Triple - Chemistry - Key Stage 4

Quantitative Chemistry

Atom Economy

Mrs. Begum

Warm up

Calculate the relative formula mass (M_r) of the following:

1. H_2SO_4
2. $AgNO_3$
3. $NaClO$
4. C_2H_5OH
5. $(NH_4)_2SO_4$

A_r:
H = 1
S = 32
O = 16
Ag = 108
N = 14
Na = 23
Cl = 35.5
C = 12

Independent task

Calculate the atom economy for the desired product in each of the reactions

1. $Cl_2 + 2NaOH \longrightarrow$ **NaClO** $+ NaCl + H_2O$ to produce **NaClO**

2. $CuO + H_2SO_4 \longrightarrow$ **CuSO$_4$** $+ H_2O$ to produce **CuSO$_4$**

3. $Fe_2O_3 + 3CO \longrightarrow$ **2Fe** $+ 3CO_2$ to produce **Fe**

4. $C_6H_{12}O_6 \longrightarrow$ **2C$_2$H$_5$OH** $+ 2CO_2$ to produce **C$_2$H$_5$OH**

5. $CH_4 + H_2O \longrightarrow$ **3H$_2$** $+ CO$ to produce **H$_2$** gas.

Independent practice

Calcium sulfate ($CaSO_4$) is used in plaster. Different chemical reactions can be used to make calcium sulfate. Two of those reactions are shown below.

Reaction 1 = $Ca(OH)_2$ + H_2SO_4 → $CaSO_4$ + H_2O

Reaction 2 = $CaCO_3$ + H_2SO_4 → $CaSO_4$ + CO_2 + H_2O

(i) Balance the equations for these two reactions.

(ii) Calculate the atom economy for both reactions.

(iii) Which method should you choose based purely on atom economy?