

Atom Economy

1. What is the atom economy for making hydrogen by reacting coal with steam?



$$\begin{aligned} \text{products} &= 2 \times 2 = 4 \\ \text{reactants} &= 12 + (2 \times 18) = 48 \end{aligned} \quad \left(\frac{4}{48}\right) \times 100 = \underline{\underline{8.3\%}}$$

2. Lithium hydroxide will react with nitric acid to produce lithium nitrate and water. What is the atom economy if our product is lithium nitrate.



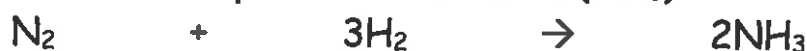
$$\begin{aligned} \text{products} &= 7 + 14 + (3 \times 16) = 69 \\ \text{reactants} &= (7 + 16 + 1) + (1 + 14 + (3 \times 16)) = 87 \end{aligned} \quad \left(\frac{69}{87}\right) \times 100 = \underline{\underline{79.3\%}}$$

3. Calculate the atom economy percentage for the Blast Furnace reaction. The desired product is iron and the waste product is carbon dioxide



$$\begin{aligned} \text{products} &= 55.8 \times 2 = 111.6 \\ \text{reactants} &= ((55.8 \times 2) + 48) + (3 \times 28) = 243.6 \end{aligned} \quad \left(\frac{111.6}{243.6}\right) \times 100 = 45.8\%$$

4. Calculate the atom economy percentage for the Haber Process. The desired product is ammonia (NH₃).



$$\begin{aligned} \text{products} &= (2 \times 17) = 34 \\ \text{reactants} &= 28 + (3 \times 2) = 34 \end{aligned} \quad \left(\frac{34}{34}\right) \times 100 = 100\%$$

(only one product
∴ always 100%)

5. Calculate the atom economy percentage for the Oswald Process (the desired product is nitric acid).



$$\begin{aligned} \text{products} &= 15 + (3 \times 16) = 63 \\ \text{reactants} &= 17 + (2 \times 32) = 81 \end{aligned} \quad \left(\frac{63}{81}\right) \times 100 = 77.7\%$$