Solutions

Each answer shows the steps, then the **result**.

2.1

- heat breaks the bonds (hydrogen/ionic) holding the enzyme's shape; the active site changes shape / denatures; so the substrate no longer fits and fewer enzyme–substrate complexes form

2.2

- Any two: re-used many times / product is pure (no enzyme) / more stable to temperature and pH / allows continuous flow

3.1 A

- A competitive inhibitor raises K_{m} but leaves $V_{\max}$ unchanged (more substrate overcomes it)

3.2 A

- A lower K_{m} means half $V_{\max}$ is reached at lower substrate concentration — higher affinity

3.3

(a)

- any two: substrate (hydrogen peroxide) concentration / volume / enzyme concentration / pH / time

(b)

- rate rises from 10 °C towards the optimum as molecules gain kinetic energy and collide more often; above the optimum the enzyme denatures, so the rate falls

(c)

- a buffer keeps pH constant so that pH is not an uncontrolled variable affecting the rate

3.4

- at high substrate concentration every active site is occupied / saturated, so adding more substrate cannot increase the rate further — it is at $V_{\max}$