

Name: _____

Honors Chemistry Unit 6 Practice Sheet

*Chapter 16:

1. If you add more solute to a solution, and the solute dissolves, then what type of solution do you have?
2. Calculate the molarity of a solution that has 20.2g of potassium nitrate in 250.0 mL of solution.
3. What mass of sucrose, $C_{12}H_{22}O_{11}$, is needed to make 300.0 mL of a 0.50M solution?
4. You must prepare 300 mL of 0.750M NaBr solution using 2.00M NaBr stock solution. How many milliliters of the stock solution should you use?
5. If you dilute 50 mL of a 3.5M sodium chloride solution to 150 mL, then what is the new molarity?
6. What is the %(v/v) of a solution that is made with 60.0 mL of methanol in a total volume of 500.0 mL?
7. How many grams of solute are needed to prepare 2000g of a 5.00% (m/m) KNO_3 solution?
8. Why does the addition of a solute elevate the boiling point of a solvent?
9. Which solution has the **higher** freezing point?

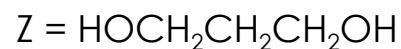
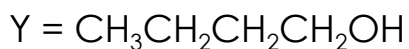
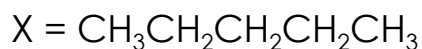
Solution A

2 mol NaCl

Solution B

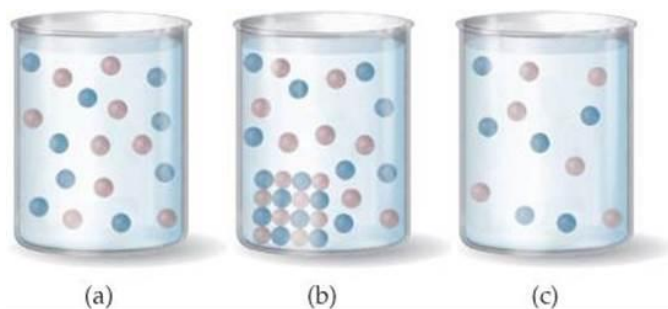
1 mol $Al_2(SO_4)_3$

10. Based on the concepts of polarity and hydrogen bonding, which of the following sequences correctly lists the compounds below in the order of their increasing solubility in water?



- a. $Z < Y < X$
- b. $Y < Z < X$
- c. $Y < X < Z$
- d. $X < Z < Y$
- e. $X < Y < Z$

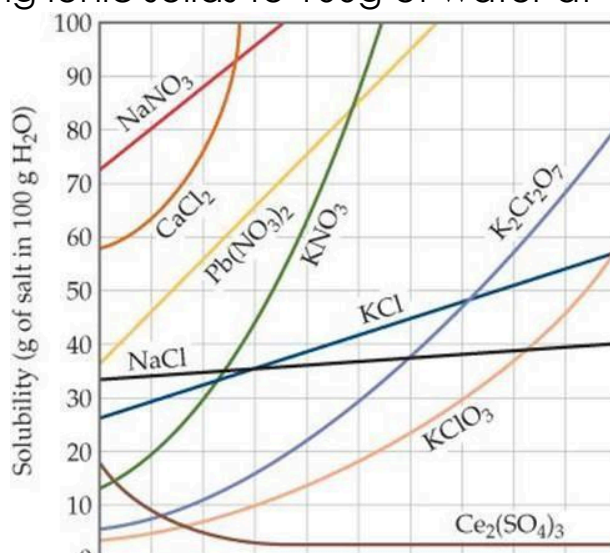
11. A 40.0 mL sample of 0.25 M KOH is added to 60.0 mL of 0.15 M Ba(OH)₂. What is the molar concentration of OH⁻_(aq) in the resulting solution? (Assume that the volumes are additive.)
- a. 0.10 M b. 0.19 M c. 0.28 M d. 0.40 M e. 0.55 M
12. Would you expect the energy of ion-solvent interaction to be greater for Na⁺ or Li⁺? Explain.
13. Which of the following is the best representation of a saturated solution? Explain your reasoning.

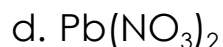


14. The figure below shows two identical volumetric flasks containing the same solution at two temperatures. Does the molarity of the solution change with the change in temperature? Explain.



15. By referring to the graph, determine whether the addition of 40.0g of each of the following ionic solids to 100g of water at 40°C will lead to a saturated solution:





16. Which of the following in each pair is likely to be more soluble in hexane, C_6H_{14} :

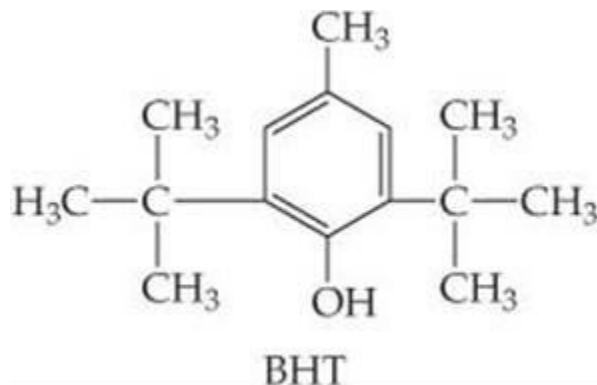


17. Explain why carbonated beverages must be stored in sealed containers. Once the beverage has been opened, why does it maintain more carbonation when refrigerated than at room temperature?

18. Consider two solutions, one formed by adding 10 g of glucose ($\text{C}_6\text{H}_{12}\text{O}_6$) to 1 L of water and the other formed by adding 10 g of sucrose ($\text{C}_{12}\text{H}_{22}\text{O}_{11}$) to 1 L of water. Are the vapor pressures over the two liquids the same? Why or why not?

19. List the following aqueous solutions in order of increasing boiling point: 0.120 M glucose, 0.050 M LiBr , 0.050 M $\text{Zn}(\text{NO}_3)_2$.

20. Butylated hydroxytoluene (BHT) has the following molecular structure:



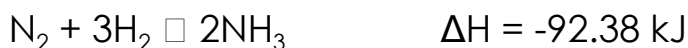
It is widely used as a preservative in a variety of foods, including dried cereals. Based on its structure, would you expect BHT to be more soluble in water or in hexane (C_6H_{14})? Explain.

*Chapter 17:

1. Convert 1750J to calories.
2. When you touch an exothermic reaction, what does the temperature feel like?
3. The temperature of a piece of unknown metal with a mass of 18.0g increases from 25.0°C to 40°C when the metal absorbs 124.2J of heat. What is the specific heat of the unknown metal?
4. What device is used to accurately measure the heat change of a reaction in the lab?
5. Is a reaction endothermic or exothermic if $\Delta H = 59.7 \text{ kJ/mol}$?
6. Calculate the amount of heat released when 4.79g of ethene reacts with excess oxygen.



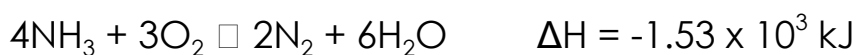
7. Calculate the number of grams of ammonia produced if -774kJ of heat is released during the following reaction.

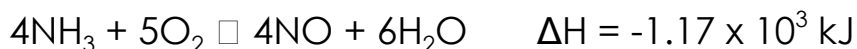


8. Does temperature change during a phase change?
9. Calculate the amount of heat gained or lost when 25g of ethanol vaporizes at 78.3°C.
10. Calculate the amount of heat gained or lost when 150g of water freezes at 0°C.
11. Draw and FULLY label the heating curve for water.
12. Calculate the amount of heat absorbed to change 88g of water at 50°C to steam at 125°C.
13. When you flip a reaction during a Hess' law problem, what do you do to the ΔH ?
14. Calculate the enthalpy change for the formation of nitrogen monoxide from its elements.

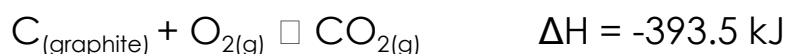
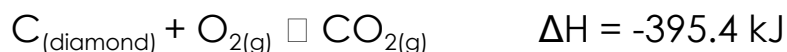


Use the following thermochemical equations.





15. What is the standard heat of formation for an element in its standard state?
16. The reactions for the combustion of diamond and graphite are shown below. Which of the following values is closest to the ΔH_{rxn} for the conversion of $\text{C}_{(\text{graphite})}$ to $\text{C}_{(\text{diamond})}$?

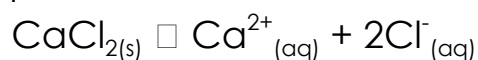


- a. -789.0 kJ
b. -1.9 kJ
c. 1.9 kJ
d. 789.0 kJ
17. Which of the following combinations of enthalpy and entropy changes accurately describes the combustion of wood into $\text{CO}_{2(\text{g})}$ and $\text{H}_2\text{O}_{(\text{g})}$ in a campfire?
- a. $\Delta H > 0$, $\Delta S > 0$
b. $\Delta H < 0$, $\Delta S < 0$
c. $\Delta H > 0$, $\Delta S < 0$
d. $\Delta H < 0$, $\Delta S > 0$
18. Given the bond energies in the table below, which of the following statements best describes the formation of 1 mole of $\text{H}_2\text{O}_{(\text{l})}$ from $\text{H}_{2(\text{g})}$ and $\text{O}_{2(\text{g})}$?

Bond	Energy (kJ mol ⁻¹)
H – H	432
O = O	494
H – O	459

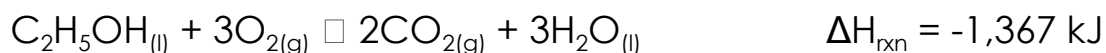
- a. The process is endothermic with an enthalpy change of approximately 480 kJ.
- b. The process is endothermic with an enthalpy change of approximately 240 kJ.
- c. The process is exothermic with an enthalpy change of approximately 480 kJ.
- d. The process is exothermic with an enthalpy change of approximately 240 kJ.

19. The entropy change for the dissolution of calcium chloride in water shown below might be expected to be positive, but that actual value of the ΔS is negative. Which of the following is the most plausible explanation for the net loss of entropy during this process?



- a. The particles in the solution are more ordered than the particles in the solid.
- b. The ions in solution can move more freely than the particles in the solid.
- c. The decreased entropy of the water molecules in the solution is greater than the increased entropy of the ions.
- d. In solution, the distance between ions is much greater than the distance between the ions in the solid.

20. The equation for the combustion of ethanol, $\text{C}_2\text{H}_5\text{OH}_{(l)}$, and selected standard heats of formation (ΔH°_f) are shown above. The standard heat of formation of $\text{CO}_{2(g)}$ is closest to:



Compound	ΔH°_f
$\text{C}_2\text{H}_5\text{OH}_{(l)}$	-278 kJ
$\text{H}_2\text{O}_{(l)}$	-286 kJ
$\text{CO}_{2(g)}$?

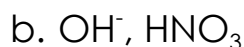
- a. -1,080 kJ mol⁻¹
- b. -540 kJ mol⁻¹
- c. -510 kJ mol⁻¹
- d. -390 kJ mol⁻¹

*Chapter 19:

1. Fill in the following charts.

original acid	conjugate base
HNO_3	
H_2O	
H_3O^+	
original base	conjugate acid
OH^-	
SO_4^{2-}	
HCO_3^-	

2. Which of the following represent conjugate acid-base pairs?



3. Calculate the $[\text{H}^+]$ in a solution in which $[\text{OH}^-] = 2.0 \times 10^{-2} \text{ M}$. Is this solution acidic, neutral, or basic?
4. What is the pH of a solution in which $[\text{H}^+] = 0.0015 \text{ M}$? Identify the solution as an acidic, neutral, or basic.
5. What is the hydroxide ion concentration of a solution with a pOH of 9.77? Identify the solution as an acidic, neutral, or basic.
6. List 3 strong acids and 3 strong bases.
7. What is the generic formula to solve for K_a ?
8. A student prepared a 0.25M solution of formic acid and measured its pH. The pH is 2.17. What is the K_a ?
9. Finish and BALANCE the following neutralization reaction.



10. What is the difference in the equivalence point and the end point of a titration?

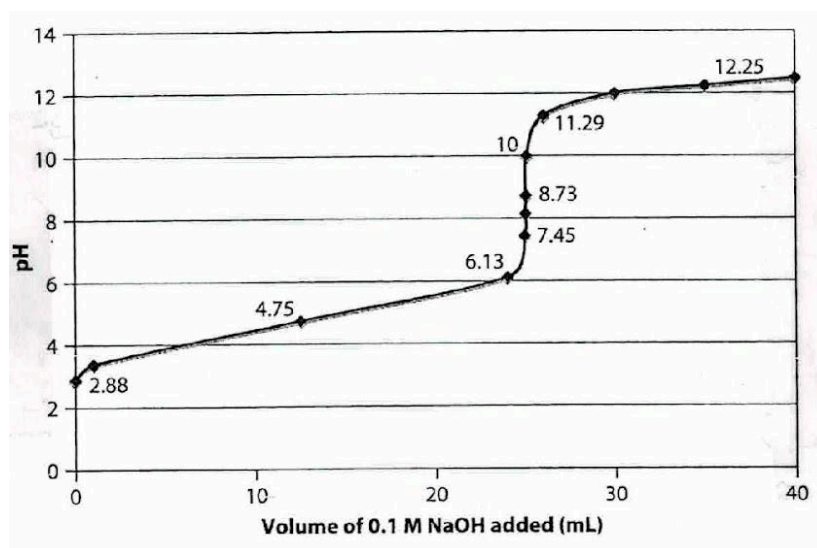
11. Titration reveals that 11.6 mL of 3.0 M sulfuric acid are required to neutralize the sodium hydroxide in 25.00 mL of NaOH solution. What is the molarity of the NaOH solution?
12. What is a buffer and how is it made?
13. Are the following salt solutions acidic, basic, or neutral?
- a. KNO_3 b. $\text{LiC}_2\text{H}_3\text{O}_2$ c. MgCl_2
14. Which of the following best explains the relationship between conjugate acid-base pairs?
- a. The acid and the base differ by one proton (H^+ ion).
- b. The conjugate base differs from the base by one proton (H^+ ion).
- c. The conjugate base differs from the acid by one proton (H^+ ion).
- d. The conjugate acid and conjugate base differ by one proton (H^+ ion).

15. Which of the following statements is true of the reaction represented below?



- a. OH^- is the conjugate acid of H_2O .
- b. LF is the conjugate base of F^- .
- c. HF and H_2O are conjugate acid-base pairs.
- d. HF and H_2O are both Bronsted-Lowry acids.

**Questions 16 – 18 refer to the titration of a solution of a weak monoprotic acid with a 0.1 M strong base NaOH. The titration curve is shown below.



16. What is the value of the pH where the number of moles of strong base added is equal to the number of moles of weak acid in the initial solution?
- a. 7.00
 - b. 7.45
 - c. 8.73
 - d. 10.00
17. At which pH are the concentration of the weak acid and its conjugate base approximately equal?
- a. 2.88
 - b. 4.75
 - c. 6.13
 - d. 7.00
18. In which of the following pH ranges does the solution act most like a buffer?
- a. 2.88 and 6.13
 - b. 4.75 and 7.45
 - c. 6.13 and 11.29
 - d. 11.29 and 12.25

19. Which of the following has the lowest conductivity in a 0.1 M solution?

- a. CuSO_4 b. KOH c. BaCl_2 d. HF e. HNO_3

20. When phenolphthalein is used as an indicator in a titration of an HCl solution with a solution of NaOH , the indicator undergoes a color change from clear to red at the end point of the titration. This color change occurs abruptly because ...

- a. phenolphthalein is a very strong acid that is capable of rapid dissociation.
- b. the solution being titrated undergoes a large pH change near the end point of the titration.
- c. phenolphthalein undergoes an irreversible reaction in basic solution
- d. OH^- acts as a catalyst for the decomposition of phenolphthalein.
- e. phenolphthalein is involved in the rate-determining step of the reaction between H_3O^+ and OH^- .