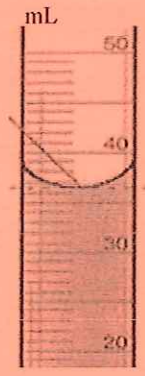
Chemistry B Final Exam Practice Quiz

Name: Key

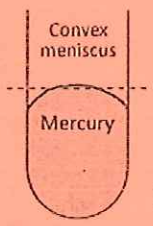
1. Find the electronegativity difference between carbon (C) and chlorine (Cl), and indicate the type of bond that will form. $3.0 - 2.5 = 0.5$
   a. 0.0 – 0.4 nonpolar covalent
   (b.) 0.4 – 1.0 moderately polar covalent
   c. 1.0 – 2.0 very polar covalent
   d. ≥ 2 ionic

2. Which measurement correctly reflects the volume shown in this graduated cylinder?



   a. 36 mL
   (b.) 36.2 mL
   c. 36.20 mL
   d. 36.200 mL

3. Mercury forms a convex meniscus in glass, as shown in the picture to the right. This indicates that ____



   a. There are no intermolecular forces present.
   b. The adhesive forces are stronger than the cohesive forces.
   (c.) The cohesive forces are stronger than the adhesive forces.

4. What is the percent composition of CO_2? ← molar mass 44.01 g/mol
   (a.) 27.29 % C and 72.71 % O
   b. 27.29 % C and 36.36 % O $\%C = \frac{12.01\,g}{44.01\,g} \times 100$
   c. 42.88 % C and 57.12 % O
   d. 42.88 % C and 72.71 % O $\%O = \frac{2 \times 16.00\,g}{44.01\,g} \times 100$

5. Determine the empirical formula of a compound with 87.4 % nitrogen and 12.6 % hydrogen.
   a. NH $87.4\,g \times \frac{1\,mol}{14.01\,g} = 6.23\,mol\,N \;/6.23 = 1$
   (b.) NH_2
   c. N_2H_4
   d. N_6H_{12} $12.6\,g \times \frac{1\,mol}{1.008\,g} = 12.5\,mol\,H \;/6.23 = 2$

6. Which of the following is an empirical formula?
   a. C_6H_{12} ÷6
   b. C_4H_8 ÷4
   (c.) C_3H_8 ÷1
   d. C_3H_6 ÷3

7. How many milliliters of 6.00 M HCl are needed to make 0.250 L of 3.00 M solution?
   a. 0. 125 mL $\frac{M_1V_1}{M_1} = \frac{M_2V_2}{M_1}$
   b. 0.50 mL
   (c.) 125 mL $\frac{3.00\,M \times 0.250\,L}{6.00\,M} = 0.125\,L$ ↓ 125 mL
   d. 500 mL

8. A 1.50 (V_1) L balloon is sealed at 25 (T_1) °C. Predict the volume if the balloon is heated to 35 °C. (T_2)
   a. 1.07 L $\frac{V_1}{T_1} = \frac{V_2}{T_2} \Rightarrow V_2 = \frac{V_1T_2}{T_1}$
   b. 1.45 L
   (c.) 1.55 L $T_1 = 298\,K$ $V_2 = \frac{1.50\,L \times 308\,K}{298\,K}$
   d. 2.10 L $T_2 = 308\,K$

9. How many moles of hydrogen gas are required to produce 4 moles of NH_3?

$$N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$$

   (a.) 6 mol H_2 $4\,mol\,NH_3 \times \frac{3\,mol\,H_2}{2\,mol\,NH_3} = 6\,mol\,H_2$
   b. 4 mol H_2
   c. 2 mol H_2
   d. 1 mol H_2

10. During an experiment you calculate that you should get 5.4 g of product from a reaction, but you only obtain 3.9 g of the product in the lab. What is your percent yield for this reaction?
    a. 1.4 %
    b. 7.2 %
    c. 28 %
    (d.) 72 %

$$\%\,Yield = \frac{Actual}{Theoretical} \times 100$$

$$\frac{3.9\,g}{5.4\,g} \times 100$$

11. Which of the following must be true of a reaction, if the change in heat involved in a chemical reaction has a positive sign? $\Delta H = +$
    a. Heat is lost to the surroundings
    (b.) Heat is gained from the surroundings
    c. No heat is exchanged during the reaction

12. Which of the following needs the greatest amount of heat to raise the temperature 1°C?
    (a.) 1 g Aluminum, $C_p = 0.90\,\frac{J}{g\,°C}$
    b. 1 g Iron, $C_p = 0.46\,\frac{J}{g\,°C}$
    c. 1 g Silver, $C_p = 0.24\,\frac{J}{g\,°C}$
    d. 1 g Platinum, $C_p = 0.13\,\frac{J}{g\,°C}$

For each of the following problems involving calculations, show all work including units. If appropriate, indicate the equation used. Be sure to complete any conversions necessary. Record your answer with units in the box.

13. Determine the mass of nitrogen trihydride gas (NH_3) produced when 34.1 L of nitrogen gas, at STP, reacts with excess hydrogen.

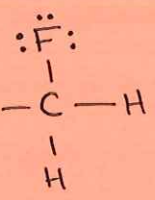
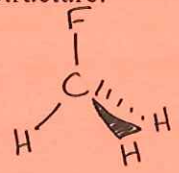
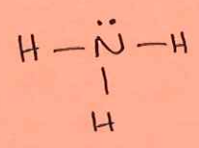
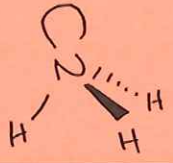
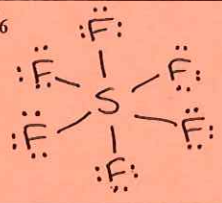
$$N_2\,(g) + 3H_2\,(g) \rightarrow 2NH_3\,(g)$$

$$34.1\,L\,N_2 \times \frac{1\,mol\,N_2}{22.4\,L\,N_2} \times \frac{2\,mol\,NH_3}{1\,mol\,N_2} \times \frac{17.03\,g\,NH_3}{1\,mol\,NH_3} =$$

(molar mass)

51.9 g NH_3

14. **Complete the table.**

Draw the Electron Dot Structure	Draw 3-D structure & Name VSEPR Shape	Indicate Polarity	*Check*(✓) **all** forces present & *Circle or box* the ☑ to identify the **strongest**.	
CH_3F  4 / 1×3 / 7 / 14e⁻	3-D Structure: 	Shape Name: Tetrahedral (Polar) or Nonpolar? ↑ Asymmetric	dispersion	✓
			dipole-dipole	(✓)
			hydrogen bonding	
NH_3  5 / 1×3 / 8e⁻	3-D Structure: 	Shape Name: Trigonal Pyramidal (Polar) or Nonpolar? ↑ Asymmetric	dispersion	✓
			dipole-dipole	✓
			hydrogen bonding	(✓)
SF_6  6 / 7×6 / 48e⁻	3-D Structure: 	Shape Name: Octahedral Polar or (Nonpolar)? ↑ Symmetric	dispersion	(✓)
			dipole-dipole	
			hydrogen bonding	

15. Based on the types of intermolecular forces you identified, which of the molecules in the table above is likely to adhere most strongly to water? ← H-bond

(circle one) CH_3F (**NH_3**) SF_6

16. Which of the molecules in the table above is likely to be the most **volatile** (evaporate the easiest)?

(circle one) CH_3F NH_3 (**SF_6**) ← weakest IM attractions

17. What is the volume (V) of a sealed container with 12.7 grams ($g \rightarrow mol\ (n)$) of O_2 gas at 45°C (T) and 2.5 atm (P)? $T = 45°C + 273 = T = 318\ K$

$$\frac{PV}{R} = \frac{nRT}{P} \qquad V = \frac{nRT}{P} = \frac{(0.397\ mol)\left(0.08206 \frac{atm\,L}{K\,mol}\right)(318\ K)}{(2.5\ atm)}$$

4.1 L

$$12.7\ g\ O_2 \times \frac{1\ mol}{32.00\ g} = 0.397\ mol$$

$C_{solid} = 2.10 \frac{J}{g\,°C}$ $C_{liquid} = 4.18 \frac{J}{g\,°C}$ $C_{gas} = 2.00 \frac{J}{g\,°C}$ $\Delta H_{solid} = -334\ J/g$ $\Delta H_{fus} = 334 \frac{J}{g}$ for H_2O $\Delta H_{cond} = -2260\ J/g$ $\Delta H_{vap} = 2260 \frac{J}{g}$ for H_2O

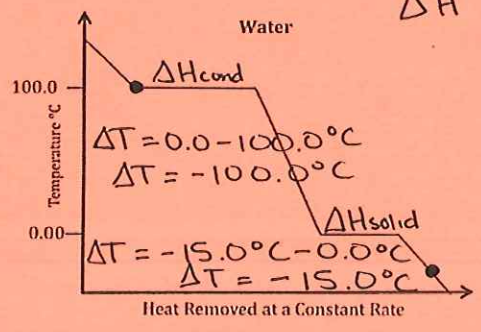
18. Calculate the change in energy (in kJ) needed to convert (25.0 g) (m) of steam at 100.0 °C to ice at −15.0 °C by following steps a and b below.

a. Using only variables, write the equation you will use to calculate the change in energy for the process described above.

$$\Delta H = (m \times \Delta H_{cond}) + (m \times C_{liq} \times \Delta T) + (m \times \Delta H_{solid}) + (m \times C_{solid} \times \Delta T)$$

latent — sensible — latent — sensible

b. Complete the calculation and report the total change in energy in kJ.



$$\Delta H = (25.0\ g \times -2260\ J/g) + (25.0\ g \times 4.18 \frac{J}{g\,°C} \times -100.0°C) + (25.0\ g \times -334\ J/g) + (25.0\ g \times 2.10 \frac{J}{g\,°C} \times -15.0°C)$$

−56500 J
−10500 J
−8350 J
− 789 J

$$-76100\ J \times \frac{1\ kJ}{1000\ J} =$$

−76.1 kJ