1. Hydrogen peroxide, H_2O_2, decomposes into water and oxygen in the presence of a catalyst, manganese (IV) oxide.

Write the equation with state symbols.

……[2]

(a) What is meant by the term catalyst?

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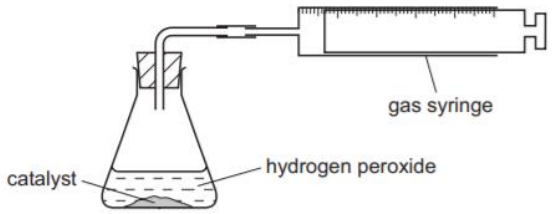
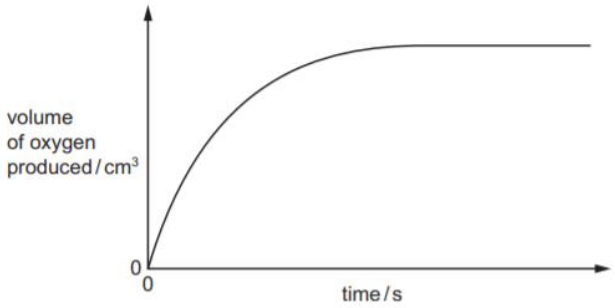
……[2]

(b) A student studies the rate of decomposition of hydrogen peroxide using the apparatus shown. The student uses 20cm3 of 0.1mol/dm3 hydrogen peroxide and 1.0g of manganese (IV) oxide.

The student measures the volume of oxygen given off at a regular time intervals until the reaction stops. A graph of the results is shown.





(i) When is the rate of reaction highest?

……[1]

(ii) Suggest one method of increasing the rate of reaction using the same amounts of hydrogen peroxide and manganese (IV) oxide.

……[1]

(c) What would be the effect on the volume of oxygen produced if the mass of the catalyst was increased?

……[1]

(d) The student carries out a second experiment to investigate whether another substance, copper (II) oxide, is a better catalyst than manganese (IV) oxide.

Describe how the second experiment is carried out. You should state clearly how you would make sure that the catalyst is the only variable.

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……[3]

[TOTAL: 10 MARKS]

Extended Task:

List down the reactions that occur in a catalytic converter and explain why these converters is a legal requirement in many countries.

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