

$\therefore \quad 2N_0$(E.A.) = $-E_2$

$\therefore \quad \Delta_{eg}H = -\frac{E_2}{2N_0}$.

27. There is electrostatic repulsion between the two species having same type of charge. So energy has to be given for the addition of additional electron to O^-.

32. $Mg \rightarrow Mg^+ + e^-$ $\quad \Delta H_1$ = 178 Kcal

$Mg^+ \rightarrow Mg^{2+} + e^-$ $\quad \Delta H_2$ = 348 Kcal

So, ΔH of $Mg \longrightarrow Mg^{2+} + 2e^-$ is $\Delta H_1 + \Delta H_2$ = 178 + 348 = 526 Kcal.

33. It can be seen by electronic configuration.

36. The number of electrons present are not same. F^- = 10 electrons, S^{2-} = 18 electrons, N^{3-} = 10 electrons.

38. (1) Larger the value of ionisation energy, more difficult will be the removal of electron to form cation.
(2) Electron affinity is the measure of the ease with which an atom receives the additional electron in its valence shell in gaseous phase.
(3) Electronegativity (Mulliken's) = $\frac{\text{Ionisation energy} + \text{Electron affinity}}{2}$.
(4) As Z_{eff} increases, the valence shell as well as inner shells electrons are more strongly attracted by the nucleus. This causes the contraction in atomic size.

42. As fourth electron is to be removed from inert gas configuration i.e. $1s^2$, $2s^2$, $2p^6$. Thus I.E. (IV) is very high.

45. IE_1 of M = EA of M^+.