

BONDING TEST PAGE 1

Questions 1-7 are based on the following choices:

1) C_2Cl_4 2) HCN 3) $CaCl_2$ 4) CO_2 5) Cl_2

1. Contains two double bonds.
2. Contains a triple bond.
3. Shows sp^2 hybridization.
4. Contains only non-polar covalent bonds.
5. Is a polar molecule that contains covalent bonds.
6. Contains one and only one pi bond.
7. Contains both polar and non-polar covalent bonds.

Questions 8-11. 1) Bonds are polar and the molecule is nonpolar

2) Bonds are polar and the liquid is hydrogen bonded.

3) Bonds are polar, the molecule is polar, and the liquid is not hydrogen bonded.

4) Bonds are nonpolar, the molecule is polar, and the liquid is not hydrogen bonded.

5) Bonds are nonpolar and the only intermolecular forces are van der Waals forces.

8. Ammonia, NH_3

9. Hydrogen, H_2

10. Silane, SiH_4

11. Hydrogen iodide, HI

12. Which of the following molecules has the largest dipole moment?

1) CO_2 2) CCl_4 3) CF_4 4) H_2S 5) H_2O

13. In which of the following substances is hydrogen bonding most significant?

1) HBr 2) H_2S 3) CH_3CF_3 4) LiH 5) CH_3OH

14. For which of the following is the concept of resonance considered LEAST relevant in explaining the shape and the bond length?

1) SO_3 2) SO_2 3) C_6H_6 4) CO_2 5) CO_3^{2-}

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15. Which of the following compounds contains both ionic and covalent bonds?
1) C_2H_2 2) CH_3COOCH_3 3) Na_2CO_3 4) $MgCl_2$ 5) CH_3OCH_3
16. The hybridization of the sulfur orbitals in SO_3 is best described as
1) sp 2) sp^2 3) sp^3 4) p^3 5) dsp^2
17. Which of the following molecules has trigonal pyramidal geometry?
1) BCl_3 2) O_3 3) $SiCl_4$ 4) SO_3 5) PF_3
18. Equivalent resonance structures are used to describe which of the following species? 1) NH_4^+ 2) N_2 3) H_2CO 4) NO_3^- 5) PO_4^{3-}
19. $AsCl_5$ is a trigonal bipyramid. Its hybridization should be 1) sp^2
2) d^2sp^3 3) sp^3d 4) sp^3 5) dsp^2
20. CH_4 , CO_2 , PCl_3 , ICl_5 , SF_6
Which does not describe any of the above molecules? 1) linear
2) octahedral 3) square planar 4) tetrahedral 5) square based pyramid
21. One can predict the order of decrease in boiling point of the following three substances to be, (from highest to lowest boiling point.)
1) HF HCl F_2 2) F_2 HCl HF 3) HF F_2 HCl
4) HCl HF F_2 5) HCl F_2 HF
22. The electronegativities of C and O are 2.5 and 3.5, respectively. Based on this information, the BOND type in CO_2 is 1) non-polar covalent
2) polar covalent 3) ionic 4) network 5) metallic
23. The tetrahedral model is least appropriate in depicting the structure of which of the following? 1) H_2O 2) $BeCl_2$ 3) NH_3 4) $CHCl_3$ 5) SiH_4
24. The geometry of each of the following molecules is listed. Which would NOT have a permanent dipole? 1) $BrCl$ - linear 2) $HgCl_2$ - linear
3) CCl_3F - tetrahedral 4) NH_3 - pyramidal 5) SCl_2 - bent
25. Which has a planar geometry? 1) ClO_3^- 2) SO_3^{2-} 3) PH_3 4) CO_3^{2-} 5) NH_4^+
26. The shapes of BF_3 and NF_3 molecules are 1) trigonal planar
2) pyramidal 3) tetrahedral 4) square planar 5) different
27. The step in the Born Haber cycle which produces the greatest amount of energy is the 1) ionization of the gaseous metal atom. 2) sublimation of the metallic solid. 3) conversion of the diatomic non-metal to free gaseous atoms 4) electron affinity of the gaseous non-metal 5) formation of the ionic crystal from the gaseous anions and cations.

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28. Which sulfide should have the least ionic character? 1) Mg 2) Na 3)Ca
4)Ba 5) K
29. A compound which contains one or more pi bonds is 1) H₂S 2) H₂SO₄
3) O₂ 4) SO₃ 5) H₂SO₃
30. The bond angle between the hydrogen atoms in H₂Se is found to be very close to 90°. Which description of the bonds is most consistent with this information? 1)between s orbitals on the hydrogen, and sp³ orbitals on the Se, with two lone pairs. 2) between s orbitals on the H and p orbitals on the Se 3) Between s orbitals on the hydrogen and sp orbitals on the Se 4) between s orbitals on the hydrogen and sp² orbitals on the Se 5) two pi bonds.
31. Which is a free radical? 1) CH₃ 2) NO₂⁻ 3) NH₃ 4) PH₃ 5) BeH₂
32. The octet rule is satisfied for the central atom in 1)XeF₄ 2) SF₆
3) PCl₃ 4) BF₃ 5) NO₂
33. sp³ hybridization with one unbonded (lone) pair of electrons on the central atom would lead to molecules which are 1) trigonal planar
2) square planar 3) T shaped 4) linear 5) pyramidal
34. Molecules of SO₂ and NO₂ are different in that only one exhibits
1)resonance 2) hybridization 3) angular (bent) structure 4)a dipole moment
5) paramagnetism
35. Which of these diatomic gases would be most stable? 1) Be₂ 2) O₂²⁺
3) Cl₂²⁻ 4) Li₂ 5) N₂
36. The best description of a C₂H₂ molecule is 1)sp³ with two lone pairs.
2) sp hybridized with two lone pairs 3) sp hybridized with 2 pi bonds
4) sp² hybridized with one lone pair 5) sigma bonds between the carbon and hydrogen, with three pi bonds between the carbons.
37. Hydrogen bonding accounts for all of the following EXCEPT
1) H₂O has a higher boiling point than H₂S 2) NH₃ has a higher boiling point than PH₃ 3) CH₃OH is a liquid while CH₃Cl is a gas at room temperature. 4) C₃H₅(OH)₃ is an extremely viscous liquid with a low vapor pressure, while C₃H₇OH is much less viscous, with a higher vapor pressure. 5) CCl₄ is a liquid, while CH₄ is a gas at room temperature.
38. In which of the following are the compound, geometry, and hybridization of the central atom correctly matched?
1) ICl₅ - sp³d, trigonal bipyramid. 2) SO₂ - sp, angular

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3) PCl_3 - sp^2 trigonal planar 4) OF_2 - sp linear 5) SF_6 - sp^3d^2 octahedral.

39-41 1) Van der Waals forces 2) Hydrogen bonding 3) non-polar covalent bonding 4) polar covalent bonding 5) ionic bonding.

39. The bonds between the nitrogen and the hydrogen in an ammonia molecule.

40. The bonding forces overcome when iodine sublimes.

41. The bonding forces overcome when a photon strikes a chlorine molecule.

(42 - 48) 1) sp^3d^2 2) sp 3) sp^2 4) sp^3 5) sp^3d

42. Leads to compounds with bond angles of approximately 120° .

43. Produces compounds with bond angles of both 120° and 90° .

44. ICl_3 has two lone pairs on the iodine.

45. The dipole moment of BeI_2 is zero.

46. OF_2 has a non-zero dipole moment.

47. Hexammine cobalt (III) ion.

48. The hybridization in the carbon atoms in 1,3-butadiene. (C_4H_6 , with two double bonds, in the first and third positions .)