

Solutions

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

2.1

- By providing an alternative pathway with a lower activation energy

2.2

- No

2.3

- Homogeneous — same phase as the reactants; heterogeneous — a different phase (e.g. solid catalyst, gas reactants)

3.1 B

- a lower-activation-energy pathway

3.2

(a)

- The activation energy (peak) is lowered; ΔH (reactant and product energies) is unchanged

(b)

- It is used in an early step and regenerated in a later step, so it is not consumed overall

3.3

- The catalyst lowers the **same** barrier for both directions, so both the forward and reverse rates rise by the same factor; equilibrium (which depends on their ratio) is reached sooner but not shifted