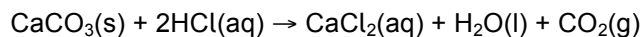
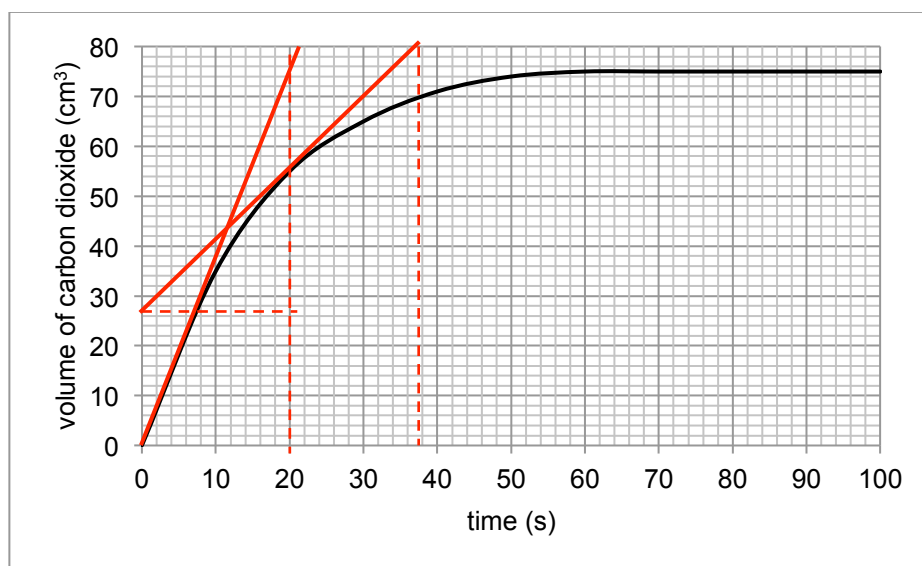




A student carried out an experiment where she recorded the volume of carbon dioxide gas formed as calcium carbonate reacts with hydrochloric acid.



The graph shows how the volume of carbon dioxide varied with time.



- 1 Calculate the mean rate of reaction in the first 20 seconds in cm^3/s

$$\text{rate} = \frac{55}{20} = 2.8 \text{ cm}^3/\text{s}$$

- 2 Draw a tangent to the graph to find the rate at 0 seconds in cm^3/s

$$\text{rate} = \frac{76-0}{20-0} = 3.8 \text{ cm}^3/\text{s}$$

- 3 Draw a tangent to the graph to find the rate at 20 seconds in cm^3/s

$$\text{rate} = \frac{80-27}{37-0} = 1.4 \text{ cm}^3/\text{s}$$

- 4 Explain why the rate is fastest at the beginning and then slows down and stops.

fastest at start: most reactant particles so high frequency of successful collisions

slows down: fewer reactant particles so lower frequency of successful collisions

stops: no reactant particles so no successful collisions