## Solutions

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

**2.1**

- a catalyst **speeds up a reaction** but is **not used up**

**2.2**

- all enzymes are **proteins**

**2.3**

- a **temperature** above the optimum
- a **pH** far from the optimum

**2.4**

- the active site has a shape **complementary** to one substrate
- a different substrate **does not fit**, so no reaction is catalysed

**2.5**

- the rate **increases at first**
- then **levels off** because all active sites are occupied

**3.1 B**

- the **active site changes shape** — the enzyme is **denatured**
- A is false (catalysts are not used up); C is for organisms; D is wrong

**3.2**

(a)

- the active site is complementary to **one** substrate
- only that substrate fits, so the enzyme is **specific**

(b)

- the wrong pH **changes the shape** of the active site
- the substrate no longer fits — the enzyme is **denatured**

**3.3**

- molecules gain **kinetic energy** and move faster
- enzyme and substrate **collide more often**

**3.4**

(a)

- 10 °C: **medium/low**
- 40 °C: **high**



- 70 °C: **very low**

(b)

- little kinetic energy at 10 °C
- fewer **successful collisions**

(c)

- bonds holding the shape are **broken**
- the active site **changes shape**, so the substrate no longer fits
- the enzyme is **permanently denatured**

(d)

- any **two** of: peroxide concentration/volume / catalase amount / pH / time counted

(e)

- pH 3 is far from catalase's optimum (~pH 7)
- the active site is **altered**, so the rate **falls**

(f)

- an enzyme is a **catalyst** and is **not used up**
- the same molecule catalyses the reaction **again and again**