

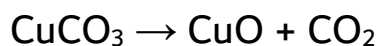
MARK SCHEME

GCSE

CHEMISTRY

Atom Economy

1. Calculate the atom economy to form copper(II) oxide from copper(II) carbonate.

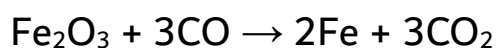


Formula mass: $\text{CuCO}_3 = 123.5$, $\text{CuO} = 79.5$

Atom economy = $79.5/123.5 \times 100 = 64.4\%$

Answer: 64.4%

2. Calculate the atom economy to form iron from iron oxide.



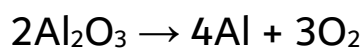
Formula mass: $\text{Fe}_2\text{O}_3 = 160$, $\text{CO} = 28$, $\text{Fe} = 56$

Sum of formula mass of all reactants = $160 + 3(28) = 244$

Atom economy = $2(56)/244 \times 100 = 45.9\%$

Answer: 45.9%

3. Calculate the atom economy to form aluminium from aluminium oxide.

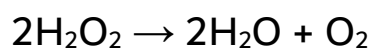


Formula mass: $\text{Al}_2\text{O}_3 = 102$, $\text{Al} = 27$

Atom economy = $4(27)/2(102) \times 100 = 52.9\%$

Answer: 52.9%

4. Calculate the atom economy to form oxygen from hydrogen peroxide.

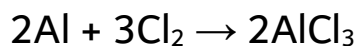


Formula mass: $\text{H}_2\text{O}_2 = 34$, $\text{O}_2 = 32$

Atom economy = $32/2(34) \times 100 = 47.1\%$

Answer: 47.1%

5. Calculate the atom economy to form aluminium chloride from aluminium in this reaction.

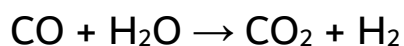


100%

Answer: 100%

6. Hydrogen (H₂) has many uses, including as the fuel in many fuel cells. It can be made in several ways.

- a) Calculate the atom economy to form hydrogen by method 1.



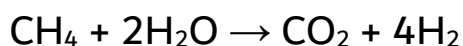
Formula mass: CO = 28, H₂O = 18, H₂ = 2

Sum of formula mass of all reactants = 28 + 18 = 46

Atom economy = $\frac{2}{46} \times 100 = 4.3\%$

Answer: 4.3%

b) Calculate the atom economy to form hydrogen by method 2.



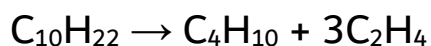
Formula mass: $\text{CH}_4 = 16$, $\text{H}_2\text{O} = 18$, $\text{H}_2 = 2$

Sum of formula mass of all reactants = $16 + 2(18) = 52$

Atom economy = $4(2)/52 \times 100 = 15.4\%$

Answer: 15.4%

7. Calculate the atom economy to form ethene (C_2H_4) from cracking decane ($\text{C}_{10}\text{H}_{22}$),



Formula mass: $\text{C}_{10}\text{H}_{22} = 142$, $\text{C}_2\text{H}_4 = 28$

Atom economy = $3(28)/142 \times 100 = 59.2\%$

Answer: 59.2%