Solutions

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

2.1

- any **two** of: higher concentration / larger surface area / higher temperature / higher pressure (gases) / a catalyst

2.2

- a catalyst **lowers the activation energy**, so more collisions are successful

2.3

- the rate **increases**

2.4

- the mass is unchanged: the catalyst is not used up

3.1 B

- hotter particles **move faster** and collide **more often with enough energy**
- A, C and D are not how temperature works

3.2

(a)

- a powder has a **larger surface area**
- more frequent collisions with the acid, so a **faster rate**

(b)

- collect the gas in a **gas syringe** and record volume against time
- or stand the flask on a **balance** and record the falling mass

3.3

- as reactants are used up there are **fewer collisions per second**, so the line is less steep
- when a reactant runs out the reaction **stops**, so the line is **flat**

3.4

(a)

- mean rate $= \dfrac{\text{volume of gas}}{\text{time}}$

$$\text{rate} = \frac{60\ \text{cm}^3}{30\ \text{s}} = \mathbf{2.0}\ \text{cm}^{\mathbf{3}}/\text{s}$$

(b)

- the particles move faster, so they collide more often
- more of the collisions have energy greater than the activation energy, so more collisions are successful

3.5

- the fine dust has a very large surface area
- so it reacts (burns) extremely quickly with oxygen in the air, releasing a lot of energy and gas at once