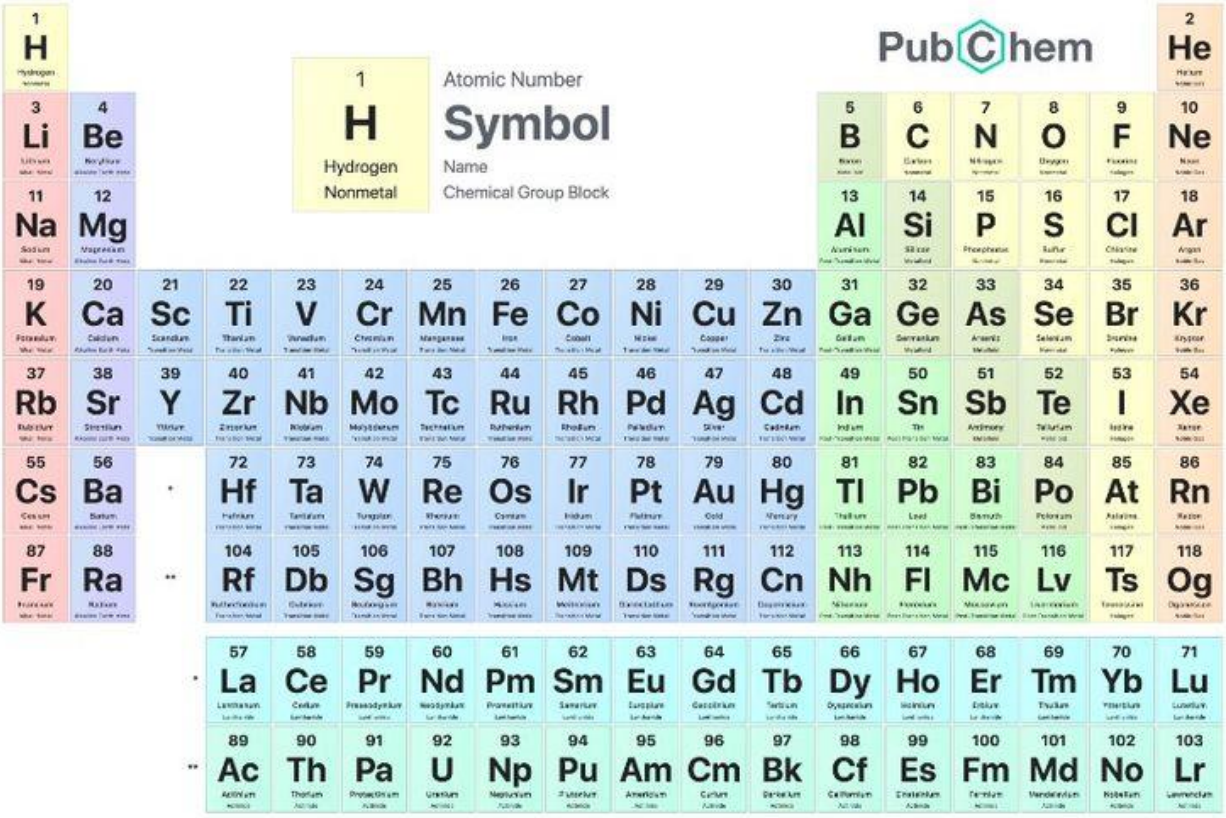
CHM 2045 Exam 3 Review



1. Draw the Lewis Structure(s) for SO_4^{2-}

2. Which of the following are exceptions to the octet rule in the central atom?

I PCl_5 II. $BeCl_2$ III. BF_3 IV. NH_3 V. H_2O

   a. I, II, III
   b. I, II, IV
   c. II, IV
   d. I, II, V
   e. II, III, IV

3. Which of the following molecules is polar?
   a. CH_2Cl_2
   b. PCl_5
   c. BF_3
   d. XeF_2

4. Name the electron geometry, molecular geometry, and bond angles for each of the following bonds.
    a. BrF_3

    b. HCN

    c. CO_3^{2-}

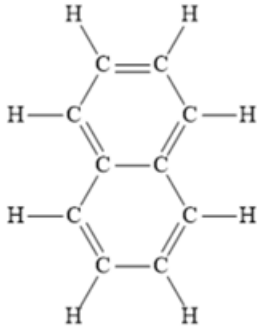
5. Which of the following solutions is matched with its correct intermolecular force between solute and solvent?
   A) CH2F2 and CH2O: dispersion
   B) Cl2 and PH3: dipole-induced dipole
   C) HF and NH3: dipole-dipole
   D) PH3 and H2O: dispersion

6. Which of the following has sp^2 hybridization?
   a. BF_3
   b. I_3^-
   c. CO_2
   d. NH_3

7. According to MO theory, which of the following is paramagnetic? MO order: σ2s < σ*2s < σ2px <π2py = π2pz < π*2py = π*2pz <σ*2px
   a. O_2
   b. O_2^+
   c. O_2^-
   d. All of the above

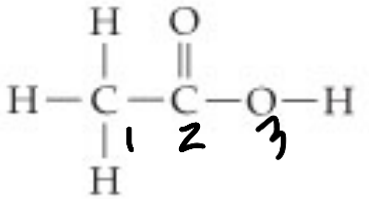
8. 19. According to MO theory, which of the following dicarbon species is expected to have the shortest bond length. Use the following valence MO order: σ2s < σ*2s < π2py = π2pz < σ2px < π*2py = π*2pz <σ*2px
   a) C_2^{2+}
   b) C_2
   c) C_2^{2-}
   d) C_2^{-}
   e) They all have the same length

9. How many sigma and pi bonds are in the molecule below?



   a. 16 sigma, 5 pi
   b. 19 sigma, 5 pi
   c. 14 sigma, 10 pi
   d. 20 sigma, 10 pi

10. What are the hybridizations of the three labeled atoms in the following molecule?



a. 1 sp^3 2. sp^2 3. sp^3
b. 1. sp^3 2. sp^2 3. sp^3d
c. 1. sp^3 2. sp^2 3. sp
d. 1. sp^3d 2. sp^3 3. sp^3

11. Rank the following in order of increasing boiling point.

I. CH_2Br_2 II. CH_3CH_2OH III. F_2 IV. CH_4

a. IV < III < II < I
b. IV < III < I < II
c. I < II < IV < III
d. III < I < II < IV

12. Which of the following has the lowest vapor pressure?

a. CH_4
b. H_2O
c. CH_2Cl_2
d. NH_3

13. Which of the following molecules is predicted to have the highest viscosity?
    a. BF_3
    b. CH_2I_2
    c. NH_3
    d. CH_4

14. Which of the following statements is true?
    a. As temperature increases, viscosity increases.
    b. Vapor pressure increases with increasing intermolecular forces
    c. The stronger intermolecular force, the stronger the surface tension.
    d. Surface tension increases with increasing temperature.

15. Calculate the heat needed to convert 10.0 g of solid bromine from -7.2°C to 70.0°C. Which of the following steps requires the most heat energy: melting the solid bromine, heating the liquid bromine from its melting point to its boiling point, boiling the bromine, or heating the gaseous bromine from its boiling point to110.0°C?Melting point for bromine -7.2°C, heat of fusion for bromine = 66.15 J/g; specific heat of liquid bromine = 0.474 J/g°C; boiling point for bromine = 58.7°C, heat of vaporization for bromine =193.21 J/g, specific heat of gaseous bromine = 0.225 J/g°C.