Chemistry 11

Molarity/Dilutions Worksheet

Name: Key
Date:
Block:

1. **Molarity Problems** – Find the missing value.

Chemical	*Mass*	*Volume*	*Molarity*
a) Na_2SO_4	16.0 g	50.0 mL	_____

$$16.0\,g\,Na_2SO_4 \times \frac{1000\,mL}{50.0\,mL} \times \frac{1\,mol\,Na_2SO_4}{142.05\,g\,Na_2SO_4} = 2.25\,M\,Na_2SO_4$$

b) HCl	143.28 g	_____	4.25 M

$$143.28\,g\,HCl \times \frac{1\,mol\,HCl}{36.46\,g\,HCl} \times \frac{1\,L\,HCl}{4.25\,mol\,HCl} = 0.925\,L\,HCl$$

c) $Pb(NO_3)_2$	_____	150.0 mL	3.00 M

$$150.0\,mL \times \frac{1\,L}{1000\,mL} \times \frac{3.00\,mol\,Pb(NO_3)_2}{1\,L} \times \frac{331.22\,g\,Pb(NO_3)_2}{1\,mol\,Pb(NO_3)_2} = 149\,g\,Pb(NO_3)_2$$

2. **Dilution Problems**

(a) 110.0 mL of 3.00 M sulfuric acid has 25.0 mL of water added to it. What is the resulting concentration of the solution? *(2.44 M H_2SO_4)*

$C_1 = 3.00\,M$

$V_1 = 110.0\,mL$

$C_2 = ?$

$V_2 = 110.0\,mL + 25.0\,mL$

$C_1V_1 = C_2V_2$

$(3.00\,M)(110.0\,mL) = (C_2)(135.0\,mL)$

$$C_2 = \frac{(3.00\,M)(110.0\,mL)}{(135.0\,mL)}$$

$= 2.44\,M$

(b) How much water must be added to 50.0 mL sample of 18.0 M nitric acid to give a resulting concentration of 0.250 M? *(3550 mL H_2O)*

$C_1 = 18.0\,M$

$V_1 = 50.0\,mL$

$C_2 = 0.250\,M$

$V_2 = ?$

$C_1V_1 = C_2V_2$

$(18.0\,M)(50.0\,mL) = (0.250\,M)(V_2)$

$$V_2 = \frac{(18.0\,M)(50.0\,mL)}{(0.250\,M)}$$

$= 3600\,mL$

Water to be added: $3600\,mL - 50.0\,mL = 3550\,mL$

(c) Barium nitrate is purchased as a 17.0 M concentration. Explain how you would prepare 500.0 mL of a 5.00 M solution. *(147 mL H_2O)*

$C_1 = 17.0M$

$V_1 = ?$

$C_2 = 5.00M$

$V_2 = 500.0mL$

$C_1V_1 = C_2V_2$

$(17.0M)(V_1) = (5.00M)(500.0mL)$

$V_1 = \frac{(5.00M)(500.0mL)}{(17.0M)}$

$= 147mL$

Step 1: Measure 147mL of barium nitrate

Step 2: Add 353mL of water to make a 500.0mL solution

(d) If 25.0 mL of 4.0 M HNO_3 solution is diluted to a volume of 600.0 mL, what will be the molarity of the diluted solution? *(0.17 M HNO_3)*

$C_1 = 25.0mL$

$V_1 = 4.0M$

$C_2 = ?$

$V_2 = 600.0mL$

$C_1V_1 = C_2V_2$

$(25.0mL)(4.0M) = (C_2)(600.0mL)$

$C_2 = \frac{(25.0mL)(4.0M)}{(600.0mL)}$

$= \boxed{0.17M}$

(e) What initial volume of 18 M hydrochloric acid is required to make 2.0 L of 0.50 M hydrochloric acid solution? *(56 mL H_2O)*

$C_1 = 18M$

$V_1 = ?$

$C_2 = 0.50M$

$V_2 = 2.0L$

$C_1V_1 = C_2V_2$

$(18M)(V_1) = (0.50M)(2.0L)$

$V_1 = \frac{(0.50M)(2.0L)}{(18M)}$

$= \boxed{0.056L = 56mL}$

(f) 250.0 mL of 0.20 M phosphoric acid is added to 1.00 L of water. What is the molarity of the resulting solution? *(0.040 M H_3PO_4)*

$C_1 = 0.20M$

$V_1 = 250.0mL$

$C_2 = ?$

$V_2 = 250.0mL + 1000mL$

$= 1250mL$

$C_1V_1 = C_2V_2$

$(0.20M)(250.0mL) = (C_2)(1250mL)$

$C_2 = \frac{(0.20M)(250.0mL)}{(1250mL)}$

$= \boxed{0.040M}$

* volume units must be the same!