AMSAT Chem 1H Mr. Dehne

Name: _____

Date: _____

Period#:___

Solutions-Ions Topic#13

WS#1: The Nature of Solutions

On the line at the left, write the letter of the definition that best matches each term.

____1. solution	a. a substance that dissolves in water to form a solution that does not conduct an electric current, forms no ions
____2. solute	b. solution with water as the solvent
____3. solvent	c. substance that is dissolved in a solution
____4. soluble	d. substance that dissolves in water to form a solution that conducts an electric current, forms ions
____5. alloy	e. solid solution containing two or more metals
____6. aqueous solution	f. homogeneous mixture of two or more substances in a single physical state
____7. electrolyte	g. substance that does the dissolving in a solution
____8. nonelectrolyte	h. capable of being dissolved

Describe and give an example of each of the following types of solution.

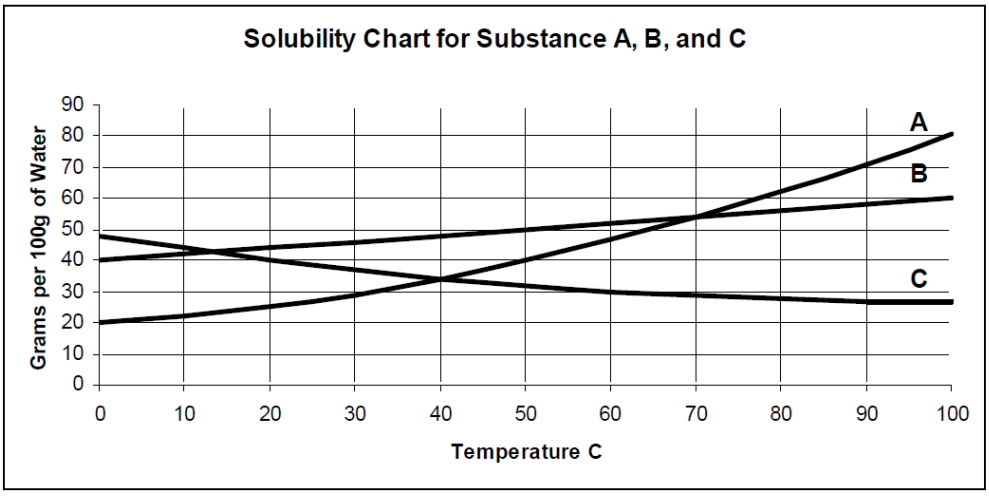
9. alloy
10. liquid solution
11. gaseous solution

Answer each of the following questions in the space provided.

12. Describe the properties of a solution
13. Explain how to distinguish between the solvent and the solute in a solution.
14. Why might a construction company build a high-rise building with steel alloy beams instead of pure iron beams?
15. Water and ethanol are miscible in all proportions, whereas oil and water are immiscible. Explain this statement.
16. Why is water called the "universal solvent"?
17. How could you determine experimentally whether a given substance is an electrolyte?
18. Give two examples of solutions in nature and explain why each is important.

WS#2: Solubility Curve

Look at the solubility curves on the graph below and then answer the following questions.



1. Which substance is the most soluble at 0°C? At 100°C?

2. How many grams of substance "B" will dissolve in 100g of water at 60°C? How about in 400g of water at the same temperature?

3. Which substance shows the least change in solubility from 0°C – 100°C?

4. As you increase the temperature of the water, what happens to the solubility of "A"?

5. As you increase the temperature of the water, what happens to the solubility of "B"?

6. As you increase the temperature of the water, what happens to the solubility of "C"?

7. Which substance(s) are probably a solid?

8. Which substance(s) are probably a gas?

9. If you put 40g of "A" into 100g of water at 50°C the solution would be?

10. If you put 40g of "B" into 100g of water at 50°C the solution would be?

11. If you put 40g of "A" into 100g of water at 20°C the solution would be?

12. Describe how to make a supersaturated solution of "B" at 50°C.

WS#3: Concentration of Solutions

Part a

concentration saturated molarity molality unsaturated supersaturated mole fraction

Fill in the blank

1. _____ is the concentration of a solution expressed as the number of moles of solute dissolved in each liter of solution.
2. A _____ solution contains as much solute as can possibly be dissolved under existing conditions of *T* & *P*.
3. The amount of solute in a given amount of solvent or solution is the _____.
4. A solution that contains more solute particles than are needed to form a saturated solution is ____.
5. The _____ is the number of moles of one component of a solution divided by the total number of moles of solution.
6. The _____ of a solution is the number of moles of solute dissolved in each kilogram of solvent.
7. A solution that has less than the max amt of solute that can be dissolved is called a(n) _____ solution.

Short Answer

8. Describe how a chemist can accurately prepare a solution of precise molarity.
9. How is molality different from molarity?
10. Explain the importance of knowing the concentration of solution in chemical labs and in daily life.

Part b

Directions: Solve and show work on additional sheet of paper. Highlight answer with a box or highlight pen.

11. What is the molarity of the solution formed by mixing 0.20mol of NaOH with enough water to make 150mL of solution? (Ans: 1.3*M*)
12. What is the molarity of the solution produced when 145g of NaCl is dissolved in enough water to prepare 2.75L of solution? (Ans: 0.902*M*)
13. How many grams of KCl are needed to prepare 0.750L of 1.50*M* solution of KCl in water? (Ans: 83.9g)
14. How many milliliters of water are added to 228g of NaOH to produce a 1.90M solution of NaOH? (Ans: 3.00×10^3L)
15. If 8.77g of KI are dissolved in enough water to make 475mL of solution, what is the molarity of the solution? (Ans: 0.111*M*)
16. What is the molality of a solid solution containing 867g of aluminum and 14.9g of copper? (Ans:0.270*m*)
17. In order to prepare a 0.523*m* aqueous solution of KI, how many grams of KI must be added to 2.00kg of water? (Ans: 174g KI)
18. What is the molar mass of a compound when 5.33g of the substance is mixed with 300mL of water to produce a 0.125*m* solution? (Ans: 142.05g/mol)

19. A gas mixture contains the following gases with the mole fractions indicated: CH_4 (0.510), C_2H_6 (0.431), C_3H_8 (0.011), and C_4H_{10} (0.013). The mixture also contains the gas acetylene (C_2H_2). What is the mole fraction of acetylene? (Ans: 0.035 C_2H_2)
20. What is the mole fraction of oxygen in a mixture that contains 66.8g of O_2, 44.1g of N_2, and 21.5g of H_2? (Ans: 0.146 O_2)
21. A gas mixture contains 70.25g of steam, 1.470g of hydrogen, and 6.58g of nitrogen. What is the mole fraction of steam? (Ans: 0.802 H_2O)
22. Calculate the molarity of each ion after 12.54g of iron (III) sulfate are dissolved in 250.0mL of distilled water. (Ans: 0.250*M* Fe^{3+} and 0.375*M* SO_4^{2-})
23. 14.35g of barium nitrate were added to 350.0mL of distilled water. After the barium nitrate was fully dissolved 50.0mL of the solution was removed and diluted with 200.0mL of distilled water. Calculate the molarity of the final solution. (Ans: 0.1569*M* for initial solution and 0.03138*M* for the dilution)
24. 14.5 grams of an unknown substance is dissolved in water to make a 0.425*M* solution. If the volume of the solution is 550.mL, what is the molar mass of the substance? Upon analysis, the compound contained 3.26% hydrogen, 19.4% carbon, and 77.4% oxygen. What is its empirical formula? (Ans: 62.03g/mol, show me the formula)

WS#4: Dissociation of Water Soluble Compounds

Determine if the following solid compounds are soluble/insoluble in water. Identify the rule used for your determination. If the compound is soluble, write a balanced dissociation equation for the compound. Remember to include the state of the compound and ions.

	Soluble (Y/N)	Rule	Balanced Dissociation Equation
1. $Cd(NO_3)_2(s)$	Y	#6	$Cd(NO_3)_2(s) \rightarrow Cd^{2+}(aq) + 2NO_3^{1-}(aq)$
2. $CdS(s)$	N	#13	NR

3. $Rb_2CO_3(s)$	9. $FeS(s)$	15. $(NH_4)_3PO_4(s)$	21. $NaClO(s)$
4. $Sr_3(PO_4)_2(s)$	10. $CuC_2H_3O_2(s)$	16. $Cu(NO_3)_2(s)$	22. $NaF(s)$
5. $AgCl(s)$	11. $Ca(OH)_2(s)$	17. $AlPO_4(s)$	23. $Na_2S(s)$
6. $KOH(s)$	12. $Na_2SO_3(s)$	18. $CaCO_3(s)$	24. $AgNO_3(s)$
7. $NH_4Cl(s)$	13. $BaSO_4(s)$	19. $Fe(OH)_2(s)$	25. $Al(OH)_3(s)$
8. $NaBr(s)$	14. $LiI(s)$	20. $Cs_2SO_4(s)$	

WS #5: Ionic and Net Ionic Equations

Write the names of the products formed, and then write the balanced molecular equation. Test each of the reactants and products against the solubility rules, both reactants must be soluble and at least one of the products must be a solid for a precipitation reaction to occur. If a reaction occurs, write the net ionic equation for the production of the precipitate.

Write the balanced molecular and net ionic equation for any reactions.

1. copper (II) chloride + ammonium sulfate →
2. strontium chloride + potassium sulfate →
3. mercury (II) nitrate + nickel (II) sulfate →
4. iron (II) nitrate + ammonium chromate →
5. tin (II) acetate + iron (III) chloride →
6. nickel (II) bromide + potassium hydroxide →
7. calcium nitrate + potassium chloride →
8. chromium (III) chloride + sodium sulfide →
9. manganese (II) acetate + potassium phosphate →
10. ammonium sulfate + magnesium nitrate →
11. nickel (II) chloride + sodium carbonate →
12. zinc (II) chloride + sodium phosphate →