CHEMISTRY

MODULE - 2

HINTS AND SOLUTIONS

ALLEN™
CAREER INSTITUTE
KOTA (RAJASTHAN)

EXERCISE-I

6. Al—Ga
Si—Ge
B—Sc

15. Ga, Ge and Sc these element prove the validity of mendeeleev periodic table

16. In a group valence shell electron configuration is same

45. If n=4 X =5 Z = 25

49 Zeff in a group remains constant

52. $3d < 4d \approx 5d$

56. $Fe \approx CO \approx Ni$

62. $K > K^+$ - radii

74. vwr $\simeq 2 \times$(covalent radii)

78. $Li < Na = K$

81. Value of ionisation potential of isotope of an element are same.

82. O < F   IP

83. 3rd IP maximum for $1s^2\,2s^2\,2p^6\,3s^2$ configuration

87. For isoelectronic species, $IP \propto Z_{eff}$

92. Number of valence electron =2

93. $IP_1 \Rightarrow Li < O < N < F$
$IP_2 \Rightarrow N < F < O < Li$

97. For isoelectronic species, $IP \propto Z_{eff}$

103. $IP \propto Z_{eff}$
$Z_{eff} = M^- < M < M^+ < M^{+2}$

113. In given element nitrogen has minimum electron gain enthalpy

115. Formation of polyvalent anion is endothermic process

118. Cl atom has highest E.A.

119. EA ; O < S > Se > Fe

123. $2s^2 2p^3$ is stable configuration, so energy release is minimum

125. EA order P < S < F < Cl

126. EN order H > Li > Na

127. Bond polarity $\propto \Delta EN$

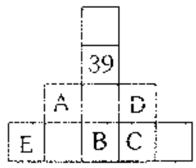
129. $EN = \dfrac{IP + EA}{2}$

135. $\dfrac{IP + EA}{2} = EN$
$2EN - IP - EA = 0$

141. Cr_2O_3, ZnO, V_2O_5 - all are amphoteric nature.

EXERCISE-III

5.



A = 56. D = 58

6. Element which contain total number of electron in f-sub shell = 53

9. $z_1 = 20,\ z_3 = 22,\ z_2 = 21$

10. $M_{(g)} \xrightarrow{100} M^+_{(g)} \longrightarrow M^{+2}_{(g)}$; $M_{(g)} \xrightarrow{250} M^{+2}_{(g)}$
$IP_1 = 100eV,\ IP_2 = 100\ eV$

11. Number of valence electron =3
charge on element = A^{+3}

13. $X \xrightarrow{EA} X^-$; $Y \xrightarrow{IP} Y^+$
so IP of X^- < IP of Y^+

15. Halogen are most electronegative element

27. Along the period, basic nature of oxides decreases while on moving down the group, basic nature of oxides increases.
$Na_2O > MgO > Al_2O_3$
so $Al_2O_3 < MgO < Na_2O < K_2O$

37.

V	Cr	Mn	Fe
$[Ar]4s^2 3d^2$	$4s^2 3d^5$	$4s^2 3d^5$	$4s^2 3d^6$
$\downarrow -2e^-$	$\downarrow -2e^-$	$\downarrow -2e^-$	$\downarrow -2e^-$
$3d^2$	$3d^4$	$3d^5$	$3d^6$

along the period Zeff↑ , IP↑, but after removing $2e^-$ from Mn, it has half filled of configuration, so having maximum ionisation enthalpy among above 4 elements.

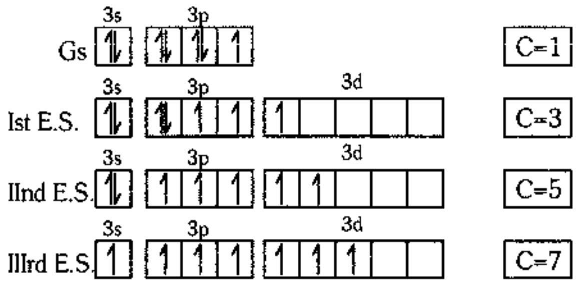
EXERCISE-1

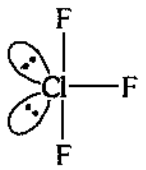
6. [Extent of overlapping ∝ directional nature]

$2s—2s < 2s—2p < 2p—2p$

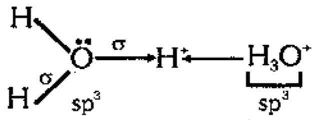
(non-directional) (more directional)

7. $_{17}Cl \rightarrow [Ne]^{10}\ 3s^2 3p^5$

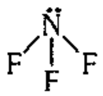




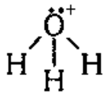
[Ist E.S. of Cl]

17. 

(shape is changed) V-shape

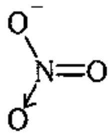
19. 

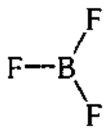
pyramidal



pyramidal

N_3^- linear

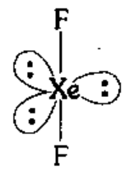


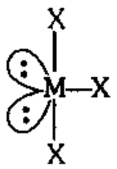


(trigonal planar)

23. NO_2^+ : O = N⁺ = O (sp, linear)

CO_2 : O=C=O (linear)

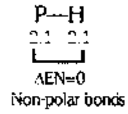
XeF_2 :  (linear)

29. MX_3 : T-shaped 

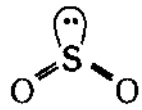
Non-bonding pairs of electrons = 2

34. [Bond angle ∝ % s character]

$$\left[B.A. \propto \frac{1}{\%p\ character}\right] \xrightarrow[\%\ s\ character(\downarrow)\ B.A.(\downarrow)]{sp\ sp^2\ sp^3}$$

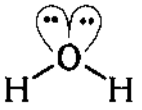
47. $\ddot{P}H_3$ (polar no.) 

(polar molecule)



(polar molecule)

48. BeF_2 (sp, linear) $\boxed{\mu = 0}$



(Bent shape)

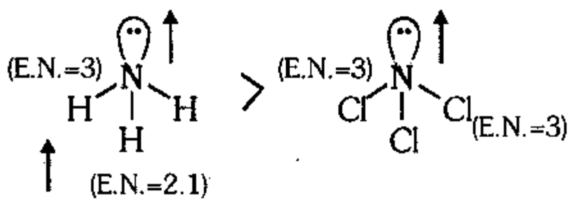
(μ≠0)

(polar molecule)

49. Molecules having zero dipole moment having symmetrical structure.

XeF_4 (μ = 0); NH_3^{2+} (μ=0)

51. Order of dipole moment :



62. CO : Total number of electron is 14 e^-

CN^- is 14 e^- [B.O. =3]

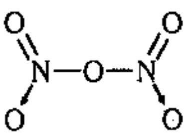
63. $O_2^{-1} \rightarrow 17\ e^- \rightarrow$ BO. 1.5 (paramagnetic)

67. $O_2^{-1} \rightarrow 17e^-$

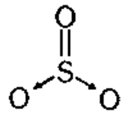
$\sigma 1s^2 \sigma^* 1s^2 \sigma 2s^2 \sigma^* 2s^2 \sigma\ 2p_z^2\ \pi 2p_x^2$

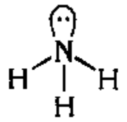
$= \pi 2p_y^2\ \pi^* 2p_x^2 = \pi^* 2p_y^1\ \sigma^* 2p_z$

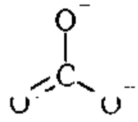
[electron pair in ABMO =3]

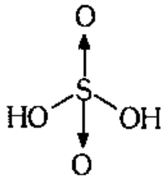
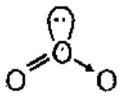
72. $N_2O_5(s)$: 

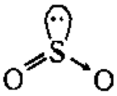
[co-ordinate & covalent bond]

73. SO_3 : 

NH_3 : 

$K_2CO_3 \rightarrow K^+ + CO_3^{2-}$ 

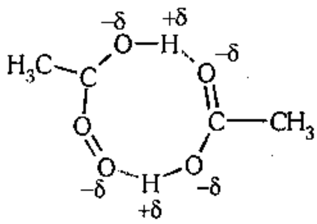
75. (i) H_2SO_4 :  (ii) O_3 : 

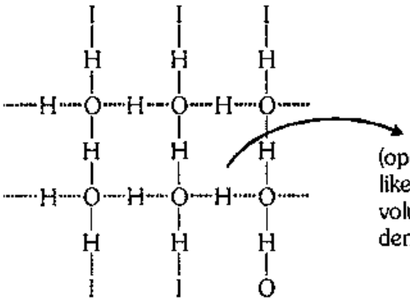
(iii) SO_3 : 

79. HF < HI < HBr < HCl

H-bonding mol. mass (↓) volatile nature (↑)

82. CH_3COOH (dimer) due to H-bonding)



85. 

(open cage like structure) volume increases density decreases

88. $KHF_2 \rightarrow K^+[HF_2]^-$ [F^-......H–F]

99. Na^+Cl^- (ionic bond)
Highest melting point

101. $LiCO_3$ Na_2CO_3 K_2CO_3 Rb_2CO_3

$\longrightarrow$

r^+ (↑), T.S.(↑)

115. Li^+ Na^+ K^+ Rb^+ Cs^+

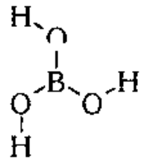
$\longrightarrow$

r^+ (↑), hydrated radii.(↓), ionic conductivity(↑)

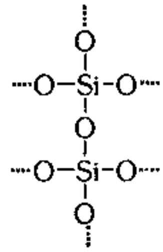
EXERCISE-III

2.

Ions	No. of electrons	structural
NO_3^-	32	Trigonal planar
CO_3^{2-}	32	Trigonal planar
ClO_3^-	42	pyrimidal
SO_3	40	trigonal planar

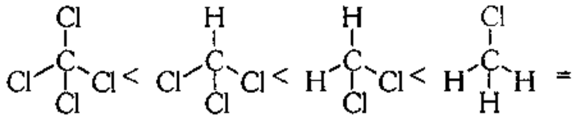
5. 

Hybridisation of B = sp^2
Hybridisation of O = sp^2

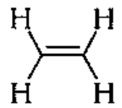
9. SiO_2 (solid) 

11. R–$\ddot{O}$–H sp^2 hybridisation

12. NH_3 PH_3 AsH_3 SbH_3 $\longrightarrow$
p character in sp^3 ↑
bond angle ↓

19. 

dipole moment

21. 

sp^2 sp^2
(planar)

22. $(\sigma 1s)^2 < (\sigma 1s^*)^2 < (\sigma 2s^*)^2 < (\sigma 2s^*)^2 < (\pi 1p_x)^2 = (\pi 2p_y^*)^2$

All electrons are paired in C_2 molecules hence C_2 will be diamagnetic.

23. ICl > Br_2 boiling point
ICl is polar molecule while Br_2 is non polar.

28. $F_2 + F^- \rightarrow$ No ion form
F_2 has not vacant d orbital so F^- do not donate lone pair electrons to F_2 molecules.

34. $N_2 \xrightarrow{\text{electron}} N_2^-$

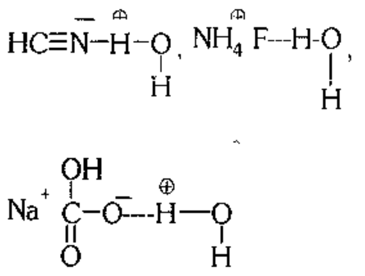
$(\sigma 2P_z)^2 < (\pi 2P_x)^0 \rightarrow (\sigma 2P_z)^2 < (\pi 2P_x)^1$

Diamagnetic Paramagnetic

$O_2 \xrightarrow{\text{electron}} O_2^-$

$(\sigma 2P_x^*)^1 = (\pi 2P_y^*)^1 \rightarrow (\pi 2P_x^*)^2 = (\pi 2P_y^*)^1$

Diamagnetic Paramagnetic

40. 

(all molecule form H-bonding with water)

42. $BeSO_4$ soluble in water due to maximum hydration energy.

43. $SO_4^{2-} + BaCl_2 \rightarrow BaSO_4 + 2Cl^-$

white ppt

↓ dil. HCl

Not dissolves

51. Bond order of $HeH^+ = 1.0$

EXERCISE-I

3. Order of reducing power Li > K > Rb > Cs > Na

5. LiCl is a covalent compound

7. Stability of hydride $\propto \frac{1}{\text{size}}$

8. With IA & IIA group element hydrogen is electronegative

11. In alkali metal salts
Alkali metal exist in M^+ ion do not contain unpaired e^-

12. Ionic conductance in aqueous medium conductance $\propto \frac{1}{\text{hydrated ion radius}}$

15. $Mg + H_2O \rightarrow Mg(OH)_2 \rightarrow MgO + H_2$

16. $3Mg + 6N_2 \xrightarrow{\Delta} 2Mg_3N_2$
$Mg_3N_2 + 6HOH \longrightarrow 3Mg(OH)_2 + 2NH_3$

19. $Na + \text{dry } NH_3 \rightarrow NaNH_2 + \frac{1}{2}H_2$

21. Complex formation tendency $\propto \phi$

22. Order of reducing power Be < Mg < Ca < Sr < Ba

23. Due to formation of protective layer of oxide.

28. Li_2SO_4 does not form alum [less coordination no.]

31. Ether – organic solvent (non polar) covalent substance dissolve in covalent solvent $BeCl_2$

33. $KO_2 \rightarrow K^+ + O_2^-$

35. Be^{+2} does not flame test due high ionisation potential.

44. Al is amphoteric element's

57. Hemihydrate $\rightarrow$ monohydrate

64. Stability $O^{-2} > O_2^- > O_2^{-2}$

65. (a) $LiHCO_3$ exist in liquid state.
(b) only K, R1 and Cs formed superoxide
(c) any Li formed nitrile

66. LiOH is basic nature

68. $BeF_2 + 2NaF \rightarrow Na_2[BeF_4]$

EXERCISE-2

1. $NaHCO_3$ & $Mg(OH)_2$

2. $A \xrightarrow{\Delta}$ colorless + Residue
Residue + water $\longrightarrow$ B
B(eq.) + aq of $CO_2 \longrightarrow$ C (solid)
$C \xrightarrow{\Delta} A$
Colorless gas $\longrightarrow CO_2$
therefore A is $CaCO_3$.
$CaCO_3 \xrightarrow{\Delta} CO_2 + CaO$

6. $Zn + NaOH \rightarrow Na_2[Zn(OH)_4] + H_2$

EXERCISE-III

1. $CaCO_3 \rightarrow CaO + CO_2$
$CaO \xrightarrow{H_2O} Ca(OH)_2 \xrightarrow{CO_2} Ca(HCO_3)_2$

4. $NaCl \rightarrow Na^+ + Cl^-$
at cathode $\rightarrow H_2$
at anode $\rightarrow Cl_2$

8. $M + NH_3\,(liq) \xrightarrow{Fe} MNH_2 + H_2$

11. $KO_2 + CO_2 \rightarrow K_2CO_3 + O_2$

EXERCISE-1(B)

2. Moderate amount of Na metal
$Na + \text{Liq. } NH_3 \longrightarrow \underset{\text{ammoniated sodium}}{[Na(NH_3)_2]^+}$
Due to presence of $\longleftarrow \underset{\text{ammoniated } e^-}{[e(NH_3)_y]^-}$
e^- blue colored solution obtained.

3. $NaHCO_3$ & NaOH cant exist together because $NaHCO_3$ is an acidic salt.

9. Photoelectric effect $\propto \frac{1}{\text{I.P.}}$ i.e. Cs has maximum photoelectric effect

13. $KO_2 + CO_2 \rightarrow K_2CO_3 + O_2$

EXERCISE-I

1. Amphoteric metal produces H_2 gas with NaOH, Zn, Al, Be.

3. Hydrogen can act as oxidising agent for more reactive metals like Ca.

5. Only amphoteric element produces hydrogen with NaOH.

10. $4D_2O + 3Fe \xrightarrow{\text{Red hot}} Fe_3O_4 + D_2$

12. RCOOH – Cation exchanger.

Replaces Ca^{2+} ion

13. Na_2Z-sodium zeolite.

Na_2Z + hard water $\rightarrow$ CaZ on MgZ + Na^+

Ca^+ & Mg^{2+}

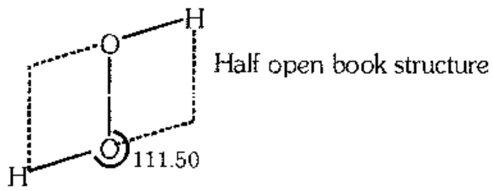
16. $N_2O_5 + D_2O \rightarrow \underset{\text{Deutronitric}}{2DNO_3}$

17. Hardness of water arises due to presence of $CaCl_2$, $CaSO_4$, $MgCl_2$, $MgSO_4$, $Ca(HCO_3)_2$ $Mg(HCO_3)_2$ only
$Ca(OH)_2 + 2HCl \rightarrow CaCl_2 + H_2O$

18. Temporary hardness arises due to $Ca(HCO_3)_2$ & $Mg(HCO_3)_2$

19. do not act as catalyst.

20.



21. Disproportionation reaction

$$2H_2\underset{-1}{O_2} \longrightarrow 2H_2\underset{-2}{O} + \underset{0}{O_2}$$

22. $\mu \neq 0 \longrightarrow$ Unsymmetrical-non-linear

25. $H_2O_2 \longrightarrow H_2O + [O]$

Bleaching action due to formation of Nascent oxygen (Oxidation).

26. $H_2O_2 > H_2O > D_2O > H_2$

EXERCISE-III

2. $Zn + NaOH \rightarrow Na_2[Zn(OH)_4] + H_2$

6. Permanently hardness due to chloride & sulphate of Mg and Ca

16. $CaC_2 + D_2O \rightarrow C_2D_2$

17. Shape of O_2F_2 similar to H_2O_2