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Chemistry Grade 11 — Chapter 3

Chemical Bonding

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Independent practice MCQs from the supplied Class 11 Chemistry notes pack. Total: 50 questions.

A. Important / Main Topics

1. Electronegativity is defined as the power of an atom to:

(A) Attract shared pair of electrons
(B) Lose electrons
(C) Gain electrons
(D) Repel shared pair of electrons

Correct Answer: A

Explanation: Electronegativity is the power of a covalently bonded atom to attract the shared pair of electrons towards itself in a molecule.

2. Which of the following bonds is ionic?

(A) H−Cl (ΔEN = 0.96)
(B) K−Cl (ΔEN = 2.34)
(C) O=O (ΔEN = 0)
(D) C−H (ΔEN = 0.4)

Correct Answer: B

Explanation: In ionic bonds, the difference in electronegativity between two atoms is higher than 1.8. K−Cl has ΔEN = 2.34.

3. The SI unit of dipole moment is:

(A) Coulomb
(B) Joule
(C) Debye
(D) Newton

Correct Answer: C

Explanation: The SI unit of dipole moment is debye.

4. Which of the following has the highest bond energy?

(A) H−Cl
(B) H−Br
(C) H−I
(D) H−F

Correct Answer: D

Explanation: H−F — this correctly answers the question.

5. According to VSEPR theory, a molecule with four bonding pairs and no lone pairs has a shape of:

(A) Tetrahedral
(B) Linear
(C) Trigonal planar
(D) Bent

Correct Answer: A

Explanation: Four bonding pairs and no lone pairs give a tetrahedral shape with a bond angle of 109.5^circ.

6. The bond angle in a water molecule (H□O) is:

(A) 109.5^circ
(B) 104.5^circ
(C) 107^circ

(D) 120^circ

Correct Answer: B

Explanation: In H□O, there are two bonding pairs and two lone pairs. Lone pair repulsion reduces the bond angle to 104.5^circ.

7. Which hybridization is present in BeCl□?

(A) sp^2
(B) sp^3
(C) sp
(D) sp^3d

Correct Answer: C

Explanation: Sp — this correctly answers the question.

8. In a coordinate covalent bond:

(A) Each atom contributes one electron
(B) Electrons are transferred completely
(C) No electrons are shared
(D) One atom provides both electrons

Correct Answer: D

Explanation: A coordinate covalent bond is formed when one atom provides both the electrons needed for a covalent bond.

9. Which of the following is the strongest intermolecular force?

(A) Hydrogen bonding
(B) London forces
(C) Dipole-dipole forces
(D) Instantaneous dipole-induced dipole forces

Correct Answer: A

Explanation: Hydrogen bonding is the strongest dipole-dipole force.

10. According to Molecular Orbital Theory, the bond order of O□ is:

(A) 1
(B) 2
(C) 3
(D) 0

Correct Answer: B

Explanation: According to Molecular Orbital Theory, the bond order of O□ is 2.

11. The shape of a molecule with three bonding pairs and one lone pair is:

(A) Tetrahedral
(B) Bent
(C) Trigonal pyramidal
(D) Linear

Correct Answer: C

Explanation: The shape of a molecule with three bonding pairs and one lone pair is Trigonal pyramidal.

12. Which of the following molecules is nonpolar?

(A) HCl
(B) H□O
(C) NH□
(D) CO□

Correct Answer: D

Explanation: CO□ is linear and the bond dipoles cancel each other out, making it nonpolar.

13. The bond angle in ammonia (NH□) is:

(A) 107^circ

(B) 109.5^circ
(C) 104.5^circ
(D) 120^circ

Correct Answer: A

Explanation: In NH□, there are three bonding pairs and one lone pair. The lone pair reduces the bond angle from 109.5^circ to 107^circ.

14. In sp² hybridization, the hybrid orbitals are arranged at:

(A) 180^circ
(B) 120^circ
(C) 109.5^circ
(D) 90^circ

Correct Answer: B

Explanation: sp² hybrid orbitals are arranged in a trigonal planar geometry at 120^circ.

15. Which of the following is a nonpolar molecule despite having polar bonds?

(A) HCl
(B) H□O
(C) CCl□
(D) NH□

Correct Answer: C

Explanation: CCl□ has a tetrahedral shape. The bond dipoles are equal and opposite and cancel each other out.

16. Which of the following molecules has a linear shape?

(A) H□O
(B) NH□
(C) CH□
(D) CO□

Correct Answer: D

Explanation: CO□ — this correctly answers the question.

17. The percentage of s-character in an sp hybrid orbital is:

(A) 50%
(B) 25%
(C) 33.33%
(D) 75%

Correct Answer: A

Explanation: The percentage of s-character in an sp hybrid orbital is 50%.

18. Which of the following has a bond order of zero?

(A) H□
(B) He□
(C) N□
(D) O□

Correct Answer: B

Explanation: He□ — this correctly answers the question.

19. According to VSEPR theory, a molecule with five bonding pairs and no lone pairs has a shape of:

(A) Octahedral
(B) Tetrahedral
(C) Trigonal bipyramidal
(D) Trigonal planar

Correct Answer: C

Explanation: According to VSEPR theory, a molecule with five bonding pairs and no lone pairs has a shape of Trigonal bipyramidal.

20. The bond angle in a molecule with sp^3 hybridization and no lone pairs is:

(A) 180^circ
(B) 120^circ
(C) 90^circ
(D) 109.5^circ

Correct Answer: D

Explanation: sp^3 hybridization with no lone pairs gives a tetrahedral geometry with a bond angle of 109.5^circ.

21. Which of the following is an example of a molecule with an expanded octet?

(A) PCl□
(B) CH□
(C) NH□
(D) H□O

Correct Answer: A

Explanation: PCl□ — this correctly answers the question.

22. In Molecular Orbital Theory, the number of molecular orbitals formed is:

(A) Less than the number of atomic orbitals combined
(B) Equal to the number of atomic orbitals combined
(C) Greater than the number of atomic orbitals combined
(D) Independent of the number of atomic orbitals combined

Correct Answer: B

Explanation: The number of molecular orbitals produced is always equal to the number of atomic orbitals that have combined.

23. Which of the following molecules is paramagnetic?

(A) N□
(B) F□
(C) O□
(D) H□

Correct Answer: C

Explanation: O□ — this correctly answers the question.

24. The correct order of strength of intermolecular forces is:

(A) London forces > Dipole-dipole > H-bonding
(B) Dipole-dipole > H-bonding > London forces
(C) London forces > H-bonding > Dipole-dipole
(D) H-bonding > Dipole-dipole > London forces

Correct Answer: D

Explanation: The correct order of strength of intermolecular forces is H-bonding > Dipole-dipole > London forces.

25. Which of the following is NOT a characteristic of hydrogen bonding?

(A) It is a covalent bond
(B) It is a strong intermolecular force
(C) It occurs when H is bonded to F, N, or O
(D) It makes ice less dense than water

Correct Answer: A

Explanation: Hydrogen bonding is an intermolecular force, NOT a bond.

B. Less Important / Secondary Topics

26. The shape of a molecule with two bonding pairs and one lone pair is:

(A) Bent
(B) Linear
(C) Trigonal planar

(D) Tetrahedral

Correct Answer: A

Explanation: The shape of a molecule with two bonding pairs and one lone pair is Bent.

27. The bond angle in SO□ is:

(A) 180^circ
(B) Less than 120^circ
(C) 120^circ
(D) 109.5^circ

Correct Answer: B

Explanation: The bond angle in SO□ is Less than 120^circ.

28. Which of the following molecules has a tetrahedral shape?

(A) BeCl□
(B) BCl□
(C) CH□
(D) PCl□

Correct Answer: C

Explanation: CH□ — this correctly answers the question.

29. Which of the following is the correct electronic configuration of Cl□ in terms of molecular orbitals?

(A) (sigma 1s)²(sigma^*1s)²(sigma 2s)²(sigma^*2s)²(sigma 2p_x)²(pi 2p_y)²(pi 2p_z)²(pi^*2p_y)¹(pi^*2p_z)¹
(B) (sigma 1s)²(sigma^*1s)²(sigma 2s)²(sigma^*2s)²(sigma 2p_x)²(pi 2p_y)²(pi 2p_z)²(pi^*2p_y)²(sigma^*2p_x)⁰
(C) (sigma 1s)²(sigma^*1s)²(sigma 2s)²(sigma^*2s)²(sigma 2p_x)¹(pi 2p_y)²(pi 2p_z)²
(D) (sigma 1s)²(sigma^*1s)²(sigma 2s)²(sigma^*2s)²(sigma 2p_x)²(pi 2p_y)²(pi 2p_z)²(pi^*2p_y)²(pi^*2p_z)²

Correct Answer: D

Explanation: Cl□ has 14 valence electrons. All are paired in the molecular orbitals. The configuration is (sigma 1s)²(sigma^*1s)²(sigma 2s)²(sigma^*2s)²(sigma 2p_x)²(pi 2p_y)²(pi 2p_z)²(pi^*2p_y)²(pi^*2p_z)².

30. The number of sigma and pi bonds in a nitrogen molecule (N≡N) is:

(A) 1 sigma, 2 pi
(B) 2 sigma, 1 pi
(C) 3 sigma, 0 pi
(D) 0 sigma, 3 pi

Correct Answer: A

Explanation: The number of sigma and pi bonds in a nitrogen molecule (N≡N) is 1 sigma, 2 pi.

31. Which of the following has the highest bond order?

(A) O□
(B) N□
(C) F□
(D) He□

Correct Answer: B

Explanation: N□ has a bond order of 3, which is the highest among the given options.

32. The shape of a molecule with six bonding pairs and no lone pairs is:

(A) Trigonal bipyramidal
(B) Tetrahedral
(C) Octahedral
(D) Linear

Correct Answer: C

Explanation: Six bonding pairs and no lone pairs give an octahedral shape with 90^circ bond angles.

33. In a coordinate covalent bond in the hydronium ion (H□O□):

(A) H□ donates a proton to water

(B) Water accepts a proton from H□
(C) Both atoms contribute one electron
(D) Water donates a lone pair to H□

Correct Answer: D

Explanation: In a coordinate covalent bond in the hydronium ion (H□O□) Water donates a lone pair to H□.

34. Which of the following is a correct statement about the dipole moment of a molecule?

(A) It depends on both charge and distance
(B) It depends only on the electronegativity difference
(C) It is always zero for polar molecules
(D) It is measured in joules

Correct Answer: A

Explanation: Dipole moment is the product of the magnitude of positive or negative charges and the distance between them.

35. The bond energy of H−H is 436 kJ mol□¹ and that of H−Br is 366 kJ mol□¹. This difference is due to:

(A) The higher electronegativity of Br
(B) The shorter bond length of H□ compared to HBr
(C) The larger size of H compared to Br
(D) The presence of lone pairs in H□

Correct Answer: B

Explanation: Bond energy of H−H is higher than H−Br due to the shorter bond length of hydrogen molecule compared to HBr.

36. For the reaction N□(g) + 3H□(g) □ 2NH□(g), what is the relationship between Kp and Kc?

(A) Kp = Kc
(B) Kp = Kc(RT)²
(C) Kp = Kc(RT)□²
(D) Kp = Kc(RT)□¹

Correct Answer: C

Explanation: Δ n = 2 - (1 + 3) = -2. Therefore, K_p = K_c(RT)□².

37. Which of the following molecules has a bond order of 2.5?

(A) O□
(B) O□□
(C) N□
(D) O□□

Correct Answer: D

*Explanation: O□□ has 11 bonding and 6 antibonding electrons. Bond order = frac11 - 62 = 2.5. *(Note: This is derived from applying MOT rules taught in the chapter).*.*

38. Which of the following correctly describes the bonding in a coordinate covalent bond?

(A) One atom provides both electrons
(B) Both atoms contribute one electron each
(C) Electrons are transferred completely
(D) Electrons are shared equally

Correct Answer: A

Explanation: In a coordinate covalent bond, one atom provides both the electrons needed for a covalent bond.

39. The hybridization of the central atom in SF□ is:

(A) sp^3
(B) sp^3d^2
(C) sp^3d
(D) sp^3d^3

Correct Answer: B

Explanation: SF□ has six bonding pairs around the central sulfur atom. To accommodate six pairs, the hybridization is sp^3d^2.

40. The bond angle in a trigonal bipyramidal molecule is:

(A) 109.5^circ
(B) 180^circ
(C) 90^circ and 120^circ
(D) 107^circ

Correct Answer: C

Explanation: In a trigonal bipyramidal molecule, the bond angles are 90^circ (axial-equatorial) and 120^circ (equatorial-equatorial).

41. According to molecular orbital theory, which of the following is diamagnetic?

(A) O□
(B) O□□
(C) O□□
(D) N□

Correct Answer: D

Explanation: N□ has all electrons paired, so it is diamagnetic. O□, O□□, and O□□ have unpaired electrons, making them paramagnetic.

42. The order of relative energies of molecular orbitals for O□ and F□ is:

(A) sigma 2p_x < pi 2p_y = pi 2p_z < pi^*2p_y = pi^*2p_z < sigma^*2p_x
(B) pi 2p_y = pi 2p_z < sigma 2p_x < pi^*2p_y = pi^*2p_z < sigma^*2p_x
(C) sigma 2p_x < sigma 2p_y < sigma 2p_z < pi 2p_x
(D) sigma 2p_x < pi 2p_y < pi 2p_z < sigma^*2p_x

Correct Answer: A

Explanation: For O□ and F□, the energy order is sigma 2p_x < pi 2p_y = pi 2p_z < pi^*2p_y = pi^*2p_z < sigma^*2p_x.

43. Which of the following molecules is polar despite having a linear shape?

(A) CO□
(B) HCl
(C) H□
(D) N□

Correct Answer: B

Explanation: HCl is a diatomic molecule with a polar bond. It has a linear shape but the dipole does not cancel, so it is polar.

44. The bond angle in NH□ is 107^circ. Which of the following explains why it is less than the ideal tetrahedral angle of 109.5^circ?

(A) The presence of three lone pairs
(B) The smaller size of nitrogen
(C) The presence of one lone pair
(D) The higher electronegativity of hydrogen

Correct Answer: C

Explanation: The presence of one lone pair — this correctly answers the question.

45. Which of the following statements about the molecular orbital theory is correct for N□?

(A) The bond order is 2
(B) The molecule is paramagnetic
(C) The molecule has 0 bonding electrons
(D) The bond order is 3

Correct Answer: D

Explanation: The bond order is 3 — this correctly answers the question.

46. Which of the following molecules has the smallest bond angle?

(A) H□O
(B) NH□
(C) CH□
(D) CO□

Correct Answer: A

Explanation: H□O has two lone pairs, reducing the bond angle to 104.5^circ, which is the smallest among the given options.

47. Which of the following is the correct Lewis structure for a coordinate covalent bond in ozone (O□)?

(A) O=O-O with a lone pair on the central oxygen
(B) O=O-O with a dative bond from the central oxygen to a terminal oxygen
(C) O-O=O with a dative bond from a terminal oxygen to the central oxygen
(D) O=O=O with all double bonds

Correct Answer: B

Explanation: O=O-O with a dative bond from the central oxygen to a terminal oxygen — this correctly answers the question.

48. The number of unpaired electrons in O□ is:

(A) 0
(B) 1
(C) 2
(D) 3

Correct Answer: C

Explanation: The molecular orbital diagram of O□ shows two unpaired electrons in the pi^* antibonding orbitals.

49. Which of the following has the highest bond energy based on the data provided?

(A) F−F
(B) Br−Br
(C) I−I
(D) Cl−Cl

Correct Answer: D

Explanation: The bond energy of Cl−Cl (242 kJ/mol) is the highest among the halogens. F−F is an exception due to lone pair repulsion.

50. Which of the following molecules has a planar structure with 120^circ bond angles?

(A) C□H□
(B) CH□
(C) C□H□
(D) NH□

Correct Answer: A

Explanation: C□H□ (ethylene) has sp² hybridization, giving a planar structure with 120^circ bond angles.