

Chemistry in Society

Worksheet 2

1. CaCO3 + 2HCl 🡪 **CaCl2** + CO2 + H2O  
     
   64%
2. 4NH3 + 6NO 🡪 **5N2** + 6H2O  
     
   56.45%
3. C2H4 + CH3CO2H + ½O2 🡪 **C2H3O2CCH3** + H2O  
     
   82.69%
4. When ethene (C2H4) is hydrolysed with water it becomes ethanol (C2H6O). What is the percentage yield of ethanol if 42g were produced from hydrolysing 28g of ethane?  
     
   n of ethene = mass/FM = 28/28 = 1

1:1 ratio   
n of ethanol = 1

Mass = n x FM = 1 x 46 = 46g  
%yield = (actual / theoretical) x 100 = 42/46 = 0.913 x 100 = 91.3%

1. Propanol, C3H7OH, can be dehydrated to produce propene, C3H6, using excess sulfuric acid. Propoxypropane, C3H7OC3H7, and water are also produced.

4C3H7OH 🡪 2C3H6 + C3H7OC3H7 + 3H2O  
  
21kg of propene were produced from a hydrolysis using 270 kg of propanol (C3H7OH), calculate the percentage yield of propene (C3H6).  
  
n of propanol = mass/FM = 270/60 = 4.5 moles

2:1 ratio

n of propene = 2.25 moles

Theoretical yield, mass = n x FM = 2.25 x 42 = 94.5kg

% Yield = actual/Theoretical = 21/94.5 = 22.2%

1. Nitrogen monoxide gas, NO, combines with oxygen to form brown fumes of nitrogen dioxide according to the following equation.  
     
    2NO + O2 🡪 2NO2  
   calculate the volume of oxygen needed to react completely with 60cm3 of nitrogen monoxide? (Take the molar volume of NO and oxygen to be 22.4 l mol-1)  
     
   mols of NO: n = v / MV = 0.06 l / 22.4 lmol-1 = 0.0027 mols  
   NO – O22 mols – 1 mol  
   moles of O2 = 0.00267 / 2 = 0.001 mols  
   volume of O2 = n x MV = 0.001 x 22.4 = 0.03 litres = 30cm3
2. How many moles of zinc will react with 50cm3 of 2 mol l-1 hydrochloric acid?

Zn(s) + 2HCl(aq) ⭢ ZnCl2(aq) + H2(g)  
  
 mols of HCl: n = v x c = 0.05 x 2 = 0.1  
 ratio is 1:2

Mols of zinc: n = 0.1/2 = 0.05

1. The concentration of sulphuric acid was determined by titration with a 0.203 moldm-3 of sodium hydroxide solution. It required 26.8 cm3 of sodium hydroxide to neutralise 25.0 cm3 of the sulphuric acid solution. Calculate the concentration of the sulphuric acid.  
     
   2NaOH + H2SO4 🡪 Na2SO4 + 2H2O  
   n of moles of NaOH = v x c = 0.268 x 0.203 = 0.054 moles  
   2:1 ratio  
   n of moles of H2SO4 = 0.0272 moles  
   c = n/v = 0.0272/0.25 = 0.109 moldm-3
2. For the combustion of sucrose:

C12H22O11 + 12O2 ---> 12CO2 + 11H2O

there are 10.0 g of sucrose and 10.0 g of oxygen reacting. Which is the limiting reagent?  
  
n of moles of sucrose = mass/FM = 10/342.3 = 0.0292 moles  
1:12 ratio  
n of moles of oxygen = 0.0292 x 12 = 0.35057 moles  
mass of oxygen required = n x FM = 0.35057 x 32 = 11.21g  
Since the oxygen required is greater than that on hand, it will run out before the sucrose. Oxygen is the limiting reagent.