Green Chemistry

1. Ethanol is produced on an industrial scale according to the addition reaction shown below.

   $$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$$

   Given that 5.00 mol of ethene gas was placed in the reaction chamber with excess water vapour, calculate the mass of ethanol produced, if the percentage yield for this reaction is 56%.

2. Ethanol is produced on an industrial scale according to the addition reaction shown below.

   $$C_2H_4(g) + H_2O(g) \rightleftharpoons C_2H_5OH(g)$$

   Calculate the percentage yield of the reaction, under certain conditions, given that 2.80 mol of ethene gas was placed in the reaction chamber with excess water vapour to produce 1.00 mol of ethanol.

3. Calcium oxide is produced by the thermal decomposition of limestone according to equation below.

   $$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

   What is the percentage yield of this process if 60.0 grams of $CaCO_3$ (formula mass 100 g/mol) produces 30.0grams of calcium oxide (formula mass 56.0 g/mol)?

4. Hydrogen gas is produced by a process called ***steam reformation.*** In this process methane reacts with super-hot steam to form carbon monoxide and hydrogen gas according to the balanced chemical equation below. Find the percent atom economy for the formation of hydrogen gas using this method.

   $$CH_4(g) + H_2O(g) \rightarrow CO(g) + 3H_2(g)$$

5. Carbon monoxide gas is produced by a process called ***steam reformation.*** In this process methane reacts with super-hot steam to form carbon monoxide and hydrogen gas according to the balanced chemical equation below. Find the percent atom economy for the formation of carbon monoxide gas using this method.

   $$CH_4(g) + H_2O(g) \rightarrow CO(g) + 3H_2(g)$$

6. Butane is burnt as a fuel on a particular space station. The CO_2 and H_2O produced are then used to regenerate O_2 gas using solar energy according the equation below.

   $$12CO_2(g) + 14H_2O(g) \rightarrow 2C_6H_{14}(g) + 19O_2(g)$$

   What is the percentage atom economy of the production of oxygen gas according to the reaction above?