

CHEM 101 Day 7

How many grams of aspirin ($C_9H_8O_4$) can be made by reacting 5 mL of acetic anhydride ($C_4H_6O_3$)?

$$D_{aa} = 1.08 \text{ g/mL}$$



$$MM_{aa} = 102.1 \text{ g}$$

$$5.00 \text{ mL } C_4H_6O_3 \times (1.08 \text{ g } C_4H_6O_3 / 1 \text{ mL } C_4H_6O_3) \times (1 \text{ mol } C_4H_6O_3 / 102.1 \text{ g } C_4H_6O_3) \times (1 \text{ mol } C_9H_8O_4 / 1 \text{ mol } C_4H_6O_3) \times (180 \text{ g } C_9H_8O_4 / 1 \text{ mol } C_9H_8O_4) = 9.52 \text{ g } C_9H_8O_4$$

If 8.20 g was produced, what is the percent yield?

$$(8.20 \text{ g} / 9.52 \text{ g}) \times 100 =$$

Solution

Homogenous mixture

Units of concentration

Molarity (M): $M = (\text{moles of a solute} / 1 \text{ L of solution})$

What is the molarity of a solution where 80 g of NaOH are dissolved in enough water to make 500 mL of solution?

$$80 \text{ g NaOH} \times (1 \text{ mol NaOH} / 40 \text{ g NaOH}) = 2 \text{ mol NaOH}$$

$$(2 \text{ mol NaOH} / 0.5 \text{ L}) = 4.00 \text{ M}$$

How many grams of NaOH would be needed to make 250 mL of a 0.1 M NaOH solution?

$$(x / 0.25 \text{ L}) = 0.1 \text{ M}, \quad x = 0.025 \text{ mol NaOH}$$

$$0.025 \text{ mol NaOH} \times (40 \text{ g NaOH} / 1 \text{ mol NaOH}) = 1 \text{ g NaOH}$$

How many mL of a 0.20 M glucose ($C_6H_{12}O_6$) are needed to provide 25 g of glucose?

$$MM_{\text{glucose}} = 180 \text{ g/mole}$$

$$25 \text{ g } C_6H_{12}O_6 \times (1 \text{ mol } C_6H_{12}O_6 / 180 \text{ g } C_6H_{12}O_6) = 0.1389 \text{ mol } C_6H_{12}O_6$$

$$(0.1389 \text{ mol } C_6H_{12}O_6 / x) = 0.2 \text{ M}, \quad x = 0.6945 \text{ L} = 695 \text{ mL}$$

Dilution (adding solvent)

$$M_1V_1 = M_2V_2$$

Stock HCl comes as 12.0 M. You need 500.0 mL of a 1 M solution. How much of the stock solution do you use?

$$(12.0 \text{ M})V_1 = (1.0 \text{ M})(500 \text{ mL})$$

$$V_2 = ((1.0 \text{ M})(500 \text{ mL})) / (12.0 \text{ M}) = 41.7 \text{ mL}$$

$\text{H}_2\text{SO}_4 + 2\text{NaOH} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{H}_2\text{O}$. What volume of 0.250 M H_2SO_4 is needed to react with 50.0 mL of 0.100 M NaOH?

$$\text{NaOH: } 0.050 \text{ L NaOH} \times (0.10 \text{ mol}/1 \text{ L}) = 0.0050 \text{ mol NaOH}$$

$$0.0050 \text{ mol NaOH} \times (1 \text{ mol H}_2\text{SO}_4/2 \text{ mol NaOH}) = 0.00250 \text{ mol H}_2\text{SO}_4$$

$$0.00250 \text{ mol H}_2\text{SO}_4 \times (1 \text{ L}/0.250 \text{ mol H}_2\text{SO}_4) = 0.0100 \text{ L}$$

$$0.0100 \text{ L} \times 1000 = 10 \text{ mL}$$