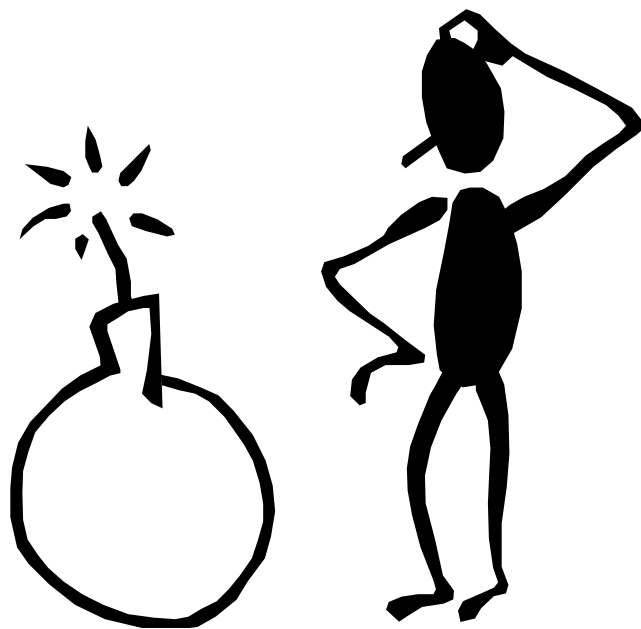


Name: _____

Chemistry 20

Solutions

Worksheets



SOLUTIONS:

Worksheet 4.1: Solution terminology and theory

Worksheet 4.2: Concentration Problems

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Worksheet 4.9: Acid & Base Calculations

Worksheet 4.10: Acid & Base Review

Worksheet 4.2: Concentration Problems

1. What is the molar concentration of an electroplating solution in which 1.50 mol of copper (II) sulfate are dissolved in 2.00 L of water?
2. What is the molar concentration of a solution in which 0.240 mol of washing soda, sodium carbonate decahydrate, is dissolved in 480 mL of water to make soft water solution?
3. What is the molar concentration of 500 mL of a solution that contains 12.7 g of swimming pool chlorinator, $\text{Ca}(\text{OCl})_2$?
4. A given sample of household ammonia contains 156 g of ammonia dissolved in water to form a 2.00L solution. What is the molar concentration of the ammonia solution?
5. Find the number of moles of sodium phosphate in 2.00L of a 0.100 mol/L sodium phosphate cleaning solution.

6. How many moles of potassium sulfate are there in 500 mL of a 0.242 mol/L solution used to remove rust stains?

7. What mass of sodium bicarbonate must be added to a 2.50 L bowl to obtain a necessary 0.150 mol/L solution?

8. What volume of a 0.075 mol/L solution would contain the necessary 1.10 mol of sodium phosphate used to remove radiator scales?

9. What mass of sodium silicate is necessary to prepare 10.0 L of a 0.00500 mol/L water softening solution?

10. How many litres of 0.800 mol/L solution would contain 119.2 g of NaOCl?

Worksheet 4.3: Making solutions and dilutions

1. A scientist has a container with solid sodium hydroxide and a container of 5.00 mol/L sodium hydroxide.
 - a) What are the two ways that the scientists can use to make a solution with a specific volume and concentration?

 - b) What are two ways that the scientist can dilute the 5.00 mol/L solution?

2. Describe the steps you would take to make 100 mL of a 0.200 mol/L sodium chloride solution from salt crystals. Include the equipment and calculations you would make. Remember this is not a reaction.

3. Describe the steps you would take to make 250 mL of a 0.453 mol/L solution of copper (II) sulfate from solid copper (II) sulfate pentahydrate. Include equipment and calculations.

4. Describe the steps you would take to make 100 mL of a 0.50 mol/L sucrose solution from a container of 2.10 mol/L sucrose solution. Include equipment and calculations.

5. Describe the steps you would take to make 500 mL of a 0.900 mol/L sulfuric acid from a 1.50 L container of 6.00 mol/L sulfuric acid solution. Include equipment and calculations.

6. What is the final concentration of a cleaner if 10 L of concentrated sodium hydroxide (19.1 mol/L) is diluted to 400 L?

7. What is the mass of baking soda (sodium hydrogen carbonate) needed to make 2.5 L of a 1.00 mol/L solution?

8. If 2.0 L of water is added to 1.0 L of a 0.250 mol/L solution of potassium hydroxide what is the final concentration. (Be Careful)

9. CHALLENGE: If 1.50 L of a 12.4 mol/L solution of hydrochloric acid was mixed with 300 mL of a 6.10 mol/L solution of hydrochloric acid, then what would be the final concentration?

10. CHALLENGE: How much water is added to 50.0 mL of a 0.500 mol/L solution to make a 0.100 mol/L solution?

Worksheet 4.4: Dissociation and ionization reactions

1. What type of compounds dissociate? What type of compounds ionize?
2. Write dissociation or ionization reactions for the following chemicals after they are mixed with water. Show the physical states of all species involved. Use modified ionization reactions when necessary.
 - a) Solid hydrochloric acid
 - b) Solid strontium hydroxide
 - c) Solid copper (II) sulfate pentahydrate
 - d) Solid sodium bicarbonate
 - e) ammonia gas
3. For each of the following write dissociation or ionization equations and find the concentration of each ion.
 - a) 0.90 mol/L solution of sodium phosphate
 - b) 0.143 mol/L solution of nitric acid
 - c) 0.0135 mol/L solution of calcium hydroxide
 - d) 0.150 mol of hydrogen fluoride gas bubbled into 1.00 L of water

4. What is the concentration of chloride ions in a solution prepared by dissolving 800 g of zinc chloride in 4.50 L of water?
5. What is the mass of calcium chloride required to prepare 2.000 L of 0.120 mol/L chloride ions?
6. What is the final concentration if 2.0 L of water is added to 4.50 L of a 0.89 mol/L solution of sodium chloride?

Worksheet 4.5: Net Ionic Equations

For the following reactions, write the nonionic equation, the total ionic equation and the net ionic equation.

1. Aqueous solutions of sodium sulfate and barium bromide are mixed.

2. A lead (II) nitrate solution reacts with sodium sulfide solution

3. Sulfuric acid is neutralized by a potassium hydroxide solution

4. Hydrochloric acid is added to a solution of barium hydroxide

5. Magnesium metal is added to an aqueous solution of hydrogen bromide

6. Zinc reacts with copper (II) sulfate solution

7. Zinc reacts with acetic acid (vinegar)

8. Bromine is added to a magnesium iodide solution

5. A 100 ml sample of sodium sulphide solution is completely reacted with 50.0 ml of 0.250 mol/L lead (II) nitrate solution. Predict the concentration of the $\text{Na}_2\text{S}_{(\text{aq})}$?
6. 500 ml of 0.150 mol/L cobalt (II) nitrate solution is reacted with 500 ml of 0.250 mol/L of sodium hydroxide solution producing 4.77 g of precipitate. Find the % yield for this reaction.
7. CHALLENGE: Predict the final mass of a 500 g bar of lead that is allowed to react completely with 2.00 L of 2.00 mol/L HCl.
8. A 75.0 mL sample of 0.25 mol/L silver chlorate solution reacts with 19.0 mL of 0.50 mol/L copper (II) sulphate solution. What is the concentration of the solution produced? (NOTE: Find out what the **total** volume of the solution produced.)

Worksheet 4.7: Review of Solutions

1. Answer the following questions
 - a) How do solutions differ from heterogeneous mixtures?
 - b) How do the number of molecules of $C_{12}H_{22}O_{11}$ in 250 mL of a 1.5 mol/L solution of $C_{12}H_{22}O_{11}$ compare to the number of molecules of $C_6H_{12}O_6$ in 250 mL of a 1.5 mol/L $C_6H_{12}O_6$?
 - c) What is the term used to describe two liquids which will **NOT** mix with each other?
 - d) What are two factors that affect the amount of solute that dissolves and two factors that affect the rate of dissolving?
2. Write the equation for each of the following dissolving in water. Use modified Arrhenius theory.
 - a) Hydrogen chloride gas
 - b) Solid aluminium nitrate
 - c) Solid sucrose
 - d) Aqueous nitric acid
3. Determine the concentration of each of the following solutes in the solution described.
 - a) 0.725 mol of cobalt (II) nitrate in 1.35 L of solution.
 - b) 15.0 g of barium sulphate in 125 mL of solution.
 - c) 1.85×10^{22} molecules of ammonia gas in 400 mL of solution.
4. Write the dissociation equation and calculate the concentration of each of the ions produced in 1.25 mol/L solution of barium chloride.
5. Write the dissociation equation and determine the concentration of the solution if 1.26 mol/L of $[Na^+]$ is found in a sodium phosphate solution.

6. CHALLENGE: What is the $[Cl^-]$ in a solution made by mixing 200 mL of 0.300 mol/L sodium chloride solution with 350 mL of 0.250 mol/L calcium chloride solution?
7. Write net ionic equations for the following reactions. (3 marks)
- a) lead nitrate solution is mixed with sodium hydroxide

 - b) barium nitrate reacts with potassium sulfide

 - c) nitric acid reacts with barium hydroxide
8. Draw a diagram describing how methanol is dissolved in water. (1 mark)
9. Predict whether the following solutes are electrolytes or nonelectrolytes:
- a) nitrogen monoxide
 - b) hydrofluoric acid
 - c) magnesium hydroxide
 - d) potassium hydrogen carbonate
10. A scientist wants to make 100 mL of a 0.150 mol/L sodium hydroxide solution. He has 100 g of solid sodium hydroxide and he has 1.00 L of a 2.25 mol/L sodium hydroxide solution. Describe step by step the two ways that he could make his 0.150 mol/L solution. Include the sample calculations and equipment.
11. A 20.0 g sample of lead (II) nitrate is mixed in 1.00 L of water. The lead (II) nitrate solution then reacts with a 1.00 L of a 0.100 mol/L solution of rubidium iodide. If 20.0 g of precipitate forms, what is the percent yield?

Worksheet 4.8: Introduction to Acids & Bases

1. Safety is very important when working with acids. Describe what the student should do in the following situations.
 - a) A student drops a 100 mL beaker with 50 mL of hydrochloric acid and spills the acid onto the floor.
 - b) A student drips a couple of drops of sodium hydroxide solution onto his hand.
 - c) A beaker with $\text{Ba}(\text{OH})_2$ tips over onto the lab bench.
 - d) A student would like to dilute an acid and would like to know if he should add the acid to the water or the water to the acid

2. WHMIS symbols help communicate dangers.
 - a) WHMIS stands for _____
 - b) The symbol that would be associated with a beaker of base that corrodes metal is

 - c) Acids and bases can cause immediate and serious damage to a person's skin. The WHMIS symbol related to this is

 - d) Some acids react with oxygen. The WHMIS symbol found on a bottle of this acid would be

3. A person would like to make 100 mL 1.00 mol/L solution of NaOH. Describe the steps the student would use. Include the calculations.

4. A person would like to dilute a 12.1 mol/L solution of HCl and make a 250 mL 3.00 mol/L solution. Describe the steps the student would use. Include the calculations.

5. Indicators change color to indicate whether you have an acid or base. Litmus paper and bromothymol blue are two common indicators. Complete the following table for these indicators.

<u>PH</u>	<u>Litmus Paper color</u>	<u>Bromothymol Blue color</u>
3		
7		
10		

6. What is one property that is similar between acids and bases?

7. What is one property that is different between acids and bases?

8. Complete the following acid or base reactions.

a) sulfuric acid is neutralized by potassium hydroxide. Identify the "salt" in the reaction.

b) hydrochloric acid reacts with magnesium

c) self ionization of water

Worksheet 4.9: Acid & Base Calculations

1. A 1.00 L solution of 1.50 mol/L perchloric acid is diluted by adding 500 mL of water. What is the hydronium concentration of the diluted solution?
2. A 250mL solution of 3.56 mol/L barium hydroxide is sitting on the counter in the lab. Help a chemistry 20 student determine the hydronium concentration of the solution.
3. A 1.00 mol/L solution of nitric acid ionizes. What is the hydroxide ion concentration?
4. A student takes 11.6 grams of strontium hydroxide and adds it to 3.00 litres of water. What is the hydronium concentration?
5. A solution contains 1.67×10^{-14} mol/L of hydronium ions. Determine the mass of barium hydroxide that was added to 1.00 L of water to make this solution.

Worksheet 4.10: Acid & Base Review

1. The concentration of hydroiodic acid is 1.73×10^{-3} mol/L. What is the pH and the pOH?
2. What is the hydronium concentration and hydroxide concentration of a 2.47×10^{-2} mol/L solution of thallium hydroxide?
3. Complete the following table (Significant digits are important):

pH	$[H^+]$	$[OH^-]$	pOH	A/B/N
			4.56	
		1.23×10^{-5}		
	3.56×10^{-8}			
12.8				
3.52				
		5.74×10^{-1}		
			7.45	
	3.99×10^{-3}			
			1.23	
		8.9×10^{-9}		

4. What color would the indicator be given the following data?

	ORANGE IV	METHLY RED	PHENOL RED	METHYL ORANGE	INDIGO CARMINE
pOH=9.00					
pH=8.3					
$[H^+]=9.5 \times 10^{-4}$					
$[OH^-]=5.6 \times 10^{-3}$					
$[H_3O^+] = 1.0 \times 10^{-7}$					