25.0 mL of acetic acid solution requires 37.3 mL of 0.150 M sodium hydroxide for complete reaction. The equation for this reaction is:

$$NaOH + HC_2H_3O_2 \rightarrow NaC_2H_3O_2 + H_2O$$

What is the molar concentration of the acetic acid?

$$\frac{\text{mol } HC_2H_3O_2}{\text{L solution}} \leftarrow 25.0 \text{ mL} = 0.0250 \text{ L}$$

Since we already know the VOLUME of acetic acid solution, we need to use the rest of the information given to find the MOLES of acetic acid.

0.150 mol NaOH = L | mol NaOH = mol $HC_2H_3O_2$ | mL = 10^{-3} L

$$37.3 \text{ mL} \times \frac{10^{-3} \text{ L}}{\text{mL}} \times \frac{0.150 \text{ mol NaOH}}{\text{L}} \times \frac{\text{mol } HC_2H_3O_2}{\text{mol NaOH}} = 0.005595 \text{ mol } HC_2H_3O_2$$

To find the molarity, divide by the volume:

$$M = \frac{\text{mol } HC_2H_3O_2}{\text{L solution}} = \frac{0.005595 \text{ mol } HC_2H_3O_2}{0.0250 \text{ L}} = \boxed{0.224 \text{ } \underline{M} \text{ } HC_2H_3O_2}$$

$$\overset{42.081\ g/mol}{4\,C_3H_6} + 6\,NO \longrightarrow \overset{53.064\ g/mol}{4\,C_3H_3N} + 6\,H_2O + N_2$$

propylene — acrylonitrile

Calculate how many grams of acrylonitrile could be obtained from 651 kg of propylene, assuming there is excess NO present.

1 - Convert mass propylene to moles using formula weight and definition of kilo-
2 - Convert moles propylene to moles acrylonitrile using chemical equation
3 - Convert moles acrylonitrile to mass using formula weight

$42.081\ g\ C_3H_6 = mol\ C_3H_6$ | $kg = 10^3\ g$ | $4\ mol\ C_3H_6 = 4\ mol\ C_3H_3N$ | $53.064\ g\ C_3H_3N = mol\ C_3H_3N$

$$651\ kg\ C_3H_6 \times \frac{10^3\ g}{kg} \times \frac{mol\ C_3H_6}{42.081\ g\ C_3H_6} \times \frac{4\ mol\ C_3H_3N}{4\ mol\ C_3H_6} \times \frac{53.064\ g\ C_3H_3N}{mol\ C_3H_3N} = \boxed{821000\ g\ C_3H_3N}$$

(821 kg)

① ② ③

151.90 g/mol

$$10\,FeSO_4 + 2\,KMnO_4 + 8\,H_2SO_4 \rightarrow 5\,Fe_2(SO_4)_3 + 2\,MnSO_4 + K_2SO_4 + 8\,H_2O$$

How many mL of 0.250M potassium permangenate are needed to react with 3.36 g of iron(II) sulfate?

1 - Convert 3.36 g iron(II) sulfate to moles using formula weight.
2 - Convert moles iron(II) sulfate to moles potassium permangenate using chemical equation
3 - Convert moles potassium permangenate to volume using concentration and unit conversion

151.90 g $FeSO_4$ = mol $FeSO_4$ | 10 mol $FeSO_4$ = 2 mol $KMnO_4$ | 0.250 mol $KMnO_4$ = L | mL = 10^{-3} L

$$3.36\,g\,FeSO_4 \times \frac{mol\,FeSO_4}{151.90\,g\,FeSO_4} \times \frac{2\,mol\,KMnO_4}{10\,mol\,FeSO_4} \times \frac{L}{0.250\,mol\,KMnO_4} \times \frac{mL}{10^{-3}\,L} =$$

(1) (2) (3)

= 17.7 mL of 0.250 M $KMnO_4$

Electrolytes and Ionic Theory

- electrolytes: substances that dissolve in water to form charge-carrying solutions

* Electrolytes form ions in solution - (ions that are mobile are able to carry charge!). These IONS can undergo certain kinds of chemistry!

IONIC THEORY

- the idea that certain compounds DISSOCIATE in water to form free IONS

What kind of compounds?

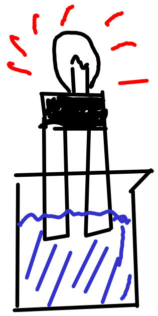
- Soluble ionic compounds
- Acids (strong AND weak)
- Bases (strong AND weak)

The ions formed may interact with each other to form NEW compounds!

Strong vs weak?

- If an electrolyte COMPLETELY IONIZES in water, it's said to be STRONG
- If an electrolyte only PARTIALLY IONIZES in water, it's said to be WEAK
- Both kinds of electrolyte undergo similar kinds of chemistry.

Ionic theory experiment



Simple conductivity tester: The stronger the electrolyte, the brighter the light.

SOME PURE COMPOUNDS (MOLECULAR AND IONIC)

DISTILLED WATER

No light. Pure water is a NONCONDUCTOR.

SOLID SODIUM CHLORIDE

Contains ions, but does not conduct. The ions are locked into the solid crystal structure of NaCl

SOLID SUCROSE $C_{12}H_{22}O_{11}$

No light. Like water, sucrose is molecular - made up of NEUTRAL molecules. Nonconductor.

MOLECULAR AND IONIC SOLUTIONS

SODIUM CHLORIDE + WATER

Bright light. Sodium chloride (like other soluble ionic compounds) is a SRONG ELECTROLYTE.

SUCROSE + WATER

No light. The sugar-water solution does not conduct (no charge carriers - everything's a neutral molecule). Sugar is a NONELECTROLYTE.

ACIDS

PURE (GLACIAL) ACETIC ACID

Pure acetic acid is a nonconductor. In the liquid state, it exists as neutral molecules (no ions present)

ACETIC ACID + WATER

Bulb light, but dimly (dimmer than NaCl/Water). Acetic acid is a WEAK ELECTROLYTE - it partially ionixes in water by reacting with water to make ions.

2M ACETIC ACID (AQUEOUS)

Light is dim, so WEAK ELECTROLYTE

2M HYDROCHLORIC ACID (AQUEOUS)

Light is bright, so STRONG ELECTROLYTE (or at least, stronger than acetic acid!)