Practice Question Set For A-Level
Subject : Chemistry
Paper-2 Topic: Kinetics

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Name of the Student:_____
Max. Marks : 20 Marks **Time : 20 Minutes**

Q1.

A student investigated how the initial rate of reaction between sulfuric acid and magnesium at 20 °C is affected by the concentration of the acid.

The equation for the reaction is

$$H_2SO_4(aq) + Mg(s) \longrightarrow MgSO_4(aq) + H_2(g)$$

(a) The student made measurements every 20 seconds for 5 minutes. The student then repeated the experiment using double the concentration of sulfuric acid.

State a measurement that the student should make every 20 seconds. Identify the apparatus that the student could use to make this measurement.

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(2)

(b) State **one** condition, other than temperature and pressure, that would need to be kept constant in this investigation.

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(1)

(c) When the student had finished the investigation, an excess of sodium hydroxide solution was added to the reaction mixture. This was to neutralise any unreacted sulfuric acid. The student found that a further reaction took place, producing magnesium hydroxide.

(i) Draw a diagram to show how the student could separate the magnesium hydroxide from the reaction mixture.

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(2)

(ii) Suggest **one** method the student could use for removing soluble impurities from the sample of magnesium hydroxide that has been separated.

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(1)

(Total 6 marks)

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Q2.

When iodine molecules are dissolved in aqueous solutions containing iodide ions, they react to form triiodide ions (I_3^-).

$$I_2 + I^- \longrightarrow I_3^-$$

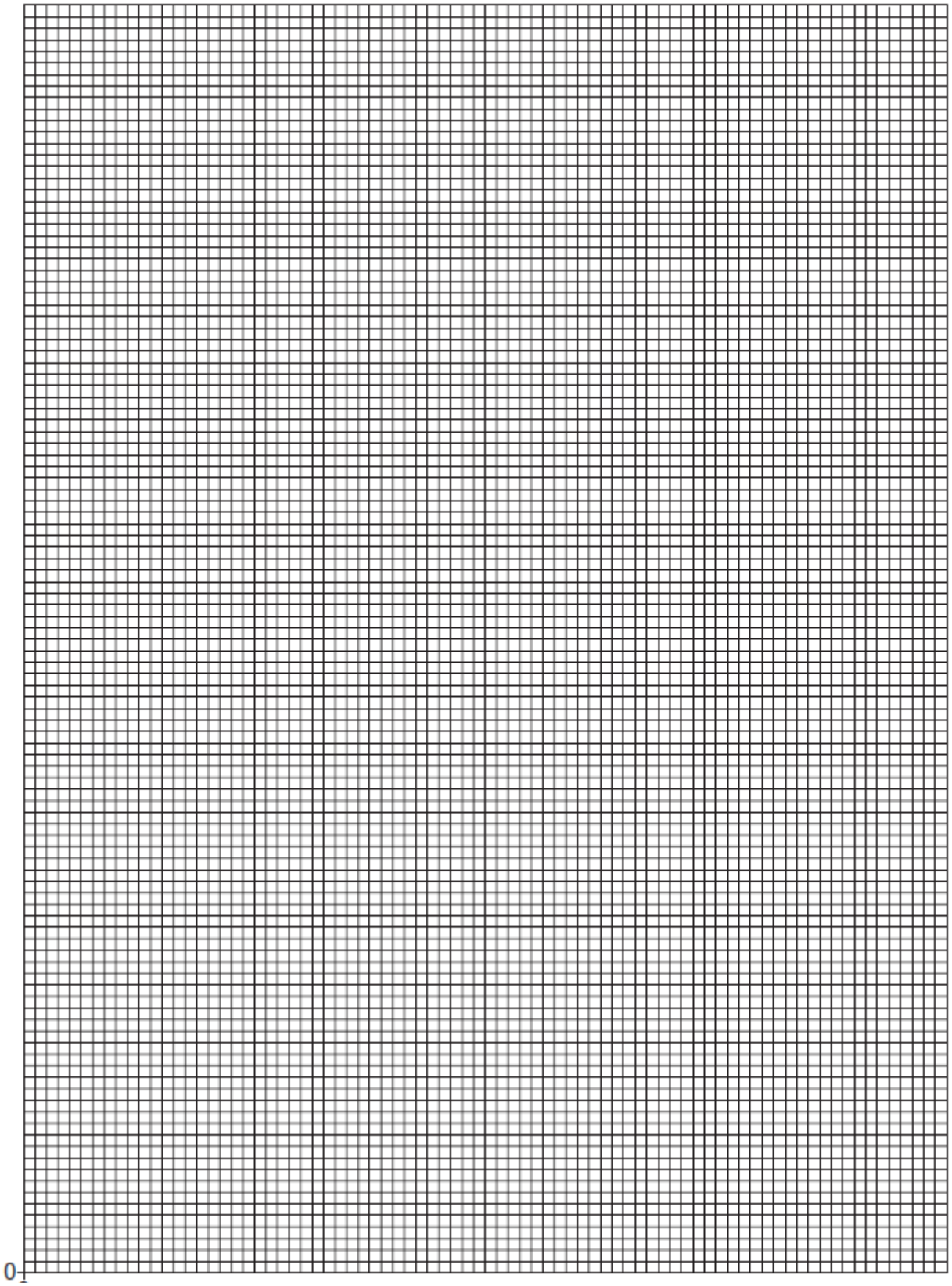
The rate of the oxidation of iodide ions to iodine by peroxodisulfate(VI) ions ($S_2O_8^{2-}$) was studied by measuring the concentration of the I_3^- ions at different times, starting at time = 0, when the reactants were mixed together. The concentration of the I_3^- ions was determined by measuring the absorption of light using a spectrometer.

The table below shows the results.

Time / s	**Concentration of I_3^- / mol dm^{-3}**
10	0.23
20	0.34
30	0.39
40	0.42
50	0.47
60	0.44
70	0.45

(a) Plot the values of the concentration of I_3^- (y-axis) against time on the grid below.

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(2)

(b) A graph of these results should include an additional point. On the grid, draw a ring around this additional point.

(1)

(c) Draw a best-fit curve on the grid, **including the extra point from part (b)**.

(2)

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(d) Draw a tangent to your curve at time = 30 seconds. Calculate the slope (gradient) of this tangent and hence the rate of reaction at 30 seconds. Include units with your final answer. Show your working.

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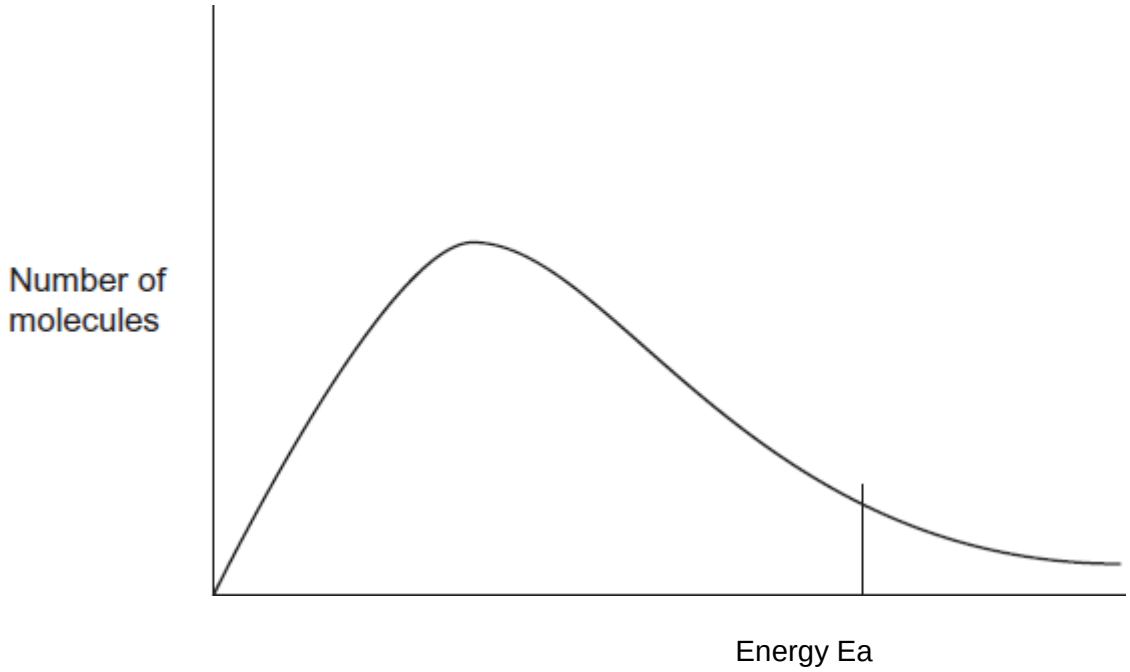
(4)

(Total 9 marks)

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Q3.

The diagram shows the Maxwell–Boltzmann distribution for a sample of gas at a fixed temperature. E_a is the activation energy for the decomposition of this gas.



E_{mp} is the most probable value for the energy of the molecules.

(a) On the appropriate axis of this diagram, mark the value of E_{mp} for **this** distribution.

On this diagram, sketch a new distribution for the same sample of gas at a **lower** temperature.

(3)

(b) With reference to the Maxwell–Boltzmann distribution, explain why a decrease in temperature decreases the rate of decomposition of this gas.

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(2)

(Total 5 marks)

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