Exercise 1.414 – Limiting reagent in gas reactions

Q1414-01 What volume of oxygen is needed to completely react with 200cm^3 of hydrogen according to the reaction:
$$2H_2 + O_2 \longrightarrow 2H_2O$$

Q1414-02 What volume of nitrogen monoxide (nitrogen II oxide) would be produced from reaction between 100cm^3 of ammonia and 100 cm^3 of oxygen gas in the catalytic oxidation of ammonia:
$$4NH_3 + 5O_2 \longrightarrow 4NO + 6H_2O$$

Q1414-03 The industrial reaction between carbon monoxide and hydrogen to make methanol takes place over a copper, zinc oxide and aluminium oxide catalyst under pressure at 250ºC:
$$CO + 2H_2 \longrightarrow HCH_2OH$$
If 20 dm^3 of carbon monoxide and 20 dm^3 of hydrogen are reacted, calculate the volume of methanol gas produced at this temperature.

Q1414-04 What will be the final volume of gas when 300cm^3 ethene reacts with 300cm^3 oxygen at 400ºC?
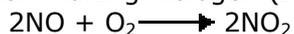
Q1414-05 What will be the final volume of the gas mixture when 100cm^3 propane reacts with 600cm^3 oxygen at 400ºC?

Q1414-06 In the industrial production of ethanol the gases ethene and steam are passed at 250ºC over a phosphoric acid catalyst supported on a porous substance such as charcoal, according to the equation:
$$C_2H_4 + H_2O \longrightarrow CH_3CH_2OH$$
If 40dm^3 of ethene are mixed with 100 dm^3 of steam what volume of ethanol (gas at this temperature) will be formed?

Q1414-07 One stage in the Ostwald process for the production of nitric acid is the reaction between nitrogen (II) oxide and oxygen making nitrogen (IV) oxide:
$$2NO + O_2 \longrightarrow 2NO_2$$
Calculate the volume of nitrogen (IV) oxide that would be produced when 1000 dm^3 of nitrogen (II) oxide reacts with 2500 dm^3 of oxygen.
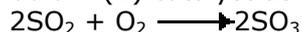
Q1414-08 In the combusion of methanal 100cm^3 of methanal reacted with 200cm^3 of oxygen. Calculate the composition of the gas mixture produced, if all measurements were taken at STP.

Q1414-09 At 200ºC carbon disulphide vapour reacts with oxygen according to the equation:
$$CS_2 + 3O_2 \longrightarrow CO_2 + 2SO_2$$
Calculate the final composition of the gas mixture produced when 1.2dm^3 of carbon disulphide vapour reacts with 1.2dm^3 of oxygen gas

Q1414-10 In the manufacture of sulphuric acid, sulphur dioxide (sulphur (IV) oxide) and oxygen are passed under pressure over a vanadium (V) catalyst at 450ºC, according to the equation:
$$2SO_2 + O_2 \longrightarrow 2SO_3$$
Calculate the volume of sulphur (VI) oxide gas produced at this temperature and pressure, if 100 dm^3 of sulphur (IV) oxide is mixed with 100 dm^3 of oxygen in the reaction.