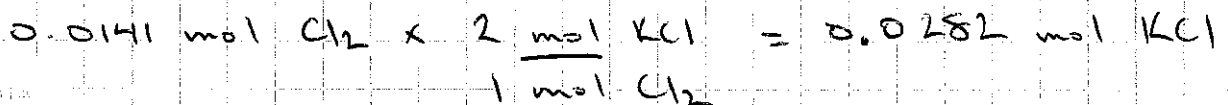
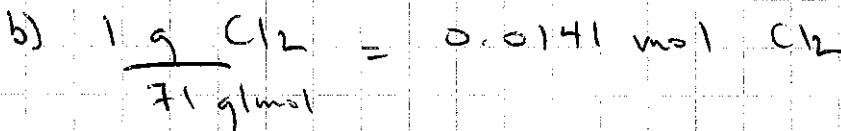
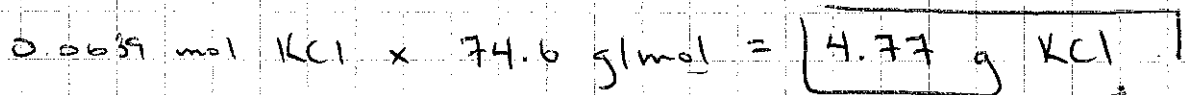
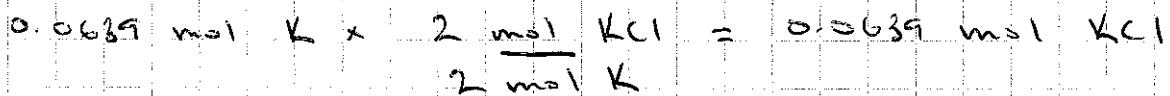
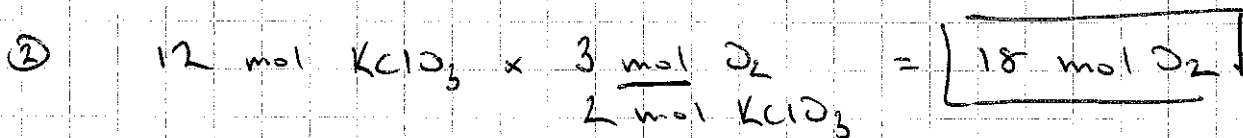
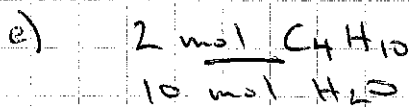
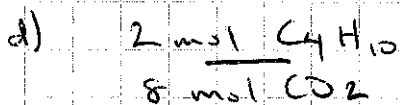
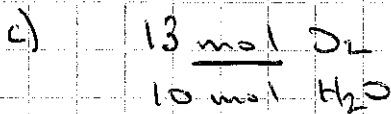
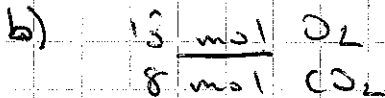
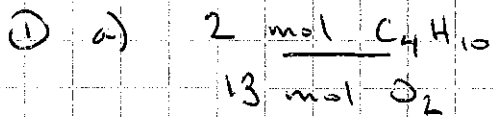


# Stoichiometry



$$\textcircled{3} \text{ b) } 0.0282 \text{ mol KCl} \times 74.6 \text{ g/mol} = \boxed{2.10 \text{ g KCl}}$$

$$\textcircled{4} \quad \frac{120 \text{ g Na}_2\text{O}}{62 \text{ g/mol}} = 1.935 \text{ mol Na}_2\text{O}$$

$$1.935 \text{ mol Na}_2\text{O} \times \frac{2 \text{ mol NaOH}}{1 \text{ mol Na}_2\text{O}} = 3.87 \text{ mol NaOH}$$

$$3.87 \text{ mol NaOH} \times 40 \text{ g/mol} = \boxed{154.8 \text{ g NaOH}}$$

$$\frac{160 \text{ g NaOH}}{40 \text{ g/mol}} = 4 \text{ mol NaOH}$$

$$4 \text{ mol NaOH} \times \frac{1 \text{ mol Na}_2\text{O}}{2 \text{ mol NaOH}} = 2 \text{ mol Na}_2\text{O}$$

$$2 \text{ mol Na}_2\text{O} \times 62 \text{ g/mol} = \boxed{124 \text{ g Na}_2\text{O}}$$

$$\textcircled{5} \quad \frac{16 \text{ g S}_8}{256.8 \text{ g/mol}} = 0.0623 \text{ mol S}_8$$

$$0.0623 \text{ mol S}_8 \times \frac{8 \text{ mol Fe}}{1 \text{ mol S}_8} = 0.498 \text{ mol Fe}$$

$$0.498 \text{ mol Fe} \times 55.8 \text{ g/mol} = \boxed{27.8 \text{ g Fe}}$$

$$0.0623 \text{ mol S}_8 \times \frac{8 \text{ mol FeS}}{1 \text{ mol S}_8} = 0.498 \text{ mol FeS}$$

$$0.498 \text{ mol FeS} \times 87.9 \text{ g/mol} = \boxed{43.8 \text{ g FeS}}$$

$$\textcircled{6} \quad 12 \text{ mol NaClO}_3 \times \frac{3 \text{ mol O}_2}{2 \text{ mol NaClO}_3} = 18 \text{ mol O}_2$$

$$18 \text{ mol O}_2 \times 32 \text{ g/mol} = \boxed{576 \text{ g O}_2}$$

$$\frac{80 \text{ g O}_2}{32 \text{ g/mol}} = 2.5 \text{ mol O}_2$$

$$2.5 \text{ mol O}_2 \times \frac{2 \text{ mol NaCl}}{3 \text{ mol O}_2} = 1.667 \text{ mol NaCl}$$

$$1.667 \text{ mol NaCl} \times 58.5 \text{ g/mol} = \boxed{97.5 \text{ g NaCl}}$$

$$\textcircled{7} \quad 3.5 \text{ mol AgNO}_3 \times \frac{1 \text{ mol Cu}}{2 \text{ mol AgNO}_3} = \boxed{1.75 \text{ mol Cu}}$$

$$\frac{89.5 \text{ g Ag}}{107.9 \text{ g/mol}} = 0.829 \text{ mol Ag}$$

$$0.829 \text{ mol Ag} \times \frac{1 \text{ mol Cu}}{2 \text{ mol Ag}} = 0.415 \text{ mol Cu}$$

$$0.415 \text{ mol Cu} \times 63.5 \text{ g/mol} = \boxed{26.4 \text{ g Cu}}$$

$$\textcircled{8} \quad \frac{25\,000 \text{ g Fe}_2\text{O}_3}{159.6 \text{ g/mol}} = 156.6 \text{ mol Fe}_2\text{O}_3$$

$$156.6 \text{ mol Fe}_2\text{O}_3 \times \frac{2 \text{ mol Fe}}{1 \text{ mol Fe}_2\text{O}_3} = 313.2 \text{ mol Fe}$$

$$313.2 \text{ mol Fe} \times 55.8 \text{ g/mol} = 17\,476.6 \text{ g}$$
$$= \boxed{17.5 \text{ Kg Fe}}$$

$$\textcircled{9} \quad \frac{120 \text{ g C}_6\text{H}_{12}\text{O}_6}{180 \text{ g/mol}} = 0.667 \text{ mol C}_6\text{H}_{12}\text{O}_6$$

$$0.667 \text{ mol C}_6\text{H}_{12}\text{O}_6 \times \frac{6 \text{ mol CO}_2}{1 \text{ mol C}_6\text{H}_{12}\text{O}_6} = 4 \text{ mol CO}_2$$

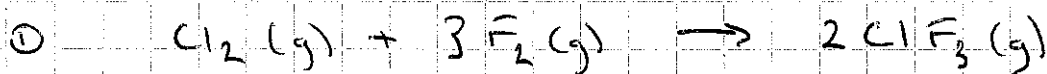
$$4 \text{ mol CO}_2 \times 44 \text{ g/mol} = \boxed{176 \text{ g CO}_2}$$

$$\textcircled{10} \quad 1.2 \text{ mol NH}_3 \times \frac{4 \text{ mol NO}}{4 \text{ mol NH}_3} = 1.2 \text{ mol NO}$$

$$1.2 \text{ mol NH}_3 \times \frac{6 \text{ mol H}_2\text{O}}{4 \text{ mol NH}_3} = 1.8 \text{ mol H}_2\text{O}$$

$$1.2 + 1.8 = 3 \text{ mol total } \boxed{(d)}$$

## Limiting Reactants



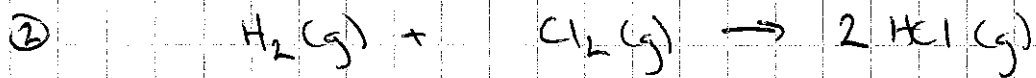
$$1.75 \text{ mol Cl}_2 \times \frac{2 \text{ mol ClF}_3}{1 \text{ mol Cl}_2} = 3.5 \text{ mol ClF}_3$$

$$3.68 \text{ mol F}_2 \times \frac{2 \text{ mol ClF}_3}{3 \text{ mol F}_2} = 2.453 \text{ mol ClF}_3$$

$\text{F}_2$  is limiting,  $\text{Cl}_2$  is excess.  
2.453 mol  $\text{ClF}_3$  are produced.

$$2.453 \text{ mol ClF}_3 \times \frac{1 \text{ mol Cl}_2}{2 \text{ mol ClF}_3} = 1.227 \text{ mol Cl}_2$$

$$1.75 \text{ mol} - 1.227 \text{ mol} = 0.523 \text{ mol Cl}_2 \text{ excess}$$



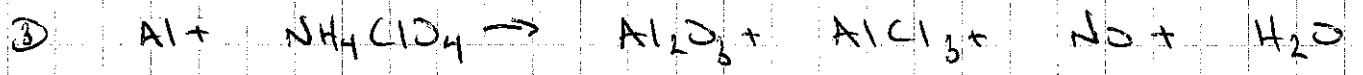
$$7.5 \text{ mol H}_2 \times \frac{2 \text{ mol HCl}}{1 \text{ mol H}_2} = 15 \text{ mol HCl}$$

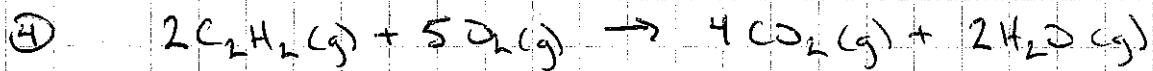
$$9.0 \text{ mol Cl}_2 \times \frac{2 \text{ mol HCl}}{1 \text{ mol Cl}_2} = 18 \text{ mol HCl}$$

$\text{H}_2$  is limiting;  $\text{Cl}_2$  is excess.  
15 mol HCl are produced.

$$15 \text{ mol HCl} \times \frac{1 \text{ mol Cl}_2}{2 \text{ mol HCl}} = 7.5 \text{ mol Cl}_2$$

$$9.0 - 7.5 = 1.5 \text{ mol excess Cl}_2$$





$$\frac{175 \text{ g C}_2\text{H}_2}{26 \text{ g/mol}} = 6.731 \text{ mol C}_2\text{H}_2$$

$$6.731 \text{ mol C}_2\text{H}_2 \times \frac{4 \text{ mol CO}_2}{2 \text{ mol C}_2\text{H}_2} = 13.462 \text{ mol CO}_2$$

$$\frac{175 \text{ g O}_2}{32 \text{ g/mol}} = 5.469 \text{ mol O}_2$$

$$5.469 \text{ mol O}_2 \times \frac{4 \text{ mol CO}_2}{5 \text{ mol O}_2} = 4.375 \text{ mol CO}_2$$

$\boxed{\text{O}_2 \text{ is limiting; C}_2\text{H}_2 \text{ is excess.}}$

$$4.375 \text{ mol CO}_2 \times \frac{2 \text{ mol C}_2\text{H}_2}{4 \text{ mol CO}_2} = 2.188 \text{ mol C}_2\text{H}_2$$

$$6.731 - 2.188 = 4.543 \text{ mol excess C}_2\text{H}_2$$

$$4.543 \text{ mol C}_2\text{H}_2 \times 26 \text{ g/mol} = \boxed{118.1 \text{ g excess C}_2\text{H}_2}$$

Theoretical Yield of  $\text{CO}_2$  is 4.375 mol (192.5 g)

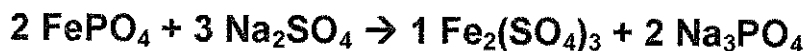
$$\text{Actual Yield} = 48.2 \text{ L} \times 1.79 \text{ g/L} = 86.3 \text{ g}$$

$$P = \frac{86.3}{192.5} \times 100 = \boxed{44.8\%}$$



## Percent Yield Worksheet

- 1) Write the equation for the reaction of iron (III) phosphate with sodium sulfate to make iron (III) sulfate and sodium phosphate.



- 2) If I perform this reaction with 25 grams of iron (III) phosphate and an excess of sodium sulfate, how many grams of iron (III) sulfate can I make?

**33 grams**

- 3) If 18.5 grams of iron (III) sulfate are actually made when I do this reaction, what is my percent yield?

$$(18.5 / 33) \times 100\% = 56\%$$

- 4) Is the answer from problem #3 reasonable? Explain.

**Yes. Any yield under 100% is reasonable under the law of conservation of mass.**

- 5) If I do this reaction with 15 grams of sodium sulfate and get a 65.0% yield, how many grams of sodium phosphate will I make?

**According to the stoichiometry, the theoretical yield is 11.5 grams. Multiplying this by 0.650, you get 7.48 grams.**