Name:_____

Exercise : 6-B Concentration Problems

How to do the problems:

Concentration problems always involve 2 factors:

1) A **concentration**, usually expressed as # g/100 mL (ex. 24 g/100 mL, or, 66 g/100 mL, etc.)

2) A **volume**, usually expressed as # mL (ex. 1000 mL, 400 mL, etc.)

These 2 factors, concentration and volume, occur on both sides of your equation. It looks like:

(Volume)	(Concentration)	=	(Volume)	(Concentration)
(mL)	(g/100 mL)	=	(mL)	(g/100 mL)

An example: You have 90 mL of solution containing 24 g/100 mL of sodium chloride. How many milliliters of solution containing 6 g/100 mL can you make ?

(Concentration) (Volume) = (Concentration) (Volume)

*** Ignore the "/100 mL" since it happens on both sides of the equation and cancel out ***

(24 g) (90 mL) = (6 g) (X mL)

2160 = (6)(X)

$$\frac{2160}{6} = X$$

360 mL = X

Now try the following:

1. You need 1000 mL of a solution containing 6 g/100 mL of sodium chloride. How many milliliters of a solution containing 24 g/100 mL of sodium chloride will you need ?

2. You have 250 mL of a solution containing 40 g/100 mL of sugar. How many milliliters of a solution containing 8 g/100 mL can you make ?

3. You need 1500 mL of a solution containing 5 g/100 mL of glucose. How many milliliters of a solution containing 50 g/100 mL will you need ?

4. You have 800 mL of a solution containing 30 g/100 mL of potassium nitrate. How many milliliters of a solution containing 3 g/100 mL can you make ?

5. You have 750 mL of a solution containing 60 g/100 mL of silver nitrate. How many milliliters of a solution containing 20 g/100 mL can you make ?

6. You need 300 mL of a solution containing 15 g/100 mL of sucrose. You have a solution containing 45 g/100 mL. How many milliliters of this solution will you need ?

7. You need 900 mL of a solution containing 10 g/100 mL of soap. How many milliliters of a solution containing 75 g/100 mL will you need ?

Name:	Partner's Name:
Date of lab:	If absent, data obtained from:

Lab 6.5 - A Sodium Chloride Solution

*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.*

Procedure	Observations

Part A - Making the Solution

_____1. Obtain a clean, dry 250 mL beaker.

_____2. Mass the beaker to 0.1 g: _____

_____3. Add 12 grams onto the mass of your beaker:

Mass of beaker _____ g
\+ 12.0 g
_____
_____ g

_____4. With the beaker on the balance, set your balance to this new mass.

_____5. Add sodium chloride, NaCl, to the beaker on the balance until it now balances.

_____6. You now have 12.0 g of sodium chloride, NaCl, in the beaker.

_____7. Take the beaker off the balance and add no more than 20 mL of water to the beaker.

_____8. Stir the beaker with a stirring rod for at least one minute.

_____9. Let the sodium chloride, NaCl, settle.

_____10. Once it has settled, carefully pour the clear liquid off the top into a 50 mL graduated cylinder. DO NOT pour any solid sodium chloride, NaCl, into the graduated cylinder.

_____11. Add no more than 15 mL of water to the beaker.

_____12. Stir the beaker with a stirring rod for at least one minute.

_____13. Let the sodium chloride, NaCl, settle.

_____14. Once it has settled, carefully pour the clear liquid off the top into the same 50 mL graduated cylinder. DO NOT pour any solid sodium chloride, NaCl, into the graduated cylinder.

_____15. Your sodium chloride, NaCl, in the beaker should all be dissolved at this point. If it is not, add no more than 5 mL of water to the beaker; stir the beaker; let it settle; pour the clear liquid into the 50 mL graduated cylinder.

_____16. Drop by drop, add water to the graduated cylinder until it reaches 50 mL exactly.

_____17. Pour your 50 mL of solution into a 125 mL flask.

_____18. Stopper the flask.

_____19. Shake the flask to thoroughly mix the solution.

_____20. Rinse the 50 mL graduated cylinder **well !**

Part B - Testing your Solution

_____21. Obtain a clean dry evaporating dish and watch glass.

_____22. Mass both the evaporating dish and watch glass together: _____

_____23. Add exactly 5.0 mL of your solution from Part A to the evaporating dish (use a dropper to be exact).

_____24. Place the watch glass over the evaporating dish (it should curve down).

_____25. Place the evaporating dish and watch glass on a wire gauze with a center and heat the dish gently.

_____26. Boil all the water away which is in the dish.

_____27. Allow the dish to cool enough to pick up with your bare hands.

_____28. Mass the dish, watch glass, and contents: _____

Questions

Part A - Making the Solution

1. Your flask had 12 g of sodium chloride, NaCl, in it and 50 mL of water. How many grams of sodium chloride, NaCl, are in each milliliter in your solution ? Show your work.

Part B - Testing the Solution

2. Calculate the mass of the sodium chloride, NaCl, left in the dish. Show your work.

3. Knowing that your answer from Question 1 is the amount of sodium chloride, NaCl, in 1.0 mL of solution, and knowing that you evaporated 5.0 mL of solution, how much sodium chloride, NaCl, should you have gotten in the dish ? Show your work.

4. How close was your answer from Question 2 to what you should have gotten in Question 3 (in other words, subtract the two answers). Show your work.

Review Questions

5. What is a solvent ? _____

6. What is a solute ? _____

7. A concentrated solution will be _____ in color than a dilute solution.

8. What is an easy way to make a solution more dilute ? _____

9. Which has more solute in it, a concentrated or a dilute solution ? _____

10. Name one way to make a solution more concentrated. _____

11. What does Benedict's solution test for ? _____

12. What is another name for dextrose ? _____

13. What is the result of a positive Benedict's test ? _____

14. Heat is given off during a(n) _____ reaction.

15. Give an example of an endothermic reaction: _____

16. During an exothermic reaction, the temperature goes _____.

17. Your teacher has some very old chemical which has all hardened into a few large clumps. He has to dissolve the chemical. Using complete sentences, with correct punctuation and spelling, what should he do to quicken the dissolving process ?

_____

_____

_____

Name:_____

Exercise 6-C: Solution Problems

How to do the problems through an example:

These solution problems ask you to solve for a number of grams, which are dissolved in a number of milliliters. An example:

How many grams of sodium chloride do you need for 500 mL of solution if the concentration is to be 12 g / 100 mL ?

- Set up the equality:

$$\frac{X\,g}{500\ mL} = \frac{12\ g}{100\ mL}$$

- Cross multiply (multiply the diagonals):

$$(X)\ (100) = (500)\ (12)$$

$$(X)\ (100) = 6000$$

- Divide each side by the number on the side with the "X"

$$\frac{(X)(100)}{100} = \frac{(6000)}{100}$$

$$X = 60\ g$$

Now try the following (please show your work):

1. How many grams of sodium iodide do you need for 200 mL of solution if the concentration is to be 20 g / 100 mL ?

2. How many grams of potassium iodide must you mass for 25 mL of solution if you need a solution containing 60 g / 100 mL ?

3. You need 1000 mL of a solution containing 15 g / 100 mL of sodium hydroxide. How many grams of sodium hydroxide must you mass for the 1000 mL ?

4. How many grams of potassium bromide do you need for 250 mL of solution if the concentration is to be 50 g / 100 mL ?

5. How many grams of nickel nitrate must you mass for 350 mL of solution if you need a solution containing 18 g / 100 mL ?

6. You need 750 mL of a solution containing 11 g / 100 mL of copper sulfate. How many grams of copper sulfate must you mass for the 750 mL ?

7. How many grams of sodium chloride, NaCl, would be in 50 mL if the solution was 0.24 g/mL ?

8. How many grams of table sugar would you need to make 2500 mL of a solution containing 0.45 g/mL ?

9. One liter of solution contains 840 grams of solute. How many grams are in one milliliter of solution ?

10. You need 1000 mL of a solution containing 0.40 g / 100 mL of sodium hydroxide. How many grams of sodium hydroxide must you mass for the 1000 mL ?

11. How many grams of potassium nitrate do you need for 650 mL of solution if the concentration is to be 0.80 g / 100 mL ?

12. How many grams of nickel chloride must you mass for 153 mL of solution if you need a solution containing 11 g / 100 mL ?

Name:	Partner's Name:
Date of lab:	If absent, data obtained from:

Lab 6.6 - Making a Saturated, Unsaturated, and Supersaturated Solution

*Make complete and accurate observations during the lab. Observations include such things as...what is happening; for any chemicals, the color, appearance, phase (solid, liquid, gas), and odor (but **NEVER** taste) ; temperature if requested; etc.*

Procedure	Observations

_____1. Fill a 250 or 400 mL beaker about 3/4 full of water.

_____2. Begin to heat the beaker while you are doing Parts A.

Part A- Making an Unsaturated and a Saturated Solution

_____3. Obtain a dish of hypo (sodium thiosulfate) from your teacher (use it in Parts A and B).

_____4. Place about 1.0 mL of water in a test tube.

_____5. Add one crystal of hypo (sodium thiosulfate). Appearance of hypo: _____

_____6. Stopper and shake the test tube.

6.a. Did the crystal dissolve ? _____

6.b. Was your solution saturated, or unsaturated ? _____

_____7. Place about 1.0 mL of water into a second test tube.

_____8. Add 1.0 g of hypo (sodium thiosulfate). (Mass a plastic dish; set the scale 1.0 g heavier; add enough hypo until it balances).

_____9. Stopper and shake the test tube until the crystals dissolve, but no longer than 3 minutes.

9.a. Did the hypo dissolve ? _____

9.b. Was your solution saturated, or unsaturated ? _____

9.c. What did you observe besides the dissolving of the crystals ? (Hint: Feel the test tube) _____

_____

9.d. What is the name for this kind of a change ? _____

_____10. Place about 1.0 mL of water into a third test tube.

_____11. Add 2.0 g of hypo (sodium thiosulfate). (Mass a plastic dish; set the scale 2.0 g heavier; add enough hypo until it balances).

_____12. Stopper and shake the test tube until the crystals dissolve, but no longer than 3 minutes.

12.a. Is your solution saturated, or unsaturated ? _____

12.b. How were you able to determine this ? _____

_____

Part B - Making a Supersaturated Solution

_____13. Place about 1.0 mL of water into a large, fat test tube.

_____14. Add 25.0 g of hypo (sodium thiosulfate). (Mass a plastic dish; set the scale 25.0 g heavier; add enough hypo until it balances).

14.a. Do you expect all the crystals to dissolve ? _____

14.b. Why or why not ? _____

14.c. Name 2 ways you might be able to increase the amount which dissolves: _____

_____

_____15. Place your test tube in the hot water bath which you prepared at the beginning of the lab.

_____16. Heat your test tube gently until it boils and a clear solution is formed.

_____17. Take your test tube out of the hot water bath and place it in your test tube rack for 2 minutes.

17.a. Is this solution saturated, unsaturated, or supersaturated ? _____

_____18. During these 2 minutes, make an ice water bath using a 250 or 400 mL beaker.

_____19. After the 2 minutes, place the test tube in the ice water bath.

_____20. Look closely at your test tube.

_____21. As the first crystal begins to form, drop a crystal of hypo (sodium thiosulfate) into the test tube.

Observe: _____

_____

21.a. After the crystallization stops, what type of a solution do you now have, saturated, unsaturated, or supersaturated ? _____

Questions

1. What is a saturated solution ? _____

_____

1.a. What will a saturated solution look like ? _____

_____

2. What is an unsaturated solution ? _____

_____

2.a. What will an unsaturated solution look like ? _____

_____

3. What is a supersaturated solution ? _____

_____

3.a. What will a supersaturated solution look like ? _____

_____

4. What can you do to a supersaturated solution to cause it to crystallize ? _____

_____

4. a. After it crystallizes, what type of solution is left, saturated, unsaturated,

supersaturated ? _____

Review Questions

5. A chemist puts potassium chloride into a beaker, adds 200 mL of water, and stirs.

What is the solute ?_____ What is the solvent ? _____

6. Define **concentrated solution**: _____

_____

7. What is the name of the test for simple sugars ? _____

a. What is the result of a positive test ? _____

8. Another chemist wants to make a copper sulfate solution more concentrated, but she is out of copper sulfate crystals and powder.

What should she do to make it more concentrated ? _____

9. If your beaker becomes warm when a chemical is added, it is a(n) _____ reaction.

Name:_____

Exercise 6-D: Chapter Review

1. Which is easier to dissolve, (A) a solid substance, or, (B) a powdered substance ? _____

   1.a. Why ? _____

2. Which will dissolve faster, (A) a crystal in water, or, (B) a crystal in water which is stirred ?_____

   2.a. Why ? _____

3. Which will dissolve faster, (A) a shaken crystal in water, or, (B) a heated crystal in water ?

   _____

4. Name 3 things which will increase the dissolving rate of a substance:

   a) _____, b) _____

   c) _____

5. The temperature goes (up or down) during an exothermic reaction.

6. The temperature goes (up or down) during an endothermic reaction.

7. In an (exothermic or endothermic) reaction heat is given off.

8. In an (exothermic or endothermic) reaction heat is taken in.

9. Copper sulfate solution is _____color.

10. Benedict's solution tests for _____.

11. A positive Benedict's test results in _____.

12. What is a solute ? _____

13. What is a solvent ? _____

14. A darker solution will be more (concentrated or dilute) than a lighter colored solution ?

15. A darker solution will be (more or less) dense than a lighter colored solution ?

16. Name 2 ways to make a solution more concentrated: _____

    _____

17. Define:

Saturated Solution: _____

_____

Unsaturated Solution: _____

_____

Supersaturated Solution: _____

_____

18. Using the Solubility Curves handout:

a. How many grams of $AgNO_3$ are needed to saturate a 10 °C solution ? _____

b. At what temperature is the solubility the same for KNO_3 and NaCl ? _____

c. A solution contains 60 g of $NaNO_3$ at 20 °C. Is the solution saturated. unsaturated, or supersaturated ? _____

d. If the temperature of a solution of KNO_3 is changed from 40 °C to 80 °C, what is the change in solubility in grams ?_____ Would the solute have to be added, or would the solute crystallize out of solution ? _____

19. You need 200 mL of solution containing 25 g/100 mL of sodium nitrate. You have a solution containing 50 g/100 mL. How many milliliters of this solution will you need ? Please show work.

20. How many grams of potassium sulfate will you need for 400 mL of solution if the concentration is to be 30 g/100 mL ? Please show work.