Solutions

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

2.1

- enough energy (at least the activation energy); the correct orientation/direction

2.2

- there are more particles in the same volume, so they collide more often – more effective collisions per second

2.3

- a powder has a larger surface area
- so more particles are exposed, giving more frequent collisions

2.4

- $\text{cm}^3\ \text{s}^{-1}$

3.1 B

- Higher pressure brings particles closer, so they collide more often

3.2 B

- $48/20 = 2.4\ \text{cm}^3\,\text{s}^{-1}$

3.3

(a)

- $\dfrac{54-30}{45-15} = \dfrac{24}{30} = 0.80\ \text{cm}^3\,\text{s}^{-1}$

(b)

- at the start the reactant concentration is highest, so collisions are more frequent and the rate is faster; as reactant is used up the rate falls

3.4

(a)

- collect the CO_2 in a gas syringe (or measure the loss in mass on a balance)
- record the volume (or mass) at regular time intervals

(b)

- the final volume of gas **halves**
- the acid is the limiting reagent, and half the moles of HCl give half the moles of CO_2

3.5

- doubling the pressure doubles the number of molecules in the same volume
- so there are more frequent collisions, and more effective (successful) collisions per second