**2.1.1 Exercise 6 - PERCENTAGE YIELD AND ATOM ECONOMY**

1. Ethene can be hydrated to make ethanol in an exothermic reaction:

C2H4(g) + H2O(g) 🡪 C2H5OH(g)

1. In one pilot experiment, 100g of ethene was hydrated and 85 g of ethanol was produced. What was the percentage yield of ethanol?
2. Suggest two ways in which the chemist could improve the yield of ethanol in the reaction.
3. What is the atom economy of the reaction?
4. Glucose can be fermented to make ethanol:

C6H12O6(g) 🡪 2C2H5OH(g) + 2CO2(g)

1. In one pilot experiment, 100 g of glucose was fermented and 35 g of ethanol was produced. What was the percentage yield of ethanol?
2. What is the atom economy of the reaction?
3. What could be done to improve the atom economy of the reaction?
4. Chloroethane can by hydrolysed to make ethanol:

C2H5Cl + NaOH 🡪 C2H5OH 🡪 NaCl

1. In one experiment, 100 g of chloroethane was hydrolysed and 45 g of ethanol was produced. What was the percentage yield of ethanol?
2. What is the atom economy of this reaction?
3. Suggest whether achieving a high atom economy or achieving a high percentage yield is more important for the sustainability of a chemical process.
4. Calculate the percentage atom economy of the following processes:
5. the production of iron in the blast furnace:

Fe2O3 + 3CO 🡪 2Fe + 3CO2

1. the production of titanium:

TiCl4 + 4Na 🡪 Ti + 4NaCl

1. the production of glass from sand:

SiO2 + 2NaOH 🡪 Na2SiO3 + H2O

1. Calculate the atom economy of each of the following methods of producing iron and decide which is the most efficient process:

a) Fe2O3 + 3CO 🡪 2Fe + 3CO2

b) Fe2O3 + 3H2 🡪 2Fe + 3H2O

c) Fe2O3 + 2Al 🡪 2Fe + Al2O3