CHM 2045 - 133

1/31/17

Combustion Analysis

Solutions

Molarity

dilution

$C_xH_y + O_2 \longrightarrow CO_2 + H_2O$

* Empirical Formula

14.1mg of C_xH_y $\longrightarrow$ 38.8mg CO_2 + 31.7mg H_2O

$$\frac{38.8\text{mg}\,CO_2}{} \left| \frac{10^{-3}\text{g}}{1\text{mg}} \right| \frac{1\text{mole C}}{12.011\text{g}} = 0.00323 \text{ mole C}$$

$$\frac{38.8\text{mg}\,CO_2}{} \left| \frac{10^{-3}\text{g}}{1\text{mg}} \right| \frac{1\text{mole}\,CO_2}{43.991\text{g}} \left| \frac{1\text{mole C}}{1\text{mole}\,CO_2} \right. = 8.81998\times10^{-4} \text{ mole C}$$

$$\frac{31.7\text{mg}\,H_2O}{} \left| \frac{10^{-3}\text{g}}{1\text{mg}} \right| \frac{1\text{mole}\,H_2O}{18.006\text{g}} \left| \frac{2\text{ mol H}}{1\text{mol}\,H_2O} \right. = 0.003522 \text{ mole H}$$

$\frac{C}{C} = 1$ $\qquad \frac{0.003522}{8.81998\times10^{-4}} = \frac{H}{C} = 4$

CH_4 empirical formula.

$\longrightarrow$

$C_xH_yO_z + O_2 \rightarrow CO_2 + H_2O$

0.1005g 0.2829g 0.1159g

$$0.2829\,g \left| \frac{1\,mole\,CO_2}{43.991\,g} \right| \frac{1\,mole\,C}{1\,mole\,CO_2} \left| \frac{12.011\,g}{1\,mole\,C} \right. =$$

$0.00643\,mole\,C$ $0.07724\,g\,C$

$$0.1159\,g\,H_2O \left| \frac{1\,mole\,H_2O}{18.006\,g} \right| \frac{2\,mole\,H}{1\,mole\,H_2O} \left| \frac{1.008\,g}{1\,mole\,H} \right. =$$

$0.01287\,mole\,H$ $0.01298\,g\,H$

$0.1005\,g - (0.07724\,g + 0.01298) = 0.01028\,g\,O$

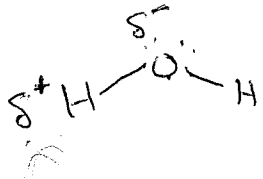
$$0.01028\,g\,O \left| \frac{1\,mole\,O}{15.99\,g} \right. = 6.429 \times 10^{-4}\,moles\,O$$

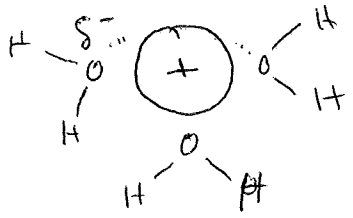
$$\frac{O}{O} = 1 \qquad \frac{C}{O} = \frac{0.000643}{0.000643} = 10 \qquad \frac{H}{O} = \frac{0.01287}{6.43 \times 10^{-4}} = 20$$

$C_{10}H_{20}O$

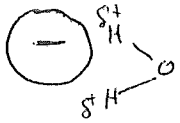
Solutions - aqueous phase of matter
'dissolved in water'

$$NaCl + H_2O \longrightarrow Na^+ + Cl^- + H_2O$$





Solvent cage



solute
NaCl
substance in lesser amt.

Solvent
H_2O
substance in larger amount

Electrolytes: dissolved, ionize, conduct electricity

Strong electrolyte: completely ionize.

$$HNO_3 \longrightarrow H^+ + NO_3^-$$

weak electrolyte

$$CH_3COH \rightleftharpoons CH_3CO^- + H^+$$

Non electrolytes

$$C_6H_{12}O_6 \longrightarrow C_6H_{12}O_6$$ no-ions.

Quantify

$$\text{Molarity} = \frac{\text{moles solute}}{\text{L sol'n}} \qquad 1.00\,\underline{M} = \frac{1.00\text{ mole}}{1\text{ L sol'n}}$$

Concentrated

Make a solution dissolve 15.0 g NaOH in 1.5 L of H_2O $\underline{M} = ?$

$$\frac{15.0\text{ g NaOH}}{} \left| \frac{1\text{ mole}}{39.99\text{ g}} \right| \frac{}{1.5\text{ L}} = 0.25\,\underline{M}$$

★ What mass of K_2SO_4 is needed to make 250.0 mL of a 0.500 $\underline{M}$ sol'n?

$$\frac{0.500\text{ mole}}{1\text{ L}} \left| 0.250\text{ L} \right| \frac{174\text{ g}}{1\text{ mole } K_2SO_4} = 21.8\text{ g}$$

$M \cdot V = \text{moles}$

Vol Flask = Too contain a specific volume

Blood is 0.14 M in NaCl. What volume of blood is needed to get 1.0 mg of NaCl?

$$\frac{1.0\text{ mg}}{} \left| \frac{1\text{ g}}{1000\text{ mg}} \right| \frac{1\text{ mole NaCl}}{58.43\text{ g}} \left| \frac{1\text{ L}}{0.14\text{ mole}} \right| = \begin{cases} 1.2 \times 10^{-4}\text{ L} \\ 0.12\text{ mL} \\ 120\,\mu\text{L} \end{cases}$$

in sol'n

cations anions

$KNO_3(aq) \rightarrow K^+ + NO_3^-$

$1\,M\ KNO_3 \rightarrow 1\,M\ K^+ \quad 1\,M\ NO_3^-$

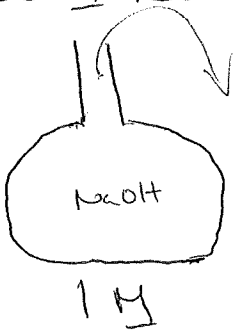
$K_2SO_4 \rightarrow 2K^+ + SO_4^{2-}$

$1\,M\ K_2SO_4 \rightarrow 2\,M\ K^+ + 1\,M\ SO_4^{2-}$

Dilution: Lowering the concentration by increasing solvent or solution volume. Keeping solute same.

Molarity · Volume = moles.

1.00 M NaOH. make 100 mL of a 0.250 M NaOH.



$M_1V_1 = \text{moles}$

$\text{moles} = M_2V_2$

$M_1V_1 = M_2V_2$

$(1.00M)(X) = (0.250M)(100.mL)$

$X = 25mL$

★ Take 25 mL of 1.00 M NaOH dilute to a final volume of 100. mL.