

- Rank the following in increasing bond polarity: CC, BO, NH, LiF
  - CC < NH < BO < LiF
  - BO < CC < LiF < NH
  - NH < BO < LiF < CC
  - CC < BO < NH < LiF
- Which of the following can be polar molecules:
  - CO<sub>2</sub>
  - Fe(CO)<sub>5</sub>
  - O<sub>3</sub>
  - I
  - I, II, III
  - III
  - I, II
- Which of the following molecules is nonpolar?
  - NH<sub>3</sub>
  - SO<sub>4</sub><sup>2-</sup>
  - SO<sub>2</sub>
  - BF<sub>2</sub>Cl
- Determine the molecular geometry and bond angles of bromine pentafluoride (BrF<sub>5</sub>)
  - Octahedral, 90, 120
  - Square Pyramidal, 90
  - Octahedral, 90
  - Square Pyramidal, 90, 120
- Which hybrid orbitals are present in XeF<sub>4</sub>?
  - dsp<sup>3</sup>
  - d<sup>2</sup>sp<sup>3</sup>
  - d<sup>2</sup>sp<sup>2</sup>
  - sp<sup>3</sup>
- Determine the electronic geometry of ICl<sub>2</sub><sup>-</sup>.
  - Trigonal pyramidal
  - Bent
  - Tetrahedral
  - Trigonal Bipyramidal
- Determine the molecular geometry of the oxygen in CH<sub>3</sub>OH.
  - Tetrahedral
  - Bent
  - Linear
  - Seesaw
- How many  $\sigma$  and  $\pi$  bonds are there in C<sub>2</sub>H<sub>2</sub>?
  - 4 $\sigma$  and 1 $\pi$
  - 3 $\sigma$  and 2 $\pi$
  - 2 $\sigma$  and 3 $\pi$
  - 3 $\sigma$  and 1 $\pi$
- What atomic orbitals are used in the bonding of NO?
  - 2s
  - 2s and 2p

- c. 2p
- d. 1s, 2s, 2p

10. Using molecular orbital theory determine which of the following molecules can exist and no be paramagnetic.

- a. B<sub>2</sub>
- b. He<sub>2</sub>
- c. CO
- d. NO

Miranda, Question Types 11-20.

11. What is the electronic configuration of B<sub>2</sub><sup>-</sup>?

- a.  $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^4$
- b.  $(\sigma_{2s})^2(\sigma_{2s}^*)^2$
- c.  $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\pi_{2p})^2$
- d.  $(\sigma_{2s})^2(\sigma_{2s}^*)^2(\sigma_{2p})^2(\pi_{2p})^2$

12. What are the bond orders for N<sub>2</sub><sup>+</sup>, N<sub>2</sub>, and N<sub>2</sub><sup>-</sup>?

- a. 3.5; 3; 3.5
- b. 2; 3; 4
- c. 2.5; 3; 3.5
- d. 2.5; 3; 2.5

13. Which molecule is diamagnetic?

- a. B<sub>2</sub><sup>2-</sup>
- b. C<sub>2</sub><sup>2+</sup>
- c. O<sub>2</sub>
- d. all are diamagnetic

14. Based on bond order, what is true about the difference between the bonds in Li<sub>2</sub> and C<sub>2</sub>?

- a. C<sub>2</sub> has a longer bond length and a higher bond energy than Li<sub>2</sub>.
- b. C<sub>2</sub> has a longer bond length and a lower bond energy than Li<sub>2</sub>.
- c. C<sub>2</sub> has a shorter bond length and a higher bond energy than Li<sub>2</sub>.
- d. C<sub>2</sub> has a shorter bond length and a lower bond energy than Li<sub>2</sub>.

15. Which of the following species does not exhibit resonance?

- a. SO<sub>3</sub>
- b. PCl<sub>5</sub>
- c. HCO<sub>2</sub>
- d. C<sub>6</sub>H<sub>6</sub>

16. At constant temperature and pressure, the volume of a gas will increase as the number of moles increases. Who's law is this?

- a. Pauli's
- b. Charles's
- c. Boyle's
- d. Avogadro's

17. A gas is contained in a flexible, 4.7 L container. The temperature of the gas is increased from 25 °C to 50 °C, and the pressure is decreased from 760 Torr to 730 Torr. What is the new volume of the gas?

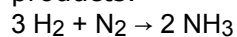
- a. 5.3 L

- b. 9.7 L
- c. 5.8 L
- d. 6.5 L

18. 3.5 grams of a gas is held in a 1.13 L container at 25 °C and 2 atm. What is the molecular weight of the gas? Which molecule could this gas be?

- a. 40 g/mol; Ar
- b. 70 g/mol; Cl<sub>2</sub>
- c. 4 g/mol; He
- d. 38 g/mol; F<sub>2</sub>

19. If the reaction goes to completion, what is the maximum number of moles that can be obtained by reacting 5.00 L of H<sub>2</sub>(g) with 2.00 L of N<sub>2</sub>(g)? Assume STP for the reactants and products.



- a. .178 mol
- b. .149 mol
- c. 1.63 mol
- d. 1.95 mol

20. If molecule A has a molecular weight of 127.5 g/mol and molecule B has a molecular weight of 120.2 g/mol, how many times faster will molecule B travel than molecule A?

- a. 1.30
- b. 1.03
- c. .971
- d. .943

21. Rank the following gases from most to least ideal in terms of the van der Waal coefficient b: CO, N<sub>2</sub>O, HF, H<sub>2</sub>O<sub>2</sub>.

- 1. HF > CO > N<sub>2</sub>O > H<sub>2</sub>O<sub>2</sub>
- 2. H<sub>2</sub>O<sub>2</sub> > HF > CO > N<sub>2</sub>O
- 3. HF > CO > H<sub>2</sub>O<sub>2</sub> > N<sub>2</sub>O
- 4. CO > HF > H<sub>2</sub>O<sub>2</sub> > N<sub>2</sub>O

22. Which of the combinations of V, n and T below would behave the most ideally?

- 1. V = 2 L, n = 0.1 moles, T = 250 K
- 2. V = 2 L, n = 0.5 moles, T = 100 K
- 3. V = 10 L, n = 0.5 moles, T = 250 K
- 4. V = 10 L, n = 0.1 moles, T = 500 K
- 5. V = 2 L, n = 0.1 moles, T = 500 K

23. Which of the following best explains all intermolecular forces?

- 1. Electrostatic attractions between opposite charges.
- 2. The capacity of molecules to form instantaneous dipoles.
- 3. The tendency of ions to arrange themselves in lattices.
- 4. The large charge density that occurs when hydrogen is bonded to a very electronegative atom.

24. Which of the following species exhibit hydrogen bonding?

- I. CH<sub>2</sub>O
- II. CH<sub>3</sub>OH
- III. CH<sub>3</sub>COOH

1. I only
2. II only
3. III only
4. I and II
5. I and III
6. II and III
7. I, II and III

25. For which of the following species are London forces significant?

1.  $\text{NH}_3$
2.  $\text{CH}_2\text{F}_2$
3.  $\text{O}_3$
4.  $\text{SF}_6$

26. Which of the following describes a fluid's ability to resist flow?

1. mucilage
2. viscosity
3. surface tension
4. capillary action
5. vapor pressure

27. Rank the following species from highest to lowest vapor pressure:  $\text{HF}$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_3$

1.  $\text{NH}_3 > \text{HF} > \text{H}_2\text{O}$
2.  $\text{HF} > \text{H}_2\text{O} > \text{NH}_3$
3.  $\text{H}_2\text{O} > \text{NH}_3 > \text{HF}$
4.  $\text{NH}_3 > \text{H}_2\text{O} > \text{HF}$

28. Rank the following species from least to greatest viscosity:  $\text{CH}_4$ ,  $\text{C}_4\text{H}_{10}$ ,  $\text{CH}_3\text{F}$ ,  $\text{CF}_4$ .

1.  $\text{CH}_4 < \text{C}_4\text{H}_{10} < \text{CH}_3\text{F} < \text{CF}_4$
2.  $\text{CH}_4 < \text{C}_4\text{H}_{10} < \text{CF}_4 < \text{CH}_3\text{F}$
3.  $\text{C}_4\text{H}_{10} < \text{CH}_4 < \text{CH}_3\text{F} < \text{CF}_4$
4.  $\text{CH}_3\text{F} < \text{C}_4\text{H}_{10} < \text{CH}_4 < \text{CF}_4$
5.  $\text{C}_4\text{H}_{10} < \text{CH}_4 < \text{CF}_4 < \text{CH}_3\text{F}$

29. Rank the following species from highest to lowest boiling point:  $\text{H}_2\text{Te}$ ,  $\text{H}_2\text{S}$ ,  $\text{H}_2\text{O}$ ,  $\text{H}_2\text{Se}$

1.  $\text{H}_2\text{O} > \text{H}_2\text{S} > \text{H}_2\text{Se} > \text{H}_2\text{Te}$
2.  $\text{H}_2\text{O} > \text{H}_2\text{Se} > \text{H}_2\text{Te} > \text{H}_2\text{S}$
3.  $\text{H}_2\text{O} > \text{H}_2\text{Te} > \text{H}_2\text{S} > \text{H}_2\text{Se}$
4.  $\text{H}_2\text{O} > \text{H}_2\text{Te} > \text{H}_2\text{Se} > \text{H}_2\text{S}$

30. Which of the species below is not covalent network?

1. graphite
2. dry ice
3. diamond
4. quartz