

Figure 3.1 Catalytic cycle for the cobalt-catalysed hydroformylation of a terminal alkene, $\text{H}_2\text{C}=\text{CHR}$.

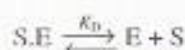
Q3.7 The statements in the key concern a single-substrate enzyme, molar mass $50\,000\text{ g mol}^{-1}$, which follows Michaelis-Menten kinetics and reacts according to the mechanism shown in Scheme 1:



Examine the statements in the key and select up to three statements that are **incorrect**.

KEY for Q3.7

- A If a solution containing 2.5 g dm^{-3} of the enzyme has a limiting rate of $6.0 \times 10^{-7}\text{ mol dm}^{-3}\text{ s}^{-1}$, then $k_2 = 1.2 \times 10^{-2}\text{ s}^{-1}$.
- B If a plot of $[\text{S}]_0/J_0$ against $[\text{S}]_0$ is a straight line with slope equal to $3.0 \times 10^2\text{ mol}^{-1}\text{ dm}^3\text{ s}$ and intercept (when $[\text{S}]_0 = 0$) equal to 0.6 s , then K_m for this enzyme is equal to $2.0 \times 10^{-3}\text{ mol dm}^{-3}$.
- C If $k_{-1} \gg k_2$, then $K_m = 1/K_D$, where K_D is the dissociation constant of the enzyme-substrate complex:



- D A plot of $\ln J_0$ versus $\ln [\text{E}]_0$ (keeping the concentration of substrate, $[\text{S}]_0$, fixed) is a straight line of gradient 1.
- E The enzyme is saturated with the substrate only towards the end of the reaction, when the kinetic reaction profile (that is, the graph of concentration versus time) levels off.

F Considering initial rates, when $K_m \gg [\text{S}]_0$, the concentration of the free enzyme is similar to that of the enzyme that was added to the initial reaction mixture.

G Considering initial rates, when $K_m \gg [\text{S}]_0$, the reaction is zeroth order with respect to the substrate.

H An alternative mechanism for the reaction (Scheme 2) also follows Michaelis-Menten kinetics if the first step involves a rapidly established pre-equilibrium.

