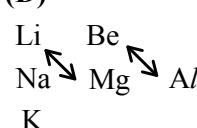


Periodic Properties (Booklet Solution)

Foundation Builders (Objective)

- (B)**
Law of triads states that in the set of three elements arranged in increasing order of atomic weight, having similar properties, the atomic weight of middle element is the arithmetic mean of other two.
- (C)**
Transition elements are those in which electron are filled in d-orbitals.
- (D)**
P-block elements are also known as representative element.
- (A)**
Covalent radii < crystal radii < vanderwaal radii.
- (B)**
Noble gases are placed in zero group but has 2 or 3 electrons in its valence shell.
- (B)**
 $N_2 = 14e^-$ & $CO = 14e^-$
- (C)**
Fact
- (C)**
Fourth period of periodic table has 3d electron filling, not 4d.
- (D)**
 Fe^{2+} has 4 unpaired electron.
- (B)**
For compound to be coloured either cation or anion has unpaired electron.
 ${}_{29}Cu^{2+} : [Ar]3d^9$
- (D)**
C & N^+ has 6 electrons in it.
- (B)**
All the species has $14e^-$ in it.
- (B)**
For iso-electronic species, more negatively charged ion is more bigger in size.
- (C)**
Same as above.
- (B)**
Same as above.
- (D)**
For same atom more positive charged species is smaller one.

17. **(B)**
For an isoelectronic species, negatively charged species is more bigger than positively charged species.
18. **(A)**
More is the P/e ratio smaller is the radius.
19. **(B)**
 $r_{\text{Na}^+} < r_{\text{F}^-}$
 $r_{\text{F}^-} < r_{\text{Cl}^-}$
 $r_{\text{Cl}^-} < r_{\text{S}^{2-}}$
 $\therefore r_{\text{Na}^+} < r_{\text{F}^-} < r_{\text{Cl}^-} < r_{\text{S}^{2-}}$
20. **(B)**
Across a period, as Z_{eff} increases. Atomic radii decreases.
21. **(A)**
For isoelectronic species
Radius of cation < radius of neutral
Atom < radius of anion
22. **(C)**
For same atom
 $r_{\text{cation}} < r_{\text{atom}} < r_{\text{anion}}$
23. **(A)**
Na > Mg (Across a period size decreases)
Na > Na⁺
Mg > Mg²⁺
24. **(B)**
For an isoelectronic species, more positive charged ion, smaller in the size. More is the negative charge on anion, more is the size.
25. **(D)**

 Li Be
 Na Mg Al
 K
26. **(C)**
Ionisation energy $\propto \frac{1}{\text{size}}$
But in a period stable configuration is preferred as size change is not very significant.
27. **(B)**
 $\text{Mg} \longrightarrow \text{Mg}^+ + e^- \quad \Delta H_1 = 1P_1 = 178 \text{ kcal mol}^{-1}$
 $\text{Mg}^+ \longrightarrow \text{Mg}^{2+} + e^- \quad \Delta H_2 = 1P_2 = 348 \text{ kcal mol}^{-1}$
 $\text{Mg} \longrightarrow \text{Mg}^{2+} + 2e^- \quad \Delta H = \Delta H_1 + \Delta H_2$
 $\quad \quad \quad \quad \quad \quad = 178 + 348$

$$= 526 \text{ kcal mol}^{-1}$$

28. (B)
 $\therefore 1P_5$ is very high i.e removal of 5th electron is very difficult. It means after removal of 4e⁻ species has acquired very stable configuration.
29. (B)
 $IE_n > IE_{n-1} > IE_{n-2} \dots > IE_2 > IE_1$
30. (B)
 I.E for electron is 3P > 4P
 3P³ is half filled than p¹ & p²
31. (B)

$$\underset{(2,8,1)}{\text{Mg}^+} \longrightarrow \underset{(2,8)}{\text{Mg}^{2+}} + e^- \text{ (I.E}_2\text{) Mg}$$

$$\underset{(2,8)}{\text{Na}^+} \longrightarrow \underset{(2,7)}{\text{Na}^{2+}} + e^- \text{ (I.E}_2\text{) Na}$$
 Inert gas configuration.
 $\therefore (\text{I.E})_2 \text{ Na} > (\text{I.E}_2) \text{ Mg}$
32. (A)
 Electronegativity $\propto \frac{1}{\text{size}}$
 Ionisation Energy $\propto \frac{1}{\text{size}}$
 \therefore I. E is less for left side, metal as their size is more, so they are more reactive.
 down the group. I. E decreases & hence reducing power decreases.
33. (C)
 ${}_5\text{B} : 1S^2 2S^2 2P^1$
 ${}_4\text{Be} : 1S^2 2S^2$: Full filled configuration is more stable.
34. (B)
 If $(\text{I.E}_2 - \text{I.E}_1) > 16\text{ev / atom}$, then lower oxidation state is more stable.
35. (D)
 For isoelectronic species,

$$\text{I.E} \propto \frac{1}{\text{size}}$$
 S^{2-} has maximum ionic radii & hence lowest I.E.
36. (C)

$$\text{I.E} \propto \frac{1}{\text{size}}$$
 \therefore size of Na is between Li & K.
 It I. E will also be in between the I.E. value of Li & K.
37. (C)
 I.E. increases tremendously when no. of reduces.
 $\text{I.E}_4 \gg \gg \text{I.E}_3$, means valence electron is 3

38. (A)
 $\text{Na} \longrightarrow \text{Na}^+ + e^- \quad \Delta H_1 = (\text{I.E.}_1)_{\text{Na}}$
 $\text{Na}^+ + e^- \longrightarrow \text{Na} \quad \Delta H_2 = -(\text{E.A.})_{\text{Na}^+}$
 $|\Delta H_1| = |\Delta H_2|$
39. (C)
 $\text{O} \xrightarrow{+e^-} \text{O}^- \quad \Delta H_{\text{eg}_1} = (-ve)$
 $\text{O}^- \xrightarrow{+e^-} \text{O}^{2-} \quad \Delta H_{\text{eg}_2} = +ve$
 $\text{O}^- \xrightarrow{+2e^-} \text{O}^{2-} \quad (\Delta H_{\text{eg}})_{\text{total}} = +ve$
 $\therefore \Delta H_{\text{eg}_2}$ for all element is positive.
40. (A)
 $\chi_0 > \chi_N$
 $\therefore (\text{E.A.})_O > (\text{E.A.})_N \quad \because$ Repulsion offered to incoming e^- in 3P orbital will be very less as compared to 2P orbital.
41. (D)
 Negative anion species will repel incoming electron due to same charge repulsion.
42. (B)
 Be is more stable due to fulfilled as subshell. Be^- is formed over coming this stability, so more energy is taken by Be. Hence it is least stable.
43. (C)
 Electron affinity (E. A)
 E. A \propto depends on repulsion to incoming electron mainly.
 E. A \propto electronegativity
44. (B)
 Refer 39
45. (B)
 In C, electronic repulsion is very high. So EA is very less. For S & Se, repulsion difference is not significant.
 $\chi_S > \chi_{\text{Se}}$
 $\therefore \text{S} > \text{Se} > \text{O}$
46. (C)
 In same period
 E.A \propto electronegativity
 $\therefore \text{N} < \text{C} < \text{O} < \text{F}$
47. (C)
 Due to high electronegativity
 $(\text{E. A})_F > (\text{E. A})_{\text{Br}}$
 \therefore Fluorine undergo reduction easily than bromine, so it is better oxidizing agent.
48. (C)

Electronegativity decreases down the group, but decreases is less in case of alkali metal as compared to halogen groups.

49. (B)

According to Pauling scale

$$\chi_p = \frac{I.E + E.A}{5.6} \text{ where I.E \& E.A is expressed in eV/atom.}$$

50. (D)

$$X_p = \frac{X_m}{2.8} \quad X_p: \text{ electronegativity on Pauling scale}$$

X_m : electronegativity on Mulliken's scale.

51. (C)

Electronegativity increases along a period and decreases down the group.

52. (A)

$$X_M = \frac{I.P + E.A}{2} \quad I.P \& E.A \text{ in eV/atom.}$$

53. (A)

More is the electronegativity difference, more is the ionic character. For same atom, electronegativity ≈ 0 .

54. (D)

$$\text{Hydration energy} \propto \frac{\text{charge}}{\text{size}}$$

55. (A)

56. (D)

Electronegativity difference increases, it means acidic strength of different element decreases.

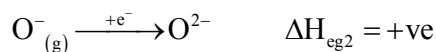
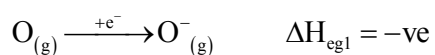
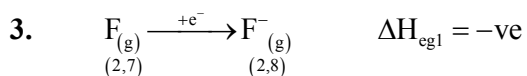
57. (C)

Group 13th element oxides are generally amphoteric.

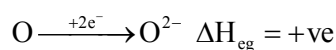
FOUNDATION BUILDER SUBJECTIVE

1. Electronegativity differences of Mn^{+7} & O^{2-} is not very high so Mn_2O_7 is acidic.

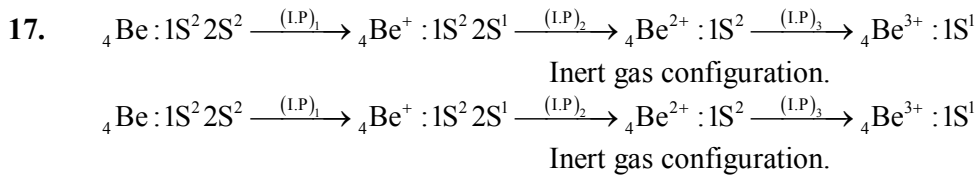
2. (I. E) $K \ll (I. E) Ag$



$$\because |\Delta H_{eg2}| > |\Delta H_{eg1}|$$



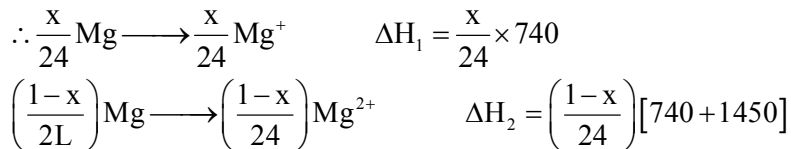
4. Refer diagonal relationship between Li and Mg
5. Due to inert pair effect, 6s electrons come closer to nucleus & hence $(I.E)_2 - (I.E)_1 > 16 \text{ eV/atom}$ for Tl.
 $\therefore Tl^{+1}$ is more stable than Tl^{+3} .
6. Because it can lose $(n-1)d$ as well as ns electrons
7. For isoelectronic species, atomic radii of more negatively charged species $>$ neutral atom $>$ cationic species
8. Anionic radii $>$ atomic radii
 For atomic radii ; vanderwall radii $>$ covalent radii
 $\therefore II < I < III$
9. Down the group shielding effect decreases.
10. For isoelectronic species
 Anion $>$ atom $>$ cation
 $\therefore F^- > Ne > Na^+$
11. $Na \xrightleftharpoons[(E.A)_{Na^+}]{(I.P)_{Na}} Na^+ + e^-$
 $\therefore |I.P \text{ of } Na| = |E.A \text{ of } Na^+|$
12. After first ionization, alkali metals achieve a noble gas configuration so, $IP_2 > IP_1$.
 Since it is true for alkaline earth metal after 2nd ionization.
 $(I.P)_3 \gg (I.P)_2$
13. Fully filled subshell is more stable than half filled.
14. Poor shielding effect of 4f subshell.
15. $x \longrightarrow \frac{1}{2}x^+ + \frac{1}{2}x^- \quad \Delta H_1 = -\frac{E.A}{2} + \frac{I.P}{2}$
 $\frac{I.P}{2} - \frac{E.A}{2} = 409$
 $\frac{1}{2}x^- \longrightarrow \frac{1}{2}x \longrightarrow \frac{1}{2}x^+$
 $\frac{E.A}{2} + \frac{I.P}{2} = 73.3$
16. ${}_6C : 1S^2 2S^2 2P^2 \quad {}_5B : 1S^2 2S^2 2P^1$
 ${}_6C$: Zeff for C $>$ B
 $(I.P)_1$ for C $>$ $(I.P)_1$ for B
 ${}_6C^+ : 1S^2 2S^2 2P^1 \quad {}_5B^+ : 1S^2 2S^2$
 Completely filled S-subshell



18. Achieving stable configuration on some time Noble gas configuration is the main reason for electron affinity

19. Be has fulfilled 2s subshell while N has half filled 2p subshell which are comparatively stable than Be^- & N^-

20. Let 'x' gm of Mg converts into Mg^+



$$\therefore \Delta H_1 + \Delta H_2 = 50 \text{kJ}$$

$$\frac{x}{24} \times 740 + \frac{1-x}{24} \times 2190 = 50$$

$$740x + 2190 - 2190x = 1200$$

$$2190x - 740x = 2190 - 1200$$

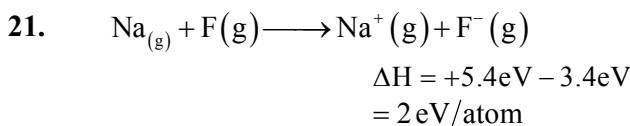
$$1450x = 990$$

$$x = \frac{990}{1450}$$

$$x = 0.6827$$

$$\% \text{ of } \text{Mg}^{2+} \text{ in final mixture} = \frac{0.317}{1} \times 100$$

$$= 31.7\%$$



$$\Delta H = 2 \text{eV/atom}$$

$$= 2 \times 1.6 \times 10^{-19} \times 6.023 \times 10^{23} \text{ J/mol}$$

$$= \frac{2 \times 1.6 \times 10^{19} \times 6.023 \times 10^{23}}{4.2 \times 10^3} \text{ Kcal/mol}$$

$$= 45.88 \text{ Kcal/mol}$$

22. no. of moles of F ionized = $\frac{328}{1681}$
 \therefore no. of F - atoms ionized = $\frac{328}{1681} N_A$

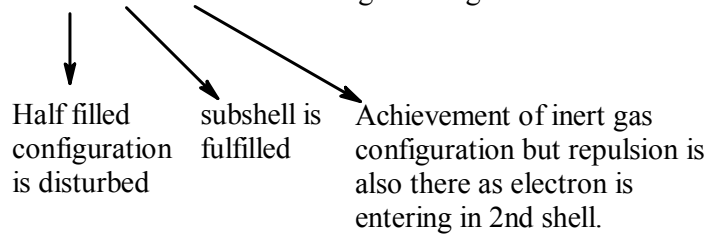
23. In bonding electron of different subshell can participate.

Get equipped for JEE Main

- (D)**
Exception to aufbau's principle.
- (D)**
Valency of X is 1
Valency of Y is 3
- (D)**
Oxygen group is known as chalcogens.
- (B)**
 $M^{3+} : [Ar]3d^{10} 4s^2$
 $M : [Ar]3d^{10} 4s^2 4p^3$.
- (B)**
 ${}^{26}Fe : [Ar]4s^2 3d^6$
 ${}^{26}Fe^{3+} : [Ar]3d^5$
- (B)**
- (C)**
Due to inert pair effect Bi^{3+} is more stable as compared to +5 state for others.
- (A)**
w.r.t oxygen
halogen family : +7
oxygen family : O
Nitrogen family : +5
Boron family : +3
- (D)**
Valency of A is 3
Valency of B is 2
 \therefore compound formed is A_2B_3 .
- (C)**
I.E increases from left to right.
- (C)**
Zeff difference between consecutive elements in transition element is less as compared to s & p-block elements. Same is the case with lanthanide series,
'd' orbitals electron offers less shielding effect as compared to s & p-block
'f' orbitals electrons offers less shielding effect as compared to s, p & d block.
- (D)**
 $Fe = Co = Ni$; Increase in effective atomic number is balanced by increase in repulsion between electrons.
 $Ni < Cu < Zn$ Increase in zeff is overcome by electronic repulsion size increases.
- (B)**
As P/e ratio increase, z_{eff} increases so 2^{nd} ionization energy is always higher than 1^{st} I. E.

14. (C)
For alkali metal $(I.E)_2 \gg (I.E)_1$
15. (A)
Atomic radius is determining factor for I. E down the group z_{eff} and stable configuration important factor for I. E across period.
16. (B)
Smaller size of atoms, more is the I. E
17. (B)
Hydration energy depends on $\frac{\text{charge}}{\text{size}}$ ratio.
18. (A)
Metal oxide are basic while non metal oxides are acidic in nature generally.
19. (C)
 ${}_{24}\text{Cr}^{2+} : [\text{Ar}]3d^4$
 ${}_{23}\text{V}^{2+} : [\text{Ar}]3d^3$
 ${}_{25}\text{Mn}^{2+} : [\text{Ar}]3d^5 \leftarrow$ Half-filled 'd' orbitals are more stable than other configuration.
 ${}_{26}\text{Fe}^{2+} : [\text{Ar}]3d^6$.
20. (B)
More is the no. of unpaired electrons, more is the paramagnetism.
21. (D)
Lawrencium ${}_{103}\text{Lr} : [\text{Rn}]7s^2 6d^1 5f^{14}$.
22. (C)
In a group, atomic number differ by 2, 8, 8, 18, 32..... Etc.
23. (B)
Isoelectronic species
24. (B)
 ${}_{3}\text{Li}^+ : 1s^2$
 ${}_{4}\text{Be}^+ : 1s^2 2s^1$
 ${}_{5}\text{B}^+ : 1s^2 2s^2$.
 $\therefore (I.E)_2$ order
 $\text{Be} < \text{B} < \text{Li}$ or $\text{Li} > \text{B} > \text{Be}$
25. (C)
Difference between $(I.E)_6$ and $(I.E)_7$ is very large. So, there is $6e^-$ in valence shell of atom at this element.
 \therefore It belongs to 16th group.
26. (A)

II < IV < III < I ← Inert gas configuration.



27. (A)

$$\text{Hydrated radius} \times \frac{\text{Charge}}{\text{size}}$$

$$\therefore K^+(\text{aq}) < Na^+(\text{aq}) < Li^+(\text{aq})$$

28. (C)

$$\text{Lattice energy} \times \frac{q^+ q^-}{r}$$

R is least for NaF

29. (B)

For alkaline, earth metal

2, 4, 12, 20, 38, 56, 78, 120.

30. (C)

Less is electronegativity difference between atoms forming a bond, more is the covalent character. So

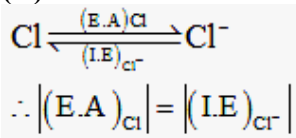
If $|X_m - X_c| > |X_o - X_H|$, the m - O bond break is polar solvent.

31. (C)

$$\text{Moles of X} = \frac{110 \times 10^{-3}}{7}$$

$$\begin{aligned} \text{Energy required} &= \frac{110 \times 10^{-3}}{7} \times 720 \text{ kJ} \\ &= 11.3 \text{ kJ} \end{aligned}$$

32. (A)



33. (B)

Cl^- is more stable than F^-

$$\therefore (\text{I.E})_{\text{Cl}^-} > (\text{I.E})_{\text{F}^-}$$

$$(\text{I.E})_{\text{Cl}} > (\text{I.E})_{\text{Cl}^-} - (\text{I.E})_{\text{neutral atom}} > (\text{I.E})_{\text{anion}}$$

$$(\text{I.E})_{\text{F}} > (\text{I.E})_{\text{Cl}} \quad \text{I.E} \propto \frac{1}{\text{size}}$$

34. (B)

35. (C)

$$(I.E)_{np} < (I.E)_{ns}$$

36. (B)

37. (A)

$$\text{Electronegativity} \propto \frac{1}{\text{size}}$$

38. (B)

$$\begin{array}{ll} |X_A - X_B| \geq 2.1 & \text{A - B is ionic bond} \\ < 2.1 & \text{A - B is covalent bond theoretically.} \end{array}$$

Practically

$$\begin{array}{ll} |X_A - X_B| < 1.7 & \text{covalent bond will be formed} \\ > 1.7 & \text{Ionic bond is formed.} \end{array}$$

39. (B)

According to Mulliken's scale

$$x = \frac{I.E + E.A}{2}$$

$$2x - Y = I.E$$

40. (B)

$$\text{Hydration energy} \propto \frac{\text{charge}}{\text{size}}$$

41. (D)

42. (D)

$O^{2-} > F^{-}$ isoelectronic species
 $O > F$ along period size decreases.

43. (D)

Be^{2+} has maximum charge / size ratio

44. (B)

45. (C)

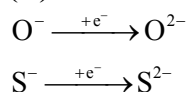
Nitrogen has half – filled 2p – orbitals.

46. (A)

In a period size decreases, So I. E increases. Magnesium has completely 3s subshell

47. (B)

48. (C)



Incoming electron is repelled by anionic electrons.

49. (B)

$(\Delta H_{eg})_2$ is always endothermic

Get equipped for JEE Advanced

1. **(ABCD)**

(A) S^- is more stable than C^-

(B) $\therefore (E.A)_S > (E.A)_O$

(C) $(E.A)_{Cl} > (E.A)_F$

'As' belongs to nitrogen family, so it has half filled subshell.

2. **(BD)**

Argon (Ar) has stable configuration.

3. **(ABCD)**

Refer theory

4. **(ACD)**

(A) $Z_{eff} \times \frac{1}{\text{size}} \quad E.A \times \frac{1}{\text{size}}$

(CD) $I.E \times \frac{1}{\text{size}}$

For isoelectronic species

$r_{\text{cation}} < r_{\text{atom}} < r_{\text{anion}}$

5. **(CD)**

$Z_{eff} \times \frac{1}{\text{size}}$

6. **(BD)**

For oxides, if electronegativity difference between elements increases, acid strength of different elements decreases. As positive charge on any element increases, electronegativity increases.

7. **(ABC)**

8. **(B)**

$(I.E)_3 \gg (I.E)_2$

+2 oxidation state of metal is more stable.

9. **(B)**

Cl has large size which results in less electronic repulsion and high electron affinity

10. **(A)**

$X \equiv \text{Ne} : 1s^2 2s^2 2p^6$

11. **(A)**

Refer Q. 6 of this exercise.

12. **(ABCD)**

Element is made up of single type of atom

${}_9\text{F} : 1s^2 2s^2 2p^5$

13. (ABC)
Halogens has most electron gain enthalpy. Alkaline earth metal has oxidation state (+2)
14. (ABC)
$$\text{I.E} \times \frac{1}{\text{size}}$$
Along period half – filled shell stability is considered
15. (B)
Compounds of Mn oxidation state of Mn.

MnO ₂	+4
KMnO ₄	+7
MnO	+2

As oxidation state increase size of atom decreases.
16. (ABCD)
$$\text{I.E} \times \frac{1}{\text{size}}$$
Metallic radii > covalent radii
 $3^+ : s^2 \equiv 0$. He
Due to poor shielding effect of electron in f – orbital, is $r_{N_b} \approx r_{T_a}$
17. (C)
Due to inert pair effect
18. (C)
$$\text{Lattice energy} \times \frac{9+9}{r}$$
19. (ABD)
$$\text{Hydration energy} \times \frac{\text{charge}}{\text{size}}$$
20. (ABC)
$$\text{I.E} \times \frac{1}{\text{size}}$$
 ∴ along a period, I. E dereases.
 $(\text{I.E}_1)_{\text{Na}} < (\text{I.E}_1)_4$
21. (A)
$$\text{Ionic mobility} \times \frac{1}{\text{Hydrated radius}}$$

$$\text{Hydrated radius} \times \frac{\text{charge}}{\text{size}}$$
22. (ABCD)
Down the 14th group, stability +4 oxidation state decreases as +2 increases.
For Pb : Pb²⁺ > Pb⁴⁺
23. (ABD)
Refer theory.

24. (A)
 $r_{x^-} > (r_x)_{\text{metallic}} \cong (r_x)_{\text{covalent}} > r_{x^+}$
25. (B)
26. (C)
27. (B)
 $M^+(g) + 280 \text{ Kcal} \longrightarrow M^{2+}(g) + e^-$
28. (ABC)

Comprehension Type

1. (D)
 Metals undergo oxidation easily
 So I.E should be less.
2. (D)
 Non – metals undergo reduction easily.
 So | EA | should be high.
3. (D)
4. (D)
 For E (I. E_1) is less than others.
5. (A)
 If difference in two successive Ionisation energy is less than higher oxidation state is more stable.
6. (C)
 E. A for noble gas is positive.
7. (A)
8. (B)
 Lanthanides having +3 oxidation states are more stable.
9. (D)
 Species which undergo reduction easily is very strong oxidizing agent.
 $Ce^{4+} + e^- \longrightarrow Fe^{3+}$
10. (C)
 2×1^2
 2×2^2
 2×2^2
 2×3^2
 \vdots
 \vdots
 \vdots
 For 10th
 Period $2 \times 6^2 = 72$
11. (C)

For $2e^-$ in each orbital maximum element in 4th shell is 18.

$$\therefore \text{For } 3e^- \text{ in each orbital} = \frac{18}{2} \times 3 = 27$$

Elements in 4th shell.

12. (D)

General electronic configuration of outer most shell of f-block element is

$$(n-2)f^{1-14}(n-1)d^{0-1}ns^2$$

13. (C)

For any shell / orbit no. 'n' maximum electron in it is $2n^2$.

$$\therefore \text{Maximum no. of possible elements in nature } \sum_{n=1}^{n=1} 2n^2$$

$$= 2 \sum_{n=1}^n n^2$$

$$= 2 \times \frac{1}{6} n(n+1)(2n+1)$$

$$= \frac{1}{3} n(n+1)(2n+1)$$

14. (B)

$$\sqrt{v} = a(z-b)$$

$$v = a(z-b)^2$$

15. (D)

$$\text{For Li : } \sqrt{v_4} = a(3-b)$$

$$3 \times 10^8 = a(3-b) \dots \dots (1)$$

$$\text{For Na : } \sqrt{v_{Na}} = a(z-b)$$

$$4 \times 10^8 = a(11-b) \dots \dots \dots (2)$$

$$(2) \dots \dots \dots (1)$$

$$10^8 = 8a$$

$$a = \frac{1}{8} \times 10^8$$

$$32 = 11 - b$$

$$b = -21$$

For K

$$\sqrt{v} = \frac{1}{8} \times 10^8 (40)$$

$$v = 25 \times 10^{16} \text{ Hz}$$

16. (B)

$$E = hv$$

$$= 6.626 \times 10^{-34} \times 12 \times 10^{16}$$

$$= 7.92 \times 10^{-17} \text{ J.}$$

17. (D)

As electronegativity difference between element increases, acidic strength of oxide is decreases & vice versa for basic strength.

18. (D)

19. (D)

20. (D)

SO₂ is an acidic oxide.

Matrix Match:

1. A → s ${}_{19}\text{K} : [\text{Ar}]4s^1$
B → r ${}_{22}\text{Ti} : [\text{Ar}]4s^23d^2$
C → p ${}_{32}\text{Ge} : [\text{Ar}]4s^23d^{10}4p^2$
 ${}_{64}\text{Gd} : {}_{54}[\text{Xe}]6s^25d^14f^7$

2. A → p, q, r ${}_3\text{Li} : 1s^22s^1$
B → p, q, r ${}_{39}\text{K} : [\text{Ar}]4s^1$
C → p, q ${}_{56}\text{Ba} : [\text{Xe}]6s^2$
 ${}_{88}\text{Ra} : [\text{Rn}]7s^2$

3. A → p ${}_{15}\text{P} : [\text{Ne}]3s^23p^3$
B → p, q, s ${}_{31}\text{Ga} : [\text{Ar}]4s^23d^{10}3p^1$
C → p, q, r ${}_{35}\text{Br} : [\text{Ar}]4s^23d^{10}3p^5$
D → p, r ${}_{85}\text{At} : [\text{Xe}]6s^24f^{14}5d^{10}6p^5$

4. A → p, s $\mu = \sqrt{n(n+2)}$ B.M n: no. of unpaired electron
B → p, s $\mu = 0 \Rightarrow$ diamagnetic
C → p, r
D → q $\mu \neq 0 \Rightarrow$ paramagnetic

5. A → p, q, r ${}_{60}\text{Nd} : [\text{Xe}]6s^25d^14f^3$
B → p, s ${}_{92}\text{U} : [\text{Rn}]7s^26d^15f^3$
C → p, s ${}_{90}\text{Th} : [\text{Rn}]7s^26d^15f^1$
D → p, s ${}_{100}\text{Fm}$ or ${}_{100}\text{Uun} : [\text{Rn}]7s^26d^15f^{11}$

6. (A)

7. (A)

8. (A)

Integer type:

1. $\mu = \sqrt{n(n+2)} = 1.732 = \sqrt{3}$
n = 1

2. (+4)

Maximum oxidation state shown by any element is equal to the number of valence electrons

3. **(+6)**
Same as above.
4. **(4)**
Amphoteric oxide are Al_2O_3 , PbO_2 , SnO_2 & BeO_2

WINDOW TO JEE MAIN

1. **(B)**
 ${}_{106}\text{Unn} : {}_{86}[\text{Rn}]7s^2 5f^{14} 6d^4$
2. **(C)**
 ${}_{29}\text{Cu} : 1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10} 4s^1$
3. **(A)**
In a period, from left to right, atomic radius decreases while E. A increases.
4. **(A)**
Phosphorous exist as solid at room temperature.
5. **(D)**
 ${}_{20}\text{Ca}^{2+} : 2, 8, 8$
6. **(A)**
 $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{Al}$
Isoelectronic with Ne has 3 shell i.e they have two filled shell
7. **(B)**
E. A \propto electronegativity of element
8. **(D)**
For alkali earth metal $(\text{IE})_3 \gg (\text{IE})_2$.
9. **(B)**
 $(\text{IE})_2$ of Mg $<$ $(\text{IE})_2$ of Na as Na^+ has acquired noble gas configuration.
10. **(A)**
All species are isoelectronic with argon i.e has $18e^-$ in them
11. **(D)**
I. E \times electronegativity
 $(\text{IE})_s < (\text{IE})_p$ as p has half filled 3p subshell
12. **(D)**
In alkali metal, electronegativity or I. E. decreases down the group.
So, it oxidises easily. Hence reactivity increases down the group.
In halogens, $\chi \downarrow$ down the group,
Hence E. A \downarrow so reactivity decreases.

13. (C)
Fact
14. (B)
Theory
15. (D)
Anion > neutral > cation
16. (C)
17. (C)
18. (B)
19. (B)
20. (C)

WINDOW TO JEE ADVANCED

1. (C)
 ${}_6\text{C}^+ : 1s^2 2s^2 2p^1$
 ${}_7\text{N}^+ : 1s^2 2s^2 2p^2$
 ${}_8\text{C}^+ : 1s^2 2s^2 2p^3$ ← half filled subshell is more stable.
 ${}_9\text{F}^+ : 1s^2 2s^2 2p^4$
 $\therefore (\text{IE})_2$
 $\text{O} > \text{F} > \text{N} > \text{C}.$
2. (C)
3. (B)
 Hydration energy $\times \frac{\text{charge}}{\text{size}}$
4. (A)
 $(\text{IE}_1)_\text{N} > (\text{IE}_1)_\text{O}$
5. (A)
 Down the group size increases as number of shell increases.
6. (C)
 Electronegativity $\times \frac{1}{\text{size}}$
7. (A)
8. (D)
 For isoelectronic species
 $r_{\text{cation}} < r_{\text{atom}} < r_{\text{anion}}$
9. (B)

$$\text{I.E} \times \frac{1}{\text{size}}$$

For comparative size, half filled subshell are more stable. So I. E is more

10. (D)
There are exception to Aufbau principle. Ex: Cr & Cu
11. (B)
Due to inert pair effect.
12. (D)
 Fe^{2+} has 4 unpaired electron.
13. (B)
14. (B)
Isoelectronic speies.
15. (B)
 $\text{I. E} \times \frac{1}{\text{size}}$
16. (B)

$${}_4\text{Be} \xrightarrow{+e^-} {}_4\text{Be}^-$$

$$1s^2 2s^2 \qquad 1s^2 2s^2 2p^1$$
(stable)

OBJECTIVE QUESTION (MCQ)

1. (BCD)
Refer theory
2. (ABC)
The difference between the I. P is very large when there is change in no. of shell
3. (D)
More is the positive charge on atom, smaller is its size.

Assertion and reasoning

1. (C)
Additional e^- are repelled more effectively by $2e^-$ in F than $3pe^-$ in Cl.
2. (C)
 $2p (2+1=3)$ is more in energy than $2s(2+0=2)$ orbital.
3. (C)
The lower oxidation states are more stable due to inert pair effect.

Fill in the Blanks.

1. Electron affinity
2. Electronegativity (χ) = $\frac{\text{I.E} + \text{E.A}}{2}$

3. Higher zeff
As p/e increases zeff increases.

4. Inert pair effect

T/F

1. (T)
Density of IA metal decreases down the group.

2. (F)
Less ionization potential means more reducing agent.

3. (F)
E. A. $\text{Cl} > \text{Br} > \text{F}$.

4. (F)
 $|\chi_m - \chi_o|$ increases down the group, so basic nature increases.

Subjective Questions.

- (i) $\text{O}^{2-} > \text{F}^- > \text{Na}^+ > \text{Mg}^{2+}$ (Isoelectronic species)
 (ii) $\text{Na} < \text{Al} < \text{Mg} < \text{Si}$, the effect of half filled or fully filled subshell only extends upto neighbouring element
 (iii) $\text{Cl}_2 > \text{F}_2 > \text{O}_2 > \text{N}_2$
 (F-F)(O=O)(N≡N)

As atomic radius increases bond length increases as bond multiplicity increases bond length decreases.

2. $\text{Ca}^{2+} < \text{Ar} < \text{Cl}^- < \text{S}^{2-}$ (Isoelectronic species)

3. ${}_6\text{C} : 1s^2 2s^2 2p^2 \xrightarrow[\text{I.P}_1]{-e^-} {}_6\text{C}^+ : 1s^2 2s^2 2p^1$
 More zeff $1.P_2 \downarrow -e^-$
 ${}_6\text{C}^{2+} : 1s^2 2s^2$

${}_5\text{B} : 1s^2 2s^2 2p^1 \xrightarrow[\text{(I.P)}_1]{-e^-} {}_5\text{B}^+ : 1s^2 2s^2 2s^2 \xrightarrow[\text{(I.P)}_2]{-e^-} {}_4\text{B}^{2+} : 1s^2 2s^1$
 Less zeff than ${}_6\text{C}$ fulfilled
 2s orbital i.e stable
 Configuration.

4. $\text{Mg}^{2+} < \text{Na}^+ < \text{F}^- < \text{O}^{2-} < \text{N}^{3-}$
 (Isoelectronic species)

5. $(\text{I.P})_{\text{Cu}} < (\text{I.P})_{\text{Zn}}$
 $(\text{I.P}_2)_{\text{Cu}} > (\text{I.P}_2)_{\text{Zn}}$.

6. $\text{Al}^{3+} < \text{Mg}^{2+} < \text{Li}^+ < \text{K}^+$
 $\left(0.51 \overset{0}{\text{Å}}\right) \left(0.66 \overset{0}{\text{Å}}\right) \left(0.68 \overset{0}{\text{Å}}\right) \left(1.33 \overset{0}{\text{Å}}\right)$