

Propanone reacts with iodine in the presence of an acid catalyst.

 $H_3C \longrightarrow CH_3 + I_2 \longrightarrow H_3C \longrightarrow CH_2 + HI$ 

A series of experiments were carried out to determine the rate equation.

$[CH_3COCH_3] \text{ (mol dm}^{-3}\text{)}$	[l <sub>2</sub> ] (mol dm <sup>-3</sup> )	$[H^+]$ (mol dm <sup>-3</sup> )	rate (mol $dm^{-3} s^{-1}$ )
2.00	0.00126	0.248	5.60 x 10 <sup>-6</sup>
4.00	0.00126	0.248	1.12 x 10 <sup>−5</sup>
2.00	0.00252	0.248	5.60 x 10 <sup>-6</sup>
2.00	0.00504	0.496	1.12 x 10 <sup>−5</sup>

**a** What is the order of reaction with respect to?  $[CH_3COCH_3]$  .....  $[I_2]$  .....  $[H^{\dagger}]$  .....

## b What is the rate equation?

- c Calculate the rate constant, including units.
- **d** Two proposed mechanisms for this reaction are shown. Which of these mechanisms, if any, is feasible for this rate equation.
  - Mechanism 1
  - Mechanism 2

Mechanism 1	Mechanism 2	
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	$\begin{array}{c} O \\ H_{3}C \\ H_{3}C \\ \hline \\ C \\ \hline \\ C \\ \hline \\ C \\ \hline \\ C \\ H_{3} \\ H_{3}C \\ \hline \\ C \\ \hline \\ \hline \\ C \\ \hline \\ \hline \\ C \\ \hline \\ C \\ \hline \\ \hline$	
$\begin{array}{c} \overset{\oplus}{_{OH}} \\ H_{3C} \overset{\longrightarrow}{\longrightarrow} & H_{3C} \overset{OH}{\longrightarrow} \\ H_{3C} \overset{\leftarrow}{\longrightarrow} & CH_{2} + H^{+} \end{array}$	$H_3C \xrightarrow{OH} CH_3 \xrightarrow{slow} H_2C \xrightarrow{OH} CH_3 + H^+$	
$\begin{array}{c cccc} OH & & O \\ & & & \\ H_{3}C & \hline C & = CH_{2} + I_{2} \end{array} \xrightarrow{fast} H_{3}C & \hline C & CH_{2} + HI \end{array}$	$\begin{array}{cccc} OH & & OH \\   &   \\ H_2C = C - CH_3 + I_2 & \xrightarrow{fast} & H_3C - C - CH_2 + I^- \\   &   \\ \end{array}$	
	$\begin{array}{c} \stackrel{O}{\overset{O}{\overset{H}}} \\ H_{3}C \underbrace{-}_{C}C \underbrace{-}_{C}CH_{2} \\ \\ H_{3}C \underbrace{-}_{C}CH_{2} \\ \\ \\ H_{3}C \underbrace{-}_{C}CH_{2} \\ \\ \\ H_{3}C \underbrace{-}_{C}CH_{2} \\ \\ \\ \\ H_{3}C \underbrace{-}_{C}CH_{2} \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\ \\$	