Kinetics – A2 2022 Chemistry P2&P3

1. June/2022/Paper_7405/2/No.1

0 1 An acidified solution of butanone reacts with iodine as shown.

$$CH_3CH_2COCH_3 + I_2 \rightarrow CH_3CH_2COCH_2I + HI$$

0 1 . 1 Draw the displayed formula for $CH_3CH_2COCH_2I$

Give the name of $CH_3CH_2COCH_2I$

[2 marks]

Displayed formula

Name _____

0 1 . 2 The rate equation for the reaction is

$$rate = k[CH_3CH_2COCH_3][H^+]$$

Table 1 shows the initial concentrations used in an experiment.

Table 1

	$CH_3CH_2COCH_3$	I_2	H^+
Initial concentration / mol dm^{-3}	4.35	0.00500	0.825

The initial rate of reaction in this experiment is 1.45×10^{-4} mol dm^{-3} s^{-1}

Calculate the value of the rate constant, k, for the reaction and give its units.

[3 marks]

k _____

Units _____

0 1 . 3 Calculate the initial rate of reaction when all of the initial concentrations are halved.

[1 mark]

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

0 1 . 4 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.

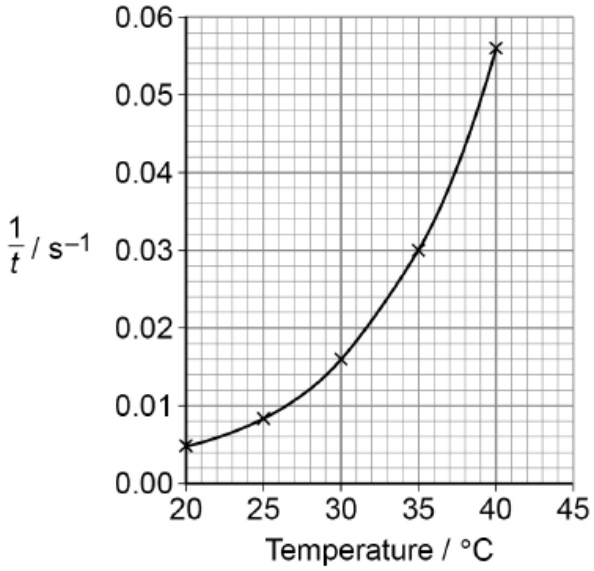
Suggest an observation used to judge when all the iodine had reacted.

[1 mark]

The experiment was repeated at different temperatures.

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

Figure 1



0 1 . 5 Describe and explain the shape of the graph in **Figure 1**.

[3 marks]

0 1 . 6 Deduce the time taken for the reaction at 35 °C

[1 mark]

Time _____ s

0 1 . 7 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, $R = 8.31$ J K^{-1} mol^{-1}

[5 marks

E_a _____ kJ mol^{-1}

0 1 . 8 Name and outline the mechanism for the reaction of butanone with KCN followed by dilute acid.

[5 marks]

Name of mechanism _____

Outline of mechanism

2. June/2022/Paper_7405/3/No.10

Which of these oxidation states is correct?

[1 mark]

A Chlorine in Cl_2 is –1 ⬭

B Chromium in $K_2Cr_2O_7$ is +7 ⬭

C Fluorine in F_2O is –1 ⬭

D Hydrogen in NaH is +1 ⬭