IB · SL · Chemistry

45 mins 2 questions

Practice Paper 1B

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Total Marks **/25**

1 (a) A student investigated the effect of temperature on the rate of hydrogen peroxide (H_2O_2) decomposition using manganese(IV) oxide (MnO_2) as a catalyst. The volume of oxygen gas produced in the first 20 seconds was measured at five different temperatures.

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

Temperature / ^oC	Volume of O_2 produced / cm^3
20	6.2
30	10.7
40	15.6
50	22.3
60	23.1
70	23.3
80	23.2

(i) Describe the trend shown in the data.

[1]

(ii) Use particle theory to explain the effect of increasing temperature on the rate of reaction.

[2]

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(3 marks)

(b) (i) Calculate the average rate of reaction at 50 ^{o}C in $cm^3\ s^{-1}$.

[1]

(ii) Calculate the percentage increase in rate when the temperature is raised from 40 ^{o}C to 50 ^{o}C.

[2]

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(3 marks)

(c) Explain why there is only a small increase in rate between 50 ^{o}C and 60 ^{o}C.

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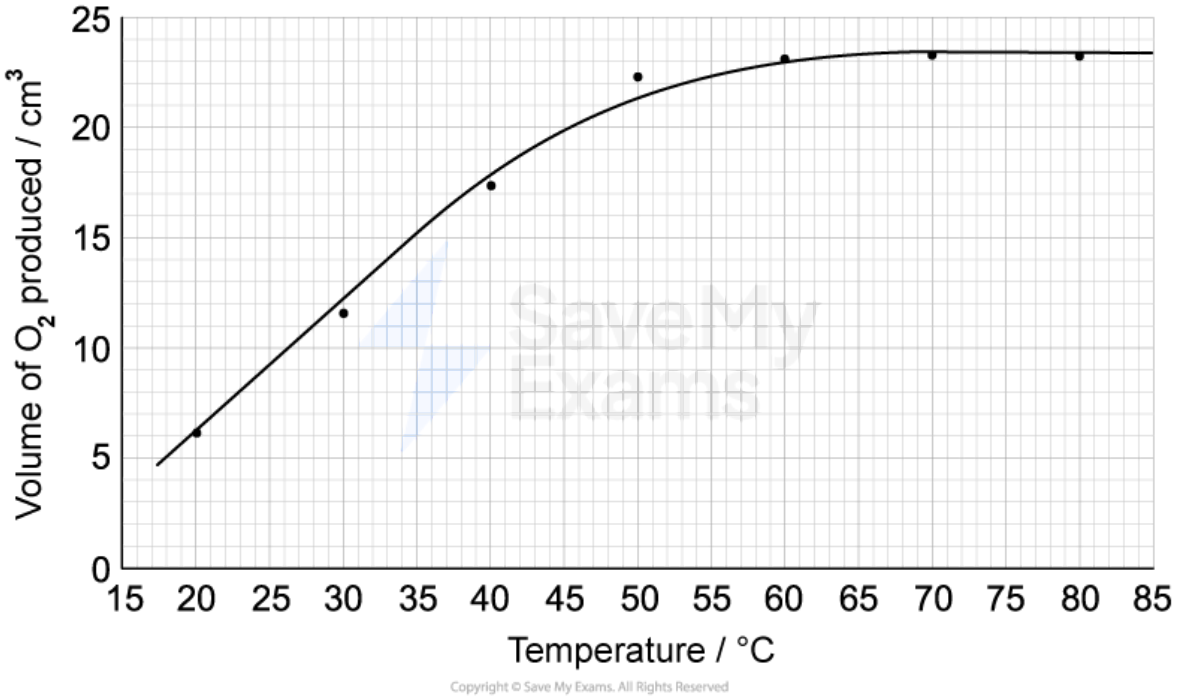
(2 marks)

(d) The student repeats the experiment without MnO_2.

(i) Sketch a second curve on the grid below to show how the reaction rate would differ without a catalyst. Label the curve.



[1]

(ii) Explain why the catalyst affects the rate.

[2]

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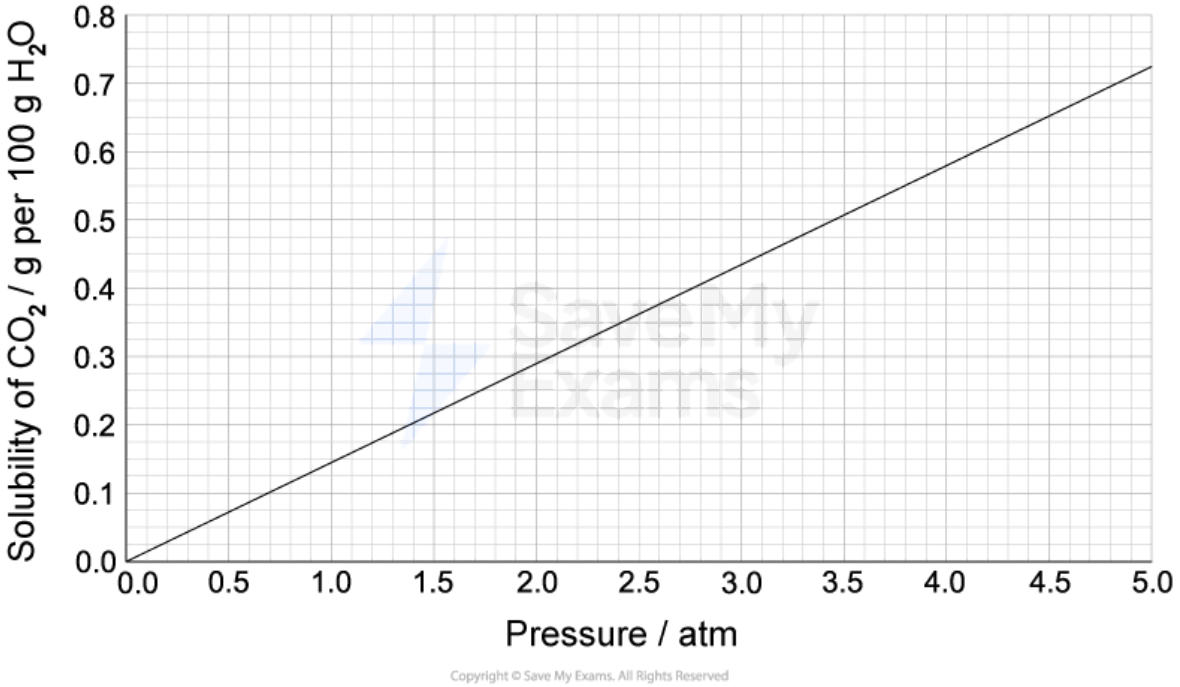
..... **(3 marks)**

(e) Suggest one procedural improvement the student could make to increase accuracy in measuring the volume of gas produced.

..... **(1 mark)**

2 (a) The graph below shows how the solubility of carbon dioxide (CO_2) in water changes with pressure at a constant temperature of 25 ^{o}C.



(i) Describe the trend shown by the graph.

[1]

(ii) State the type of relationship shown between pressure and solubility.

[1]

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(2 marks)

(b) Explain the trend using ideas about particle behaviour.

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(2 marks)

(c) (i) Use the graph to determine the solubility of CO_2 at 2.5 atm.

[1]

(ii) Use the graph to determine the pressure needed for a solubility of 0.580 g per 100 g H_2O.

[1]

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..... **(2 marks)**

(d) Explain why the graph passes through the origin.

..... **(1 mark)**

(e) (i) Explain why increasing the temperature would reduce the solubility of CO_2 in water.

[2]

(ii) Predict how the graph would look if temperature increased.

[1]

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..... **(3 marks)**

(f) Suggest one real-world situation that relies on the solubility of gases in liquids.

..... **(1 mark)**

(g) Explain why the dissolution of CO_2 in water is considered an exothermic process.

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..... **(2 marks)**