

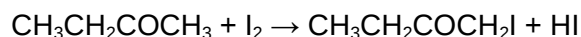
Name of the Student: _____

Max. Marks : 21 Marks

Time : 21 Minutes

Q1.

An acidified solution of butanone reacts with iodine as shown.



- (a) Draw the displayed formula for
- $\text{CH}_3\text{CH}_2\text{COCH}_2\text{I}$

Give the name of $\text{CH}_3\text{CH}_2\text{COCH}_2\text{I}$

Displayed formula

Name _____

(2)

- (b) The rate equation for the reaction is

$$\text{rate} = k[\text{CH}_3\text{CH}_2\text{COCH}_3][\text{H}^+]$$

Table 1 shows the initial concentrations used in an experiment.

	Table 1		
	$\text{CH}_3\text{CH}_2\text{COCH}_3$	I_2	H^+
Initial concentration / mol dm^{-3}	4.35	0.00500	0.825

The initial rate of reaction in this experiment is $1.45 \times 10^{-4} \text{ mol dm}^{-3} \text{ s}^{-1}$ Calculate the value of the rate constant, k , for the reaction and give its units.

k _____

Units _____

(3)

- (c) Calculate the initial rate of reaction when all of the initial concentrations are halved.

Initial rate of reaction _____ $\text{mol dm}^{-3} \text{s}^{-1}$

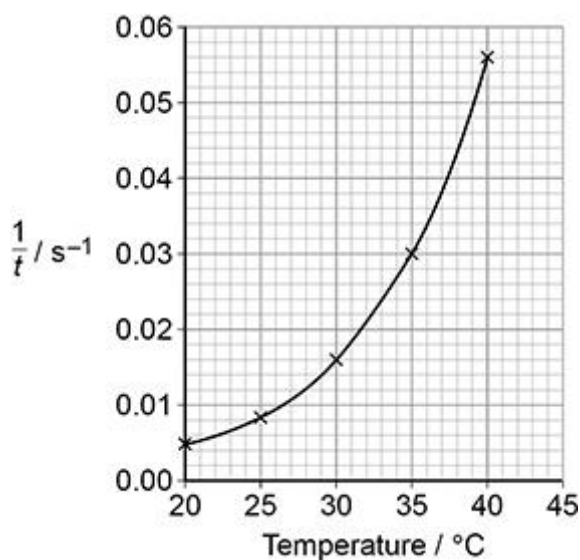
(1)

- (d) An experiment was done to measure the time, t , taken for a solution of iodine to react completely when added to an excess of an acidified solution of butanone.

Suggest an observation used to judge when all the iodine had reacted.

The experiment was repeated at different temperatures.

The graph below shows how $\frac{1}{t}$ varied with temperature for these experiments.



(1)

- (e) Describe and explain the shape of the graph above.

(3)

- (f) Deduce the time taken for the reaction at 35 °C

Time _____ s

(1)

- (g) For a different reaction, **Table 2** shows the value of the rate constant at different temperatures.

Table 2

Experiment	Temperature / K	Rate constant / s ⁻¹
1	$T_1 = 303$	$k_1 = 1.55 \times 10^{-5}$
2	$T_2 = 333$	$k_2 = 1.70 \times 10^{-4}$

This equation can be used to calculate the activation energy, E_a

$$\ln \left(\frac{k_1}{k_2} \right) = \frac{E_a}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$

Calculate the value, in kJ mol⁻¹, of the activation energy, E_a

The gas constant, $R = 8.31 \text{ J K}^{-1} \text{ mol}^{-1}$

E_a _____ kJ mol^{-1}

(5)

- (h) Name and outline the mechanism for the reaction of butanone with KCN followed by dilute acid.

Name of mechanism _____

Outline of mechanism

(5)

(Total 21 marks)