**Solutions and Solubility: Unit test**

First Name: Last Name:

Date: Period:

Marks: KU: /23 TI: /10 A: /12 C: /6

**This test has four parts. Carefully read all directions and questions.**

***Part A – Matching***

**Directions**: On the line to the left of each description in Column A, write the letter from Column B of the term being described. Some words in Column B will not be used. **(1 mark each, 10 marks total K/U)**

|  |  |  |  |
| --- | --- | --- | --- |
| **COLUMN A** | | **COLUMN B** | |
| \_\_\_\_ 1. | An example of a solution of gases | A. | Bronze |
| \_\_\_\_ 2. | A solution which will not dissolve any more solute | B. | Temperature |
| \_\_\_\_ 3. | An alloy of copper and tin used in making statues | C. | Water |
| \_\_\_\_ 4. | Sugar does this in tea or coffee | D. | Air |
| \_\_\_\_ 5. | The Universal solvent | E. | Filtration |
| \_\_\_\_ 6. | A solution in which water is the solvent | F. | Acid |
| \_\_\_\_ 7. | Name given to the dissolved substance | G. | Solute |
| \_\_\_\_ 8. | Method which will not separate solutions | H. | Solution |
| \_\_\_\_ 9. | A substance which produces H+in water | I. | Mole |
| \_\_\_\_ 10. | A factor affecting the amount of solute that can dissolve in a solvent | J. | Heat |
|  |  | K. | Saturated |
|  |  | L. | Dissolves |
| *Answer key: 1D, 2K, 3A, 4L, 5C, 6M, 7G, 8E, 9F, 10B* | | M. | Aqueous solution |
|  |  | N. | Distillation |

***Part B – Multiple Choice – 1 mark per question [Answers are provided in red]***

**Directions: For each question, circle the letter (“a”, “b”, “c”, “d” or “e”) of the correct answer.**

1. How many milliliters of 2.00 M Na2SO4 are required to react with 3.23 g BaCl2 (formula mass = 208) to form BaSO4? The reaction is (K/U)

Na2SO4 + BaCl2 --> 2 NaCl + BaSO4

1. 15.5 mL
2. 31.0 mL
3. 0.0155 mL
4. 0.00775 mL
5. 7.75 mL

2. When 200 mL of 0.300 M AgNO3 and 300 mL of 0.300 M KI are mixed, the following reaction occurs:

Ag+(aq) + I- (aq) --> AgI (s).

How many moles of AgI are formed in the reaction mixture? (K/U)

1. 0.075 mol
2. 0.060 mol
3. 0.150 mol
4. 0.030 mol
5. 0.090 mol

3. If 2.0 mol KOH is reacted with 1.0 mol H3PO4, one of the major products will be: (K/U)

1. K2HPO4
2. KH
3. K3PO4
4. K2PO4
5. KH2PO4

4. How many milliliters of 0.352 M CaCl2 are needed to produce 1.25 g of Cl2 gas in the following reaction? [Hint: the CaCl2 is the source of Cl- ] (K/U)

2 MnO4- + 10 Cl- + 16 H+ --> 2 Mn2+ + 5 Cl2 + 8 H2O

1. 25 mL
2. 35 mL
3. 75 mL
4. 50 mL
5. 100 mL

5. What volume of 0.400 M sodium hydroxide is required to react with 3.20 g of ammonium carbonate (MM = 96.1) according to the following equation? (K/U)

2 NaOH (aq) + (NH4)2CO3 (s) --> 2 NH3 (g) + Na2CO3 (aq) + 2 H2O (l)

1. 83.3 cm3
2. 167 cm3
3. 333 cm3
4. 666 cm3

6. If all of the chloride within a 5.000 g sample of an unknown metal chloride is precipitated as AgCl with 70.90 mL of 0.2010 M AgNO3, what is the percentage of chloride in the sample? (K/U)

1. 50.55%
2. 10.10%
3. 1.425%
4. 20.2%
5. none of the above

7. A Bronsted-Lowry base is defined as a substance which: (K/U)

1. Accepts H+ ions
2. Produces OH- ions
3. Conducts electricity
4. Donates protons
5. Completely dissociates in water

8. How does the [H+] in an aqueous solution with pH = 4 compare with the [H+] in a solution with pH = 2? The [H+] in the pH = 4 solution is \_\_\_\_\_\_\_\_\_ the [H+] in the pH = 2 solution: (K/U)

1. Twice as much as
2. Half as much as
3. One tenth (1/10) of
4. One one-hundredth (1/100) of

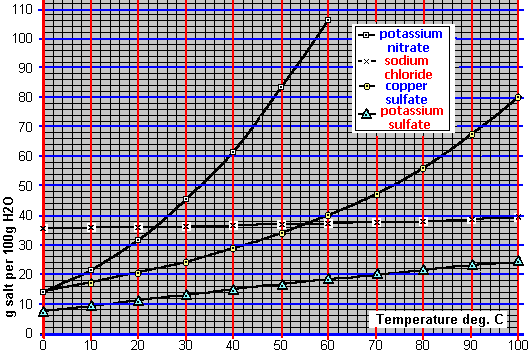
**Use the solubility graph below to answer questions 9. and 10.**

9. Using the graph below, what is the solubility of copper sulphate (CuSO4) in g/100g water at 630C? (K/U)

* 1. 88
  2. 42
  3. 44
  4. 90

10. Using the graph below, what is the minimum mass of water you can completely dissolve 28 g of copper sulfate in at 80oC? [7h-95] (K/U)

* 1. 200 g
  2. 25 g
  3. 50 g
  4. 100 g



***Part C – Short Answer***

1. Give one word or term for each of the following descriptions:  **(**(K/U) **3 marks)**
   1. A type of mixture where the solute has completely dissolved in the solvent. \_*Solution*\_\_
   2. A measure of how much solute is dissolved in a solution. \_\_*concentration*\_\_\_\_\_
   3. Forces between the molecules in a substance. \_\_*intermolecular*\_\_\_\_

***Part D – Short Answer and Problem Solving - For the following questions, show all work to get full marks:***

1. What is the Molarity of a solution with 4.0 moles of NaOH dissolved in 2.0 L of water? **(T/I 2 marks)**

*Answer Molarity = number of moles/Volume in liters*

*Therefore, Molarity of solution = 4.0 moles/2.0L = 2.0M*

1. (a)Write a dissociation equation for Copper (II) nitrate. Remember to balance the equation and include the state, i.e. (s), (aq), (l). **(T/I 2 mark)**

*Answer. (a) Cu(NO3)2(s) Cu2+(aq) + 2 NO3-(aq)*

(b) How many moles of nitrate ions are in a liter of 2.00 M Cu(NO3)2 solution?   
 **(T/I 2 marks)**

*Molarity = number of moles/volume in liters   
 Or, Number of moles = Molarity x liters  
 = 2.00 M x 1 L= 2.00 moles of Cu(NO3)2 Number of moles of Nitrate ions = 2.00 moles Cu(NO3)2 x 2 mol NO3- /1mol Cu(NO3)2Number of moles of nitrate ions = 4.00 moles.*

1. What volume of solution contains 2.39 g of KCl if the concentration of the solution is 0.060 M KCl? **(T/I 2 marks)**

*Answer Number of moles = 2.39g x 1 mol /74.551g = 0.03205mol*

*Molarity = number of moles/volume in litres*

*Therefore, volume = number of moles/Molarity= 0.03205mol/0.060 M*

*Volume of solution= 0.53L*

1. (a) What are the Ar
3. Compare and contrast the effect of opening and drinking a can of icy-cold cola to the effect of opening and drinking a can of warm, totally non-refreshing cola in terms of amount of fizz. Explain what is happening in terms of solubility of carbon dioxide in each can. **(T/I 2 marks, C 2 marks)**

*Answer. As the temperature increases, the solubility of gases decreases. The warmer coke will therefore have less fizz and thus will be flat and non-refreshing.*

1. You should always put the two solutions for a titration experiment in clean, dry beakers. You do not need to dry the Erlenmeyer flask to which you add the solutions, however, if it has been thoroughly rinsed with distilled water. Explain the difference in these procedures. **(A 4 marks, C 2 marks)**

*Ans: Liquid in Erlenmeyer flask is usually a standard solution (known concentration) of known volume (25.0 mL) from a pipette, so it is not necessary to dry the flask.* ***Note: This question is from McGraw-Hill text.***

1. Commercial processors of potatoes remove the skin by using 10-20% by mass solution of sodium hydroxide. The potatoes are soaked in the solution for a few minutes at 60-70°C, after which the peel can be sprayed off using fresh water. You work in the laboratory at a large food processor and must analyse a batch of sodium hydroxide solution. You pipette 25.00 mL of NaOH (aq) and find it has a mass of 25.75 g. Then you titrate the basic solution against 1.986 mol/L HCl, and find it requires 30.21 mL of acid to reach an end point.
   1. What is the molar concentration of the sodium hydroxide solution? **(A 4 marks)**
   2. The mass percent of NaOH present must be a minimum of 10% for the solution to be used. Can this solution be used to process the potatoes? Explain your reasoning. **(A 4 marks, C 2 marks)**

***Answer***

***(a)*** *HCl(aq) + NaOH(aq) → NaCl(aq) + H2O(\_)*

*Amount of HCl = 1.986 mol/L × 0.03021 L = 0.06000 mol*

*Since HCl and NaOH reacts in a 1 : 1 ratio, there must be 0.06000 mol of NaOH.*

*[NaOH] = 0.06000 mol ÷ 25.00 mL = 2.4 mol/L*

***(b)*** *Molar mass of NaOH = 40.0 g*

*Mass of NaOH in 25.00 mL solution = 0.06000 mol × 40.0 g/mol = 2.40 g*

*Mass percent of NaOH = (2.40g ÷ 25.75 g) × 100% = 9.32%*

*The solution will not be used because it does not meet the minimum 10% by mass of NaOH required.*

*NaOH in 25.75 mL solution = 2.39/25.75 = 0.0928% = 0.0928 × 100 = 9.28%*

*Solution should not be used because it does not meet the minimum 10% required.*

***Note: This question is from McGraw-Hill text.***