Chemistry

Standard level

Paper 2

Practice paper

Topic: Chemical Kinetics

Chemistry

Standard level

Paper 2

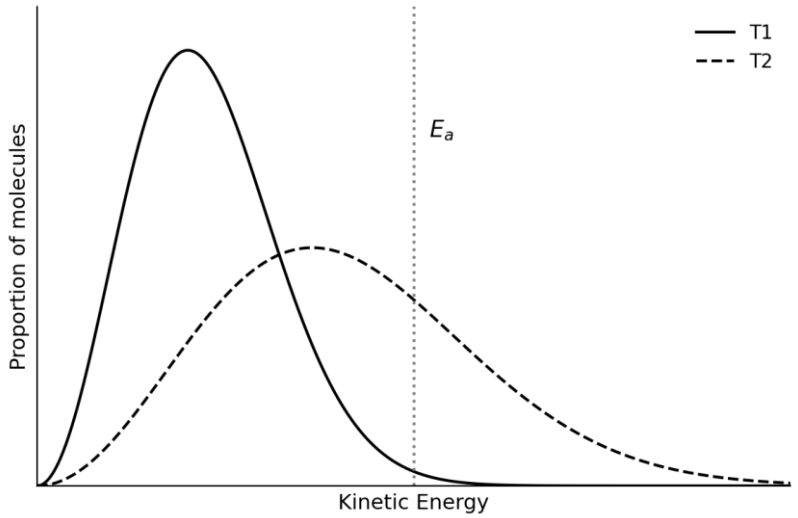
Specimen paper

1 hour 15 minutes

Instructions to candidates

- Answer all questions.
- Answers must be written within the answer boxes provided.
- A calculator is required for this paper.
- The maximum mark for this examination paper is [40 marks].

1. The following diagram shows the Maxwell-Boltzmann distribution of molecular kinetic energies for a gas at two different temperatures, T_1 and T_2. The vertical dashed line represents the activation energy, E_a.



(a) Deduce whether T_1 or T_2 is the higher temperature. Justify your answer using the features of the curves. **[2]**

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(b) Use the graph to explain why the rate of reaction is significantly higher at temperature T_2. **[2]**

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(c) The reaction is repeated at T_1 but with a solid catalyst. State the effect of the catalyst on the position of the E_a line and explain how this increases the rate of reaction. **[2]**

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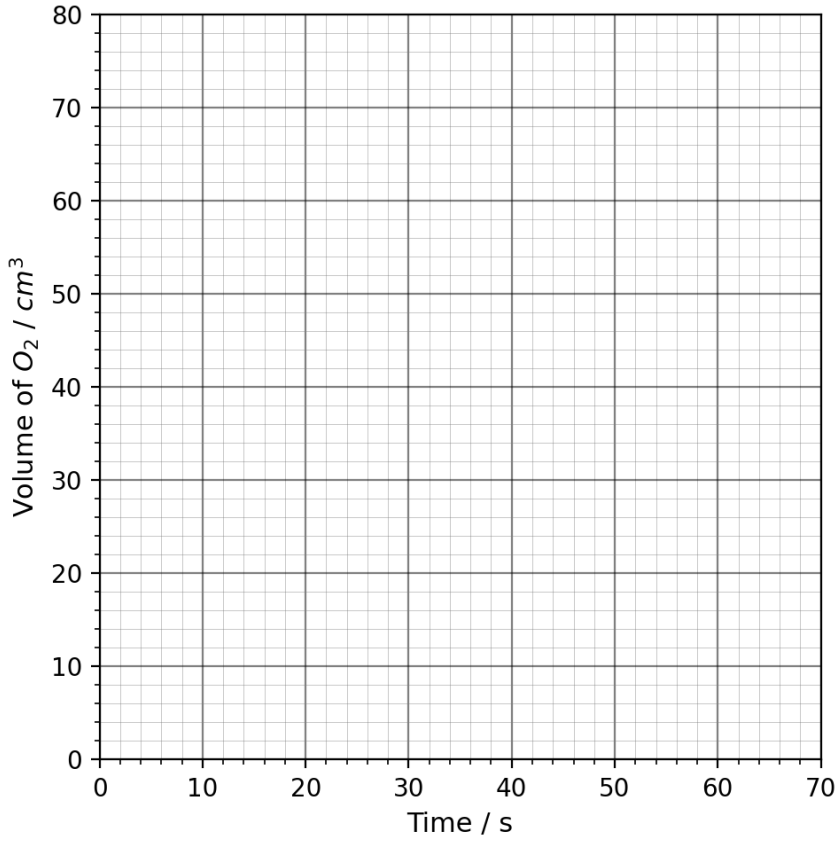
2. A student investigates the decomposition of hydrogen peroxide, $H_2O_2(aq)$, using a manganese(IV) oxide catalyst. The volume of oxygen gas produced was recorded at 10-second intervals.

Time / s	0	10	20	30	40	50	60
Volume of O_2 / cm^3	0	25	42	54	62	67	70

(a) Plot a graph of Volume of O_2 against Time on the grid provided below. **[3]**



(b) Determine the instantaneous rate of the reaction at t = 20 s. **[3]**

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3. Even when particles collide with energy greater than the activation energy, a reaction may not necessarily occur.

(a) Identify the other requirement that must be met during the collision for it to be successful. **[1]**

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4. A student uses a colorimeter to measure the rate of a reaction where a purple reactant species turns colorless over time.

(a) Outline how the absorbance data produced by the colorimeter can be used to generate a concentration-time graph. **[2]**

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5. Consider the reaction: $2H_2O_2(aq) \rightarrow 2H_2O(l) + O_2(g)$.

(a) Suggest two different physical methods that could be used to continuously monitor the rate of this specific reaction. **[2]**

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