$M = \frac{n}{V}$ $M_1V_1 = M_2V_2$

$M_1 > M_2$ $V_1 < V_2$

Name: KEY

Date: _____

Chemistry

Concentration of Solutions WS 3 (Dilutions)

I. *Perform the following concentration calculations, showing all work and circling your answers:*

1. How much stock solution (V_1) would you need to prepare 60.0 mL (V_2) of 0.200 M (M_2) HCl from a stock solution of 4.00 M HCl? (M_1)

$M_1V_1 = M_2V_2$ $V_1 = \frac{M_2V_2}{M_1} = \frac{(0.200\ M)(60.0\ mL)}{4.00\ M}$ = 3.00 mL of 4.00 M HCl

2. How much nitric acid (V_1) would you need to prepare 500. mL (V_2) of 1.75 M (M_2) HNO_3 solution from an 8.61 M (M_1) stock solution of HNO_3?

$M_1V_1 = M_2V_2$ $V_1 = \frac{M_2V_2}{M_1} = \frac{(1.75\ M)(500.\ mL)}{8.61\ M}$ = 102 mL of 8.61 M HNO_3

3. You have 505 mL (V_1) of a 0.125 M (M_1) HCl solution and you want to dilute it to exactly 0.100 M. (M_2) How much water should you add? Find V_2 first, then subtract V_1

$M_1V_1 = M_2V_2$ $V_2 = \frac{M_1V_1}{M_2} = \frac{(0.125\ M)(505\ mL)}{0.100\ M}$ = 631 mL (final volume) − 505 mL = add 126 mL

4. 275 mL (V_1) of a 3.0 M (M_1) HCl solution is diluted to have a final volume of 775 mL (V_2). What is the final concentration? (M_2)

$M_1V_1 = M_2V_2$ $M_2 = \frac{M_1V_1}{V_2} = \frac{(3.0\ M)(275\ mL)}{775\ mL}$ = 1.1 M HCl

5. You have a 0.5 M (M_1) NaOH stock solution. For an experiment, you need 0.08 M (M_2) NaOH. How would you prepare 125 mL (V_2) of this lower concentration? (V_1?)

$M_1V_1 = M_2V_2$ $V_1 = \frac{M_2V_2}{M_1} = \frac{(0.08\ M)(125\ mL)}{0.5\ M}$ = 20 mL of 0.5 M NaOH, dilute to 125 mL

6. What would be the final volume (V_2) when 25.0 mL (V_1) of a 0.680 M (M_1) solution is diluted to 0.15 M? (M_2)

$M_1V_1 = M_2V_2$ $V_2 = \frac{M_1V_1}{M_2} = \frac{(0.680\ M)(25.0\ mL)}{0.15\ M}$ = 110 mL

7. If you want to make 300. mL of 3.5 M HCl, how much 6.0 M HCl would you need to dilute in water in order to make this lower concentration?

$M_1V_1 = M_2V_2$ $\quad V_1 = \frac{M_2V_2}{M_1} = \frac{(3.5\ M)(300.\ mL)}{6.0\ M}$ = **175 mL of 6.0 M HCl**

8. 64 g of NaOH are dissolved in 175 mL of solution. What is its concentration? If this solution is then diluted with 200 additional mL H_2O, what is its final concentration?

$\frac{64\ g\ NaOH}{39.997\ g\ NaOH} \left| \frac{1\ mol\ NaOH}{} \right.$ = 1.6 mol NaOH $\quad M = \frac{n}{V} = \frac{1.60\ mol\ NaOH}{0.175\ L}$ = 9.14 M NaOH = M_1

$M_1V_1 = M_2V_2$ $\quad M_2 = \frac{M_1V_1}{V_2} = \frac{(9.14\ M)(175\ mL)}{375\ mL}$ = **4.27 M NaOH**

9. How much water do you have to add to 15 mL of 4.5 M K_2SO_4 solution in order to dilute it to 0.805 M?

$M_1V_1 = M_2V_2$ $\quad V_2 = \frac{M_1V_1}{M_2} = \frac{(4.5\ M)(15\ mL)}{0.805\ M}$ = 84 mL (final) − 15 mL (initial) = **69 mL**

10. A 6.0 M sodium nitrate stock solution is diluted to form 550. mL of 1.5 M solution. How much stock solution is needed to form the dilute solution?

$M_1V_1 = M_2V_2$ $\quad V_1 = \frac{M_2V_2}{M_1} = \frac{(1.5\ M)(550.\ mL)}{6.0\ M}$ = **140 mL of 6.0 M $NaNO_3$**

11. After diluting 160. mL of an unknown acid to a final volume of 500. mL, its final concentration is found to be 0.398 M. What was the original concentration of the acid?

$M_1V_1 = M_2V_2$ $\quad M_1 = \frac{M_2V_2}{V_1} = \frac{(0.398\ M)(500.\ mL)}{160.\ mL}$ = **1.24 M**

12. 37.03 g of acetic acid are dissolved in 800. mL of water. What is the concentration of this solution? If 350. mL of water is added to the solution, what will be its new concentration?

$\frac{37.03\ g\ CH_3COOH}{60.052\ g\ CH_3COOH} \left| \frac{1\ mol\ CH_3COOH}{} \right.$ = 0.6166 mol CH_3COOH $\quad M = \frac{n}{V} = \frac{0.6166\ mol}{0.800\ L}$ = **0.771 M CH_3COOH**

$M_1V_1 = M_2V_2$ $\quad M_2 = \frac{M_1V_1}{V_2} = \frac{(0.771\ M)(800.\ mL)}{1150.\ mL}$ = **0.536 M CH_3COOH**