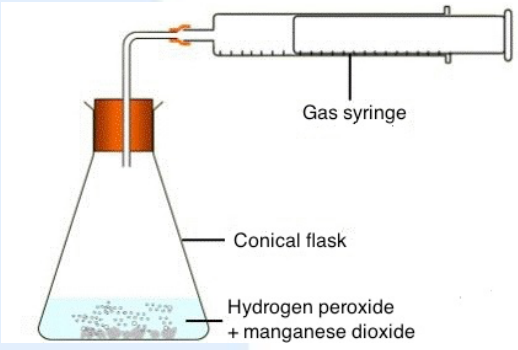
SL HL Paper 3 Section A Experimental work (5)

Hydrogen peroxide decomposes according to the equation:

$2H_2O_2(aq) \rightarrow O_2(g) + 2H_2O(l)$

The catalytic effect of adding solid manganese dioxide powder to an aqueous solution of hydrogen peroxide was studied using the set-up shown below.



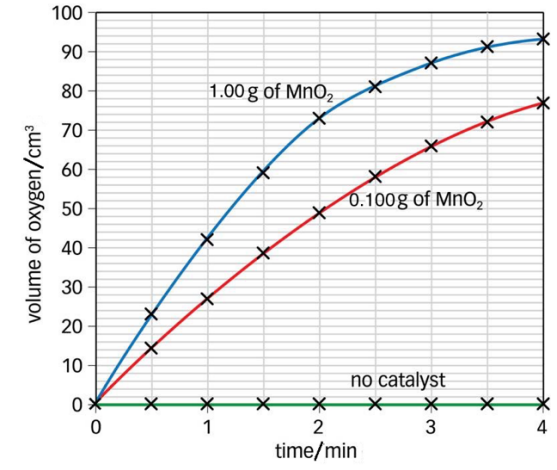
In three separate experiments the volume of oxygen evolved was measured over time when no manganese dioxide was added, when 0.100 g of manganese dioxide was added and when 1.00 g of manganese dioxide was added to the same volume of hydrogen peroxide solution. The temperature was kept constant throughout.

(a) In order to add the manganese dioxide the bung had to be taken out of the conical flask and replaced quickly. This altered the pressure in the apparatus and affected the initial reading on the syringe. Suggest a simple modification to the apparatus which would allow the manganese dioxide to be added to the hydrogen peroxide solution without the bung having to be removed. ***[1]***

(b) Manganese dioxide is a black powder and hydrogen peroxide solution is a colourless liquid. Describe what will be observed inside the flask, before, during and after the reaction involving manganese dioxide has taken place. ***[2]***

(cont.)

(c) The quantitative results obtained are shown graphically below.



(c) Determine the rate of reaction after one minute when 1.00 g of manganese dioxide had been used as a catalyst. ***[1]***

(d) Suggest why the rate of the reaction does not increase by a factor of ten when the mass of catalyst added is increased tenfold from 0.100 g to 1.00 g. ***[1]***

(e) Assuming that the total volume of oxygen evolved by the time the reaction has gone to completion is 100 cm^3 (measured at STP), calculate the amount (in mol) of hydrogen peroxide present initially. ***[1]***