

Solutions

Original marking guidance: M1 method, A1 accuracy, B1 explanation.

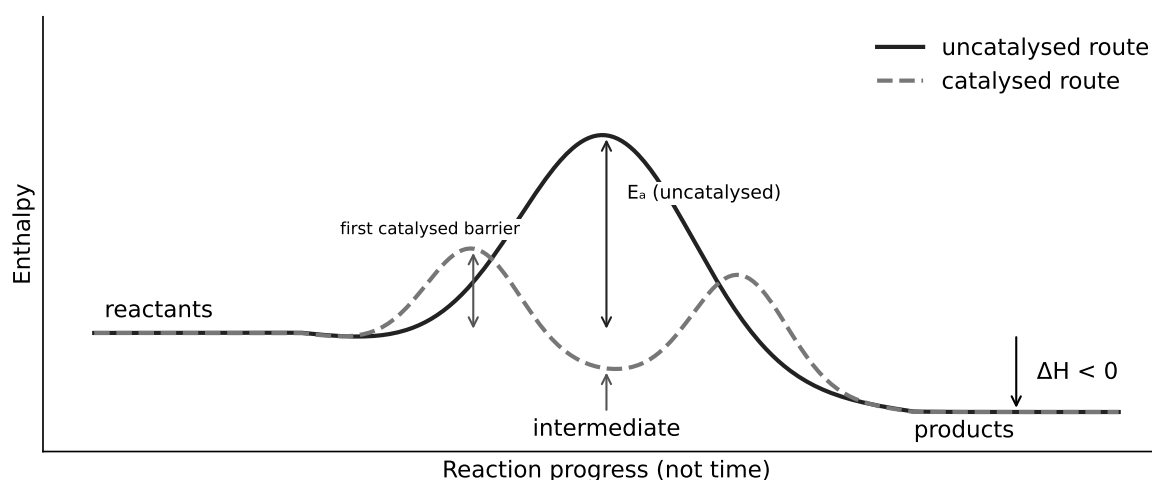
2.1 $1/40 = 0.0250 \text{ s}^{-1}$; $1/25 = 0.0400 \text{ s}^{-1}$; ratio $0.0400/0.0250 = 1.60$.

2.2 Powder has greater exposed surface area, so acid particles collide with accessible carbonate more frequently. It does not automatically increase the final CO_2 amount.

2.3 Peak becomes lower and shifts to higher energy. Area beyond the activation threshold increases; total area remains constant.

3.1 $\text{rate} = \Delta V/\Delta t = (42 - 18)/(80 - 20) = 0.40 \text{ cm}^3 \text{ s}^{-1}$. Final volume/time is an average over the whole interval, not the local tangent rate.

3.2



Two catalysed maxima with an intermediate minimum; lower activation barriers and unchanged initial/final levels/ ΔH . Adequate rate at lower temperature saves energy. A selective catalyst may reduce unwanted products and improve atom economy; this depends on the reaction pathways.