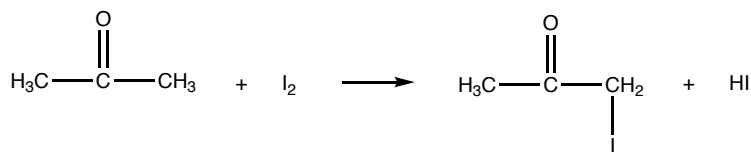




Propanone reacts with iodine in the presence of an acid catalyst.



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

| $[\text{CH}_3\text{COCH}_3]$ (mol dm <sup>-3</sup> ) | $[\text{I}_2]$ (mol dm <sup>-3</sup> ) | $[\text{H}^+]$ (mol dm <sup>-3</sup> ) | rate (mol dm <sup>-3</sup> s <sup>-1</sup> ) |
|--|--|--|--|
| 2.00   | 0.00126                                | 0.248                                  | $5.60 \times 10^{-6}$                        |
| 4.00   | 0.00126                                | 0.248                                  | $1.12 \times 10^{-5}$                        |
| 2.00   | 0.00252                                | 0.248                                  | $5.60 \times 10^{-6}$                        |
| 2.00   | 0.00504                                | 0.496                                  | $1.12 \times 10^{-5}$                        |

- a What is the order of reaction with respect to?     $[\text{CH}_3\text{COCH}_3]$  **1**     $[\text{I}_2]$  **0**     $[\text{H}^+]$  **1**
- b What is the rate equation?    **rate = k  $[\text{CH}_3\text{COCH}_3]$   $[\text{H}^+]$**
- c Calculate the rate constant, including units.

$$k = \frac{\text{rate}}{[\text{CH}_3\text{COCH}_3][\text{H}^+]} = \frac{5.60 \times 10^{-6}}{2.00 \times 0.248} = 1.13 \times 10^{-5} \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$$

- d Two proposed mechanisms for this reaction are shown. Which of these mechanisms, if any, is feasible for this rate equation.

*Mechanism 1*    **yes – this is feasible**

*Mechanism 2*    **yes – this is feasible**

