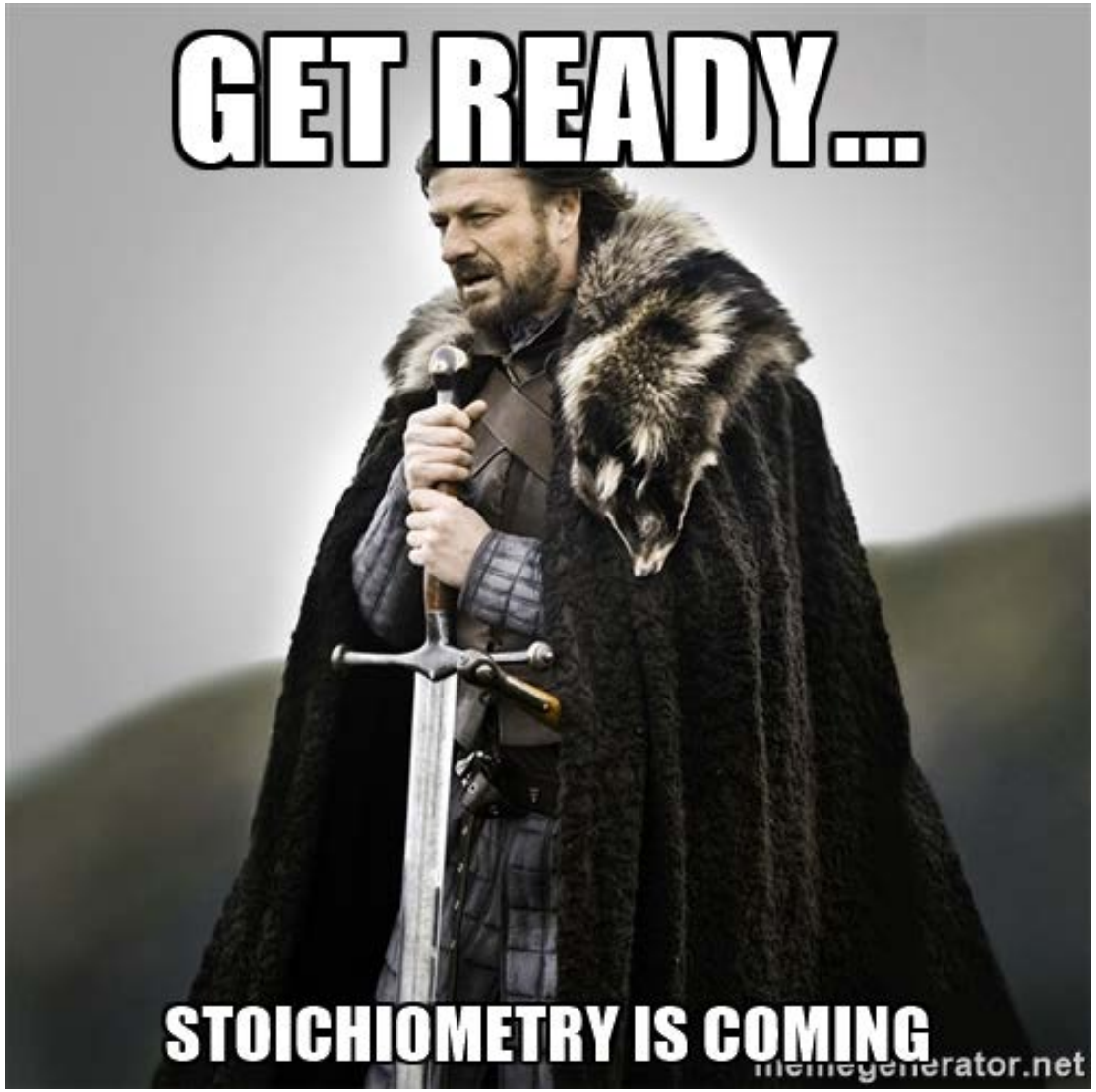
Solution Stoichiometry



Outcomes:

- Solve problems involving calculations for concentration, moles, mass and volume.

Solution Stoichiometry:

We can use concentration (molarity) in stoichiometry to find the mass/moles/volume/etc. of species in a chemical reaction.

We will follow the same steps as before when doing stoichiometry problems.

Cu^{2+} NO_3^-

Examples:

If a 200mL solution of 0.100mol/L $AgNO_3$ completely reacts with copper (II), what mass of silver will be produced?

$$2AgNO_3 + Cu \longrightarrow Cu(NO_3)_2 + 2Ag$$

200mL, 0.1 mol/L

$$0.2\,L \times \frac{0.1\ mol}{1\ L} = 0.02\ mol\ AgNO_3 \times \frac{2\ mol\ Ag}{2\ mol\ AgNO_3} = 0.02\ mol\ Ag \times \frac{107.9\ g}{1\ mol} = 2.16\ g\ Ag$$

Solution Stoichiometry:

Ag^+ NO_3^- Na^+ PO_4^{3-}

Write the balanced equation for the precipitation reaction between solutions of silver nitrate and sodium phosphate. To produce aqueous sodium nitrate and solid silver phosphate. ***Include physical states of all species.***

$$3AgNO_{3(aq)} + Na_3PO_{4(aq)} \rightarrow 3NaNO_{3(aq)} + Ag_3PO_{4(s)}$$

Use the reaction in #2 to determine the mass of silver phosphate will be produced when 600ml of a 2M silver nitrate solution reacts with excess sodium phosphate solution?

$$0.6\,L \times \frac{2\ mol}{1\ L} = 1.2\ mol\ AgNO_3 \times \frac{1\ mol\ Ag_3PO_4}{3\ mol\ AgNO_3} = 0.4\ mol\ Ag_3PO_4 \times \frac{418.7\ g}{1\ mol}$$

$$= 167.48\,g$$

Solution Stoichiometry:

Try this one…

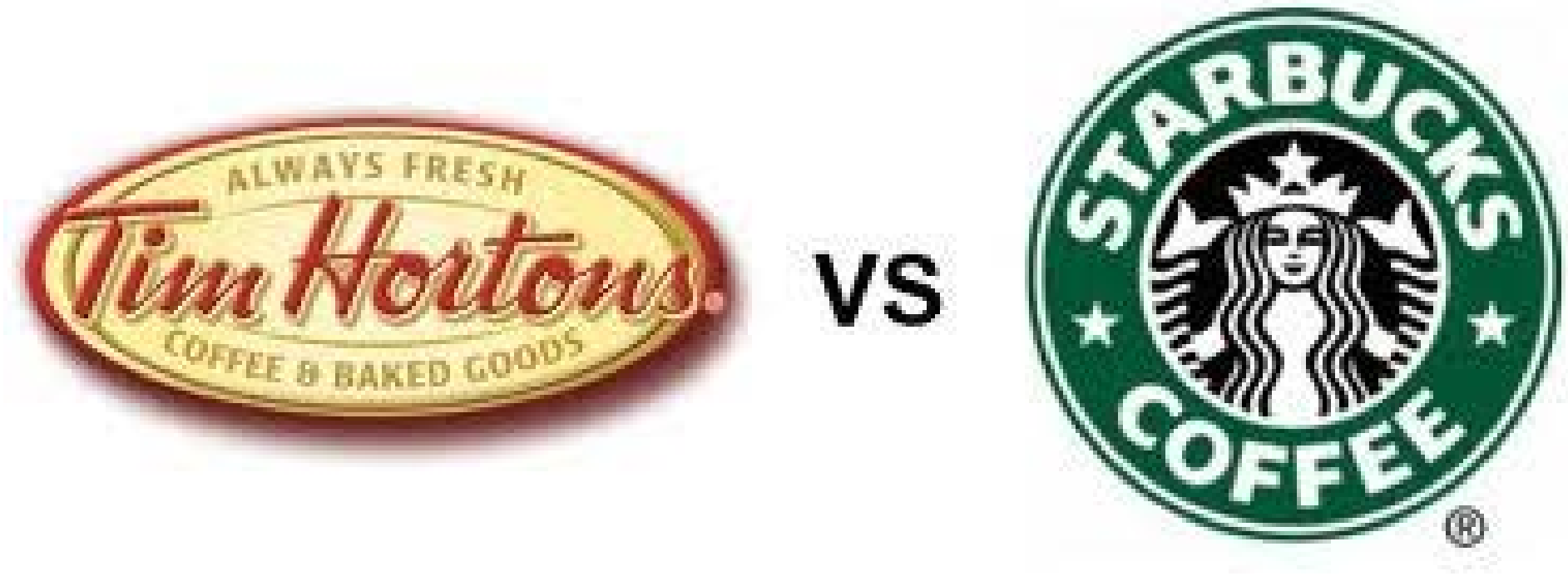
If excess Na_2SO_4 solution is mixed with 575mL of a 0.100mol/L $Ba(NO_3)_2$ solution, what is the mass of the precipitate ($BaSO_4$) that is formed? (13.42g)

$$Na_2SO_4 + Ba(NO_3)_2 \longrightarrow 2NaNO_3 + BaSO_4$$

$$0.575\,L \times \frac{0.1\,mol}{1\,L} = 0.0575\,mol\,Ba(NO_3)_2 \times \frac{1\,mol\,BaSO_4}{1\,mol\,Ba(NO_3)_2} = 0.0575\,mol\,BaSO_4 \times \frac{233.4\,g}{1\,mol}$$

$$= 13.42\,g\,BaSO_4$$

Importance of Concentration



Outcomes:

Describe examples of situations where solutions of known concentration are important

Importance of Concentration:

Importance in Reactions:

- Concentration will affect the **RATE** of a **REACTION**.
- If there is a **HIGHER CONCENTRATION** of **REACTANTS** in a solution, there will be **MORE COLLISIONS**, and hence a **FASTER REACTION**.
- Example: Zn in a **CONCENTRATED** HCl solution will react more **VIGOROUSLY** than in a **DILUTE** solution.

Importance in industry:

- Concentration of solutions is very important in real world such as in **INDUSTRIES** and **PHARMACEUTICALS**. Here are some examples where the need of concentration is very important
- Cl^- in **SWIMMING POOLS**
- Nitrates in **WATER** samples
- **PESTICIDES** in food
- **Hg** in **WATER** supplies
- **FLUORIDE** in **DRINKING** water
- Pb in **SOIL**
- **INTRAVENOUS** solutions
- **PRESCRIPTION** drugs
- Drug **OVERDOSES**
- Air **QUALITY** control

#2) 13.44L

4) 16.8L

6) 5 $\frac{mol}{L}$

8) 11.1 $\frac{mol}{L}$

10) 4.03 L