Tuesday, February 3rd, 2015

Learning Target : I can make solutions and dilutions.

Homework: n/a

As you enter...

What is the definition and formula for molarity?

(hint: check out your brochure)

Molarity = concentration of a solution (M)

$$M = \frac{\text{moles}}{\text{volume}}$$

$$\text{moles} = \frac{\text{mass}}{\text{gram formula mass}}$$

Big Idea: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

AGENDA

3rd/4th period

- Pre-Lab Lesson (15 min)
- Lab #14: Solutions and Dilutions (45 min)

9th period

- Lab Recap (10 min)
- Exit Tix (5 min)

Tix out the door

Write your name and **EMAIL** on the paper, please.

Describe how you would make 200 mL of a 1.0 M HCl solution from a 6.0 M stock solution.

New Unit: SOLUTIONS

1 What is a solution?

...solute vs solvent

2 How do you make solutions?

...dilution, concentration, solubility

3 Why do solutions form?

...intermolecular forces, polarity, "like dissolves like"

4 What can affect solution formation?

...solubility factors, particle diagrams

Part 1: Making a solution

TABLE E formulas:

Molarity = moles / Liters
(concentration) (volume)

moles = mass / gram formula mass

OR

mass = moles x gram formula mass

So in lab... to make a solution of a specific concentration, you have to use these equations to figure out how many grams (mass) of the solid you will need to mix with a certain amount of water.

Example: Make a 0.5 M NaCl solution in 250 mL.

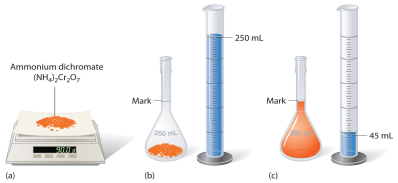
1. Convert volume to liters: 250 mL (1 L / 1000 mL) = .25 L

2. Calculate moles: moles = (0.5 M)(.25 L) = 0.125 mol NaCl

3. Use moles to calculate mass needed:

mass = (0.125 mol)(58 g/mol) = 7.25 g NaCl needed

4. Make solution: Put 7.25 g of NaCl in a 250 mL volumetric flask and fill flask with about 250 mL of distilled water (up to the line) and mix well to make a 0.5 M solution.



Part 2: Making a dilution

TABLE E formula:

$M_1V_1 = M_2V_2$

M = molarity (concentration)
V = volume
1 = refers to stock solution
2 = refers to diluted solution

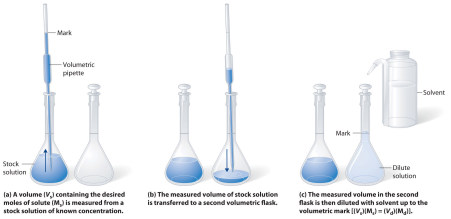
initial "stock"
"dilution"
making in pt 2

So in lab... to make a dilution, you take a highly concentrated (stock) solution and water it down with a specific amount of water based on the desired concentration.

Ex: Make a 0.5 M NaCl solution in 200 mL from 6.0 M stock solution.

1. Determine volume of stock solution needed using $M_1V_1 = M_2V_2$:
(6.0 M)(V_1) = (0.5 M)(200 mL)
V_1 = 16.67 mL of stock solution required

2. Make dilution: Since you want to make a 200 mL solution, pour 16.67 mL of the stock solution into the 200 mL volumetric flask and fill the rest of the flask with about 183.33 mL of distilled water up to the line. Plug the flask with a rubber stopper and carefully mix the solution.



$M_1 V_1 = M_2 V_2$

M_1: 0.1 M

V_2: 100 mL

M_2: 0.05 M

$(0.1)(V_1) = (0.05M)(100mL)$

$\frac{0.1}{0.1} V_1 = \frac{5}{0.1}$

$V_1 = 50\ mL\ NaOH\ solution$

$50\ mL\ H_2O$

$M = \frac{mol}{volume}$ ← Liters

$\frac{0.1}{1} \times \frac{mol}{0.1\ L}$

$100\ mL \times \frac{1\ L}{1000\ mL} = .1\ L$

mol = 0.01 moles

moles → mass

$moles = \frac{mass}{gfm}$ ← NaOH

$23 + 16 + 1 = 40\ g/mol$

$0.01\ mol \times \frac{x}{40\ g/mol}$

$x = 0.4\ g\ NaOH$ in 100 mL H_2O

Wednesday, February 4th, 2015

Learning Target : I can express the concentration of a solution as molarity, percent by mass, percent by volume, and parts per million.

Homework: n/a

As you enter...

What is the molarity of a solution of 10 mol of $CaCl_2$ in 20 L.

(hint: use your reference tables if you forgot the formula)

$M = \frac{\text{moles}}{\text{volume (Liters)}} = \frac{10 \text{ mol}}{20 \text{ L}} = 0.5 \text{ M}$

Note: Final grades are posted above the collection bin.

Big Idea: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

3rd period

- Solution Calculations (40 min)
- Exit Tix (5 min)

Tix out the door

Write your name and **EMAIL** on the paper, please.

What is the concentration (molarity) of a solution with 6.0 moles of NaCl dissolved in 2.0 L of water?

Dilutions using $M_1V_1 = M_2V_2$...

1. What volume of 4 M stock solution do you need to make a 2 L solution that has a 2M concentration?

2. What volume of a 3 M stock solution is required to make a diluted solution that is 1 M in 600 mL?

1. 25g NaCl in 100g solution

$\frac{\text{mass of solute}}{\text{mass of solution}} \times 100 = \frac{25g}{100g} \times 100$

$= 25\%$

3. 76 mL O_2 in 140 mL solution

$\frac{\text{volume of solute}}{\text{volume of solution}} \times 100 = \frac{76mL}{140\ mL} \times 100$

$= 54.3\%$

4. $\frac{\text{volume of solute}}{\text{volume of solution}} \times 100 = \frac{225mL}{1000\ mL} \times 100$

$= 22.5\%$

$1000\ mL = 1L$

3 Molarity $= \frac{mol}{volume}$ ↘ Liters

1. 0.4
2. $0.375 = 0.4$
3. 20g NaOH in 2L solution

$M = ?$

$M = \frac{mol}{2L} \rightarrow$ moles $= \frac{\text{given mass}}{\text{gram formula mass}}$

$= \frac{20g}{40\ g/mol} = .5\ mol$

$= \frac{.5mol}{2L} = 0.25M$

4.

moles $= \frac{87g}{58\ g/mol} = 1.5mol$

$M = \frac{mol}{volume} = \frac{1.5mol}{0.5L} = 3M$

5. 20 mol
   $V = 4L$
   $M = 5M$

$M = \frac{mol}{Volume}$

$\frac{5}{1} \times \frac{mol}{4}$

$mol = 5 \times 4 = 20mol$

6. 3.5L

$M = \frac{mol}{volume}$

$2M = \frac{7\ mol}{X}$

$2X = 7$

$X = 3.5$

3

7. Mass = ?
   $V = 4L$
   $M = 0.5\ M$ KOH

molarity $*M = \frac{mol}{L}$

$\frac{0.5}{1} \times \frac{mol}{4L}$

$mol = 4 \times .5 = 2\ mol$

mol → mass (g)

moles $= \frac{\text{given mass}}{\text{g fm}}$ ← KOH

$\frac{2\ mol}{1} \times \frac{X}{56\ g/mol}$

$X = 112\ g$

8

1. $M = \frac{mol}{L}$

$0.1 = \frac{x}{3}$

$x = .3\ mol$

2. moles $= \frac{\text{given mass}}{\text{g fm of } CoCl_2}$

$.3 = \frac{x\ g}{129}$

$\text{mass} = 38.7g$

Thursday, February 5th, 2015

Learning Target : I can construct a solubility curve and relate it to my understandings of saturation.

Homework: n/a

As you enter...

What is the molarity of a solution of 100 g of KBr in 10 L?

(hint: 2 step problem)

gfm = 39 + 80

$M = \frac{mol}{L} = \frac{0.84\ mol}{10\ L} = 0.084\ M$

grams → moles

① $moles = \frac{given\ mass}{gram\ formula\ mass} = \frac{100\ g}{119\ g/mol} = 0.84\ mol$

Note: Final grades are posted above the collection bin.

Big Idea: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

AGENDA

3rd period

- Finish Solution Calculations (10 min)
- Mini-Lesson: Saturation (10 min)
- Lab 15: Solubility (60 min)

4th period

- Post-Lab Summary (10 min)

Tix out the door

Write your name and **EMAIL** on the paper, please.

n/a

PRE-LAB

potassium nitrate = KNO_3 Table E

gram formula mass = 101 g/mol

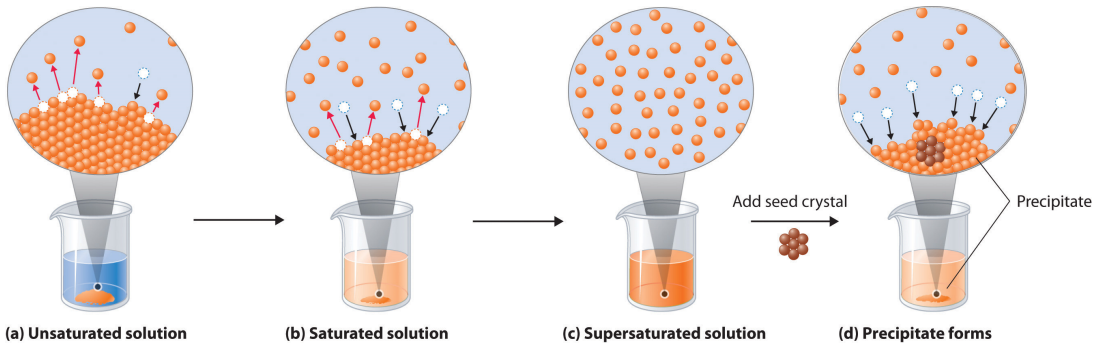
39 + 14 + 3(16) = 101

solute =

solvent =

solution =

POST-LAB

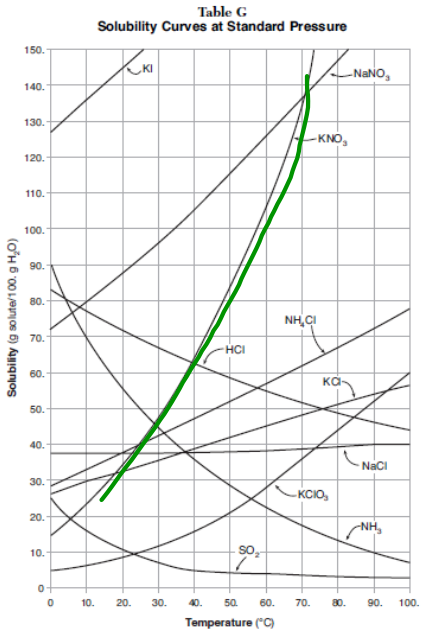


Solubility graph tells you the maximum amount of a substance that can be dissolved in water.

Saturated = amount of substance ON the line

Unsaturated = amount of substance BELOW the line

Supersaturated = amount of substance ABOVE the line



Friday, February 6th, 2015

Learning Target : I can construct a solubility curve and relate it to my understandings of saturation (again).

Homework: Table G HW due Monday (Need reference tables for this!!)

As you enter... Take out your reference tables booklet for class today.

How does temperature affect solubility (amount able to dissolve in water)?

The higher the temp, the (faster) more that can be dissolved (higher solubility).

Note: As you enter checks today will only be done in the first 10 minutes of class.

Big Idea: Matter is made up of particles whose properties determine the observable characteristics of matter and its reactivity.

3rd period

- Finish Lab 15: Solubility (40 min)
- Exit Tix (5 min)

You must hand in your lab by the end of the period... finished or not.

Tix out the door

Write your name and **EMAIL** on the paper, please.

What information does the solubility curve in Table G of your reference tables give you?

Note: it helps to actually look at Table G.