

3. CHEMICAL BONDING AND MOLECULAR STRUCTURE

PREVIOUS EAMCET BITS

1. The bond length of HCl molecule is 1.275 \AA and its dipole moment is 1.03 D. The ionic character of the molecule (in percent) (charge of electron 4.8×10^{-10} esu) is

[2008 E]

- 1) 100 2) 67.3 3) 33.6 4) 16.83

Ans: 1

Sol: % of ionic character = $\frac{\mu_{\text{experimental}}}{\mu_{\text{theoretical}}} \times 100$
 $\mu_{\text{experimental}} = e \times d = 4.8 \times 10^{-10} \text{ esu} \times 1.275 \times 10^{-8} \text{ cm}$
 $= 6.12 \times 10^{-18} \text{ esu cm}$
 $= 6.12 \text{ D}$

$\mu_{\text{theoretical}} = 1.03 \text{ D}$

$\therefore \% \text{ of ionic character} = \frac{1.03}{6.12} \times 100 = 16.83$

2. Match the following

[2008 M]

List – I



List – II

i) Linear

ii) Planar triangular

iii) Tetrahedral

iv) Octahedral

v) Square planar

The correct answer

	A	B	C	D
1)	ii	iii	iv	i
3)	ii	v	iv	i

	A	B	C	D
2)	v	iii	ii	i
4)	v	iv	iii	ii

Ans: 3

- Sol: Match the following

(A) BCl_3 = Planar triangular (ii)

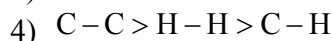
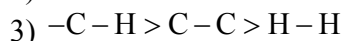
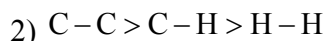
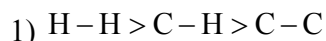
(B) PdBr_4^{2-} = square planar (v)

(C) SF_6 = Octahedral (iv)

(D) I_3 = linear (i)

3. The decreasing order of bond dissociation energy of C – C , C – H and H – H bond is

[2007 E]

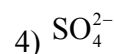
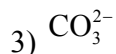
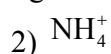


Ans: 1

- Sol: The decreasing order of bond dissociation energies are $\text{H-H} > \text{C-H} > \text{C-C}$

4. Which of the following is not tetrahedral

[2007]



Ans: 3

Sol: In CO_3^{2-} carbon under goes sp^2 hybridization and shape of the ion is trigonal planar. While shape of BF_4^- , NH_4^+ and SO_4^{2-} have tetrahedral structure.

5. **Assertion (A)** : I_3^- is linear [2007 M]
Reason (R) : It is not in sp hybridised state.

The correct answer is

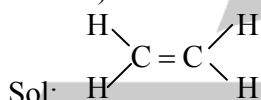
1. Both A and R are true and R is the correct explanation of A
2. Both A and R are true but R is not the correct explanation of A
3. A is true, R is not true
4. A is not true but R is true

Ans :2

Sol: I_3^- is linear . There is sp^3d hybridisation but not sp . But R is not correct explanation of A.

6. A molecule (X) has i) four sigma bonds formed by the overlap of sp^2 and s orbital. (ii) One sigma bond formed by sp^2 and sp^2 orbitals and iii) one π bonds is formed by P_x and P_x orbitals. Which of the following is X ? [2006 E]

- 1) C_2H_6 2) $\text{C}_2\text{H}_3\text{Cl}$ 3) $\text{C}_2\text{H}_2\text{Cl}_2$ 4) C_2H_4



$$\sigma(sp^2 - sp^2) = 1 ; \quad \sigma(sp^2 - s) = 4 ; \quad \pi = 1$$

7. $\text{H}-\text{O}-\text{H}$ bond angle in H_2O is 104.5° and not $109^\circ 28'$ because of [2006 M]
 1) lone pair – lone pair repulsion 2) lone pair – bond pair repulsion
 3) bond pair – bond pair repulsion 4) high electronegativity of oxygen

Ans: 1

Sol: In H_2O oxygen atom undergoes sp^3 hybridization and shape of the molecule must be tetrahedral and bond angle must be $109^\circ 28'$. But due to the repulsion between lone pair and lone pair of electron shape of the molecule is distorted to angular (or) 'V' shape and bond angle is decreases to $104^\circ .5^\circ$

8. Which of the following molecule has zero dipole moment? (2005-M)
 1) BeCl_2 2) HCl 3) NH_3 4) H_2O

Ans: 1

Sol: BeCl_2 has symmetrical and linear structure hence (i) is correct

9. Which of the following is a favourable factor for cation formation? (2005-M)
 1. Low ionisation potential 2. High electron affinity
 3. High electronegativity 4. Small atomic size

Ans : 1

Sol. Low IP favours cation ion formation

10. Which of the following is a linear molecule? (2005-E)
 1) BeCl_2 2) H_2O 3) SO_2 4) CH_4

Ans: 1

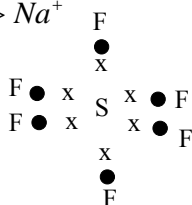
Sol. $\text{BeCl}_2 = \text{Linear}$ $\text{H}_2\text{O} = \text{Angular}$
 $\text{SO}_2 = \text{Angular}$ $\text{CH}_4 = \text{tetrahedral}$

11. Which of the following statement is correct? (2005-E)

1. The number of electrons present in the valency shell of S in SF_6 is 12.
2. The rates of ionic reactions are very slow.
3. According to VSEPR theory, $SnCl_2$ is the linear molecule.
4. The correct order of ability to form ionic compounds among Na^+ , Mg^{2+} and Al^{3+} is $Al^{3+} > Mg^{2+} > Na^+$

Ans: 1

Sol:



In SF_6 s atom has 12 valence electron

12. Which of the following is not correct regarding the properties of ionic compounds (2004-E)

1. Ionic compounds have high melting and boiling points.
2. Their reaction velocity in aqueous medium is very high.
3. Ionic compounds in their molten and aqueous solutions do not conduct electricity.
4. They are highly soluble in polar solvents.

Ans: 3

Sol: Ionic compounds in their molten state and aqueous solution conducts electricity hence (3). Is the wrong answer.

13. Which of the following statement is not correct (2004-M)

1. One of the favourable conditions for the formation of cation is low ionisation potential.
2. Co-ordination number of Cs in CsCl is 8
3. Ionic bond is directional.
4. Ionic compounds have high melting and boiling points.

Ans: 3

Sol: Ionic bond is non directional

∴ (3) in the wrong answer

14. If the boiling point of ethanol (molecular weight -46) is $78^\circ C$. What is the boiling point of diethyl ether (molecular weight=74)? (2004-M)

1. $100^\circ C$
2. $78^\circ C$
3. $86^\circ C$
4. $34^\circ C$

Ans: 4

Sol: Alcohols have high boiling point than ethers due to the presence of intermolecular hydrogen bond.

15. Which one of the following is a correct set? (2003-E)

1. H_2O, sp^3 , angular
2. H_2O, sp^2 , linear
3. NH_4^+, dsp^2 , square planar
4. CH_4, dsp^2 , tetrahedral

Ans: 1

Sol: In H_2O oxygen atom undergoes sp^3 hybridisation shape of the molecule is angular due to repulsion between lone pairs of electron hence (1) is correct.

16. If the bond length and dipole moment of a diatomic molecule are 1.25 \AA and 1.0 D respectively, what is the percent ionic character of the bond? (2003-E)

1. 10.66
2. 12.33
3. 16.66
4. 19.33

Ans: 3

$$\text{Sol. \% of ionic character} = \frac{\mu_{\text{observed}}}{\mu_{\text{theoretical}}} \times 100$$

$$\mu_{\text{obs}} = 1\text{D}$$

$$\mu_{\text{theoretical}} = e \times d = 4.8 \times 10^{-10} \text{esu} \times 1.25 \times 10^{-8} \text{cm}$$

$$= 4.8 \times 1.25 \times 10^{-18} \text{esu.cm}$$

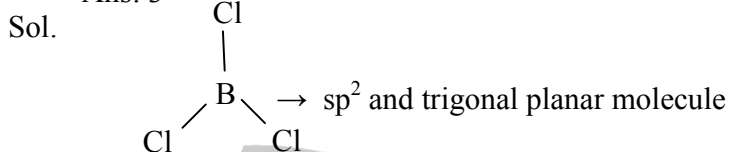
$$= 4.8 \times 1.25 \text{D}$$

$$\% \text{ of ionic character} = \frac{1}{4.8 \times 1.25 \text{D}} \times 100 = 16.66$$

17. Which one of the following is a planar molecule? (2003-M)

1. NH_3 2. H_3O^+ 3. BCl_3 4. PCl_3

Ans: 3



18. Which one of the following is the correct set with respect to molecule, hybridization and shape? (2003-M)

1. $\text{BeCl}_2, \text{sp}^2$, linear 2. $\text{BeCl}_2, \text{sp}^2$, triangular planar
3. $\text{BCl}_3, \text{sp}^2$, triangular planar 4. $\text{BCl}_3, \text{sp}^3$, tetrahedral

Ans: 3

Sol. In BCl_3 , 'B' atom undergoes sp^2 hybridisation and shape of the molecule is trigonal planar hence (3) is the correct choice.

19. Which one of the following is the correct set with reference to molecular formula, hybridisation of central atom and shape of the molecule? (2002-M)

1. CO_2, sp^2 , bent 2. $\text{H}_2\text{O}, \text{sp}^2$, bent 3. BeCl_2, sp , linear 4. $\text{H}_2\text{O}, \text{sp}^3$, linear

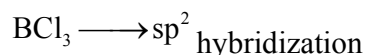
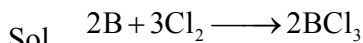
Ans: 3

Sol. In BeCl_2 , Be atom undergoes sp hybridization and shape of the molecule is linear hence (3) is the correct choice.

20. An element M reacts with chlorine to form a compound X. The bond angle in X is 120° . What is M? (2002-M)

1. Be 2. B 3. Mg 4. N

Ans: 2



And shape of molecule trigonal planar bond angle is 120° .

21. The bond energies (in KJ mol^{-1}) of P-H, As-H and N-H respectively are (2002-E)

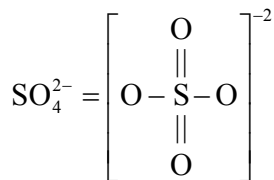
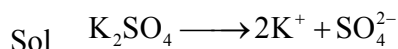
1. 247, 318 and 389 2. 247, 389 and 318 3. 318, 389 and 247 4. 318, 247 and 389

Ans: 4

Sol. Decreasing order of stability $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3$
Decreasing order of bond energy $\text{N-H} > \text{P-H} > \text{As-H}$

22. Which one of the following molecule contains both ionic and covalent bonds? (2002-E)
 1. CH_2Cl_2 2. K_2SO_4 3. $BeCl_2$ 4. SO_2

Ans: 2

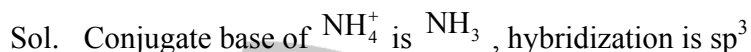


In between K^+ and SO_4^{2-} ionic bond is present.

In SO_4^{2-} covalent bonds are present.

23. What is the hybridisation state of the central atom in the conjugate base of NH_4^+ ion? (2002-E)
 1. sp 2. sp^3 3. sp^2 4. dsp^2

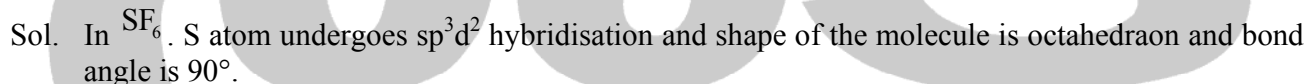
Ans: 2



24. Which of the following statement is true? (2001E)

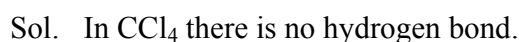
1. Hybridisation of the central atom in NH_3 and CH_4 is SP_2
2. $BeCl_2$ has "V" shape while SO_2 is linear
3. SF_6 is octahedral and $F - S - F$ bond angle is 90°
4. CO_2 has dipole moment

Ans: 3



25. In which of the following substance, hydrogen bonding is absent? (2001 M)
 1. HF 2. H_2O 3. CCl_4 4. Salicylaldehyde

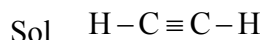
Ans: 3



26. Acetylene has....bonds (2001 M)

1. $2\sigma, 2\pi$
2. $2\sigma, 3\pi$
3. $3\sigma, 2\pi$
4. $3\sigma, 3\pi$

Ans: 3

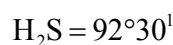
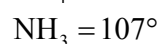
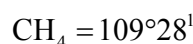
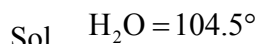


In acetylene 3σ and 2π bonds are present

27. Which of the following has the lowest bond angle? (2000 E)

1. H_2O
2. CH_4
3. H_2S
4. NH_3

Ans: 3



28. Which of the following hydrocarbon has least carbon-carbon bond length? (2000 E)
1. C_2H_6 2. C_2H_4 3. C_6H_6 4. C_2H_2
Ans: 4

Sol. C – C bond length in $C_2H_6 = 1.54 \text{ \AA}$
C – C bond length in $C_2H_4 = 1.34 \text{ \AA}$
C – C bond length in $C_6H_6 = 1.39 \text{ \AA}$
C – C bond length in $C_2H_2 = 1.20 \text{ \AA}$

29. Which of the following is correct pair? (2000 E)
1. $BeCl_2$, linear 2. NH_3 , linear 3. CO_2 , tetrahedral 4. BF_3 , octahedral
Ans: 1

Sol. $BeCl_2$ is linear

30. What is the crystal structure of Cesium Chloride? (2000 E)
1. Body centered cubic 2. face centered cubic
3. tetrahedral 4. octahedral
Ans: 1

Sol. The crystal structure of $CsCl$ is body centred cubic

31. Which of the following has least bond energy? (2000 M)
1. F_2 2. H_2 3. N_2 4. O_2
Ans: 1

Sol. F_2 has least bond dissociation energy .

32. Which of the following has the lowest boiling point? (2000 M)
1. CH_4 2. H_2O 3. HF 4. C_2H_5OH
Ans: 1

Sol. CH_4 has less boiling point due to the absence of hydrogen bond.

