Block:____ Name: Key.

Worksheet: Problems Involving Solutions

1. What mass of solute is required to make up the following solutions?

(a) 200. mL of a 0.25 M NaOH solution?

Na = 23
O = 16.0
H = 1.01
40.01

$\frac{0.25\ mol}{L} \times 0.2\ L \times \frac{40.01\ g}{mol} = 2.0$

2.0 g NaOH

(b) 50. mL of a 2.0 x 10^{-2} M $CaCl_2$ solution?

Ca = 40.1
2Cl = 71
111.1

$\frac{2.0 \times 10^{-2}\ mol}{L} \times 0.05\ L \times \frac{111.1\ g}{mol} = 0.111\ g$

0.11 g $CaCl_2$

2. What is the molarity of the following solutions?

H = 1.01
N = 14
O_3 = 48
63.01

(a) 212 g of HNO_3 in 250. mL solution?

$212\ g \times \frac{1\ mol}{63.01\ g} = 3.3645\ mol \div 0.25\ L = \frac{13.458\ mol}{L}$

13.5 M HNO_3

(b) A 5.0 L solution containing 10. moles of $MgCl_2$?

$\frac{10\ mol}{5.0\ L} = 2\ mol/L$

2.0 M

3. How many moles of each salt are present in:

(a) 10. mL of 3.0 M of KCl?

$\frac{3.0\ mol}{L} \times 0.01\ L = 0.03\ mol$

0.030 mol or 3.0×10^{-2} mol

(b) 5.0 L of 12 M NaCl?

$\frac{12\ mol}{L} \times 5.0\ L = 60\ moles$

60. moles

4. What volume of solution is required to make up each of the following solutions?

(a) 1.2 moles of $MgSO_4$ are used to make a 1.0 M solution?

$1.2\ mol \times \frac{1\ L}{1.0\ mol} =$ **1.2 L**

(b) 0.050 mole of AgI are used to make a 1.0 x 10^{-4} M solution?

$0.050\ mol \times \frac{L}{1.3 \times 10^{-4}\ mol} =$ **500 L**

5. calculate the volume required to prepare the following diluted solution:

$M_1V_1 = M_2V_2$

Given 1.0 M NaOH; need 250. mL of 0.25 M NaOH

M_1 = 1.0 M NaOH M_2 = 0.25 M NaOH

V_1 = ? V_2 = 0.250 L

$\frac{1.0\ mol/L \times V_1}{1.0} = \frac{0.25\ mol/L \times 0.25\ L}{1.0\ mol/L}$

Sig figs

63 mL

V = 0.0625 L or 62.5 mL

6. If water is added to 100 mL of a 0.15 M NaOH solution until the final volume is 150 mL, what will the molarity of the diluted solution be?

M_1 = 0.15 M M_2 = ?

V_1 = .100 L V_2 = .15 L

$\frac{0.15\ mol}{L} \times 0.1\ L = M_2 \times 0.15\ L$

$\frac{0.15\ mol}{0.15\ L} = \frac{0.1\ mol}{L} = M_2$

0.1 M NaOH

V_1 M_1

7. If 25 mL of water is added to 125 mL of a 0.15 M NaOH solution, what will the molarity of the diluted solution be?

$M_1 = 0.15\,M$ $M_2 = ?$
$V_1 = 0.125\,L$ $V_2 = 0.150\,L$

$\frac{0.15\,mol}{L} \times 0.125\,L = M_2 \times 0.15\,L$

$0.01875\,mol = M_2 \times 0.15\,L$

$0.125\,M = M_2$

0.13 M NaOH

8. I have 345 mL of a 1.5 M NaCl solution. If I boil the water until the volume of the solution is 250 mL, what will the molarity of the solution be?

$M_1 = 1.5\,M$ $M_2 = ?$
$V_1 = 0.345\,L$ $V_2 = 0.25\,L$

$\frac{1.5\,mol}{L} \times 0.345\,L = M_2 \times 0.25\,L$

$2.07\,M = M_2$

2.1 M NaCl

9. Write the **dissociation equation** for each of the following solutions and then calculate the **concentration of each ion** in each solution.:

(a) 1.05 M K_3PO_4

equation: $K_3PO_4 \rightarrow K^+ + 3PO_4^{3-}$

concentration of ions: $[K^+] = 1.05\,M$

$[PO_4^{3-}] = 3.15\,M$

(b) 0.102 M $Fe_2(SO_4)_3$

equation: $Fe_2(SO_4)_3 \rightarrow 2Fe^{3+} + 3SO_4^{2-}$

$0.102 \times 2 = 0.204$

$0.102 \times 3 = 0.306$

concentration of ions: $[Fe^{3+}] = 0.204\,M$

$[SO_4^{2-}] = 0.306$

Define the following words:

Soluble - able to dissolve - more than 0.1 mol of solute will dissolve in 1 L of solution @ 25°C

Solution
- homogenous mixture - uniform - retains some properties of its components

Dissociation
- cations + anions being separated by the solvent $AB \rightarrow A^+ + B^-$

Solubility
The maximum amount of solute that will dissolve in a given amount of solvent at a particular temperature