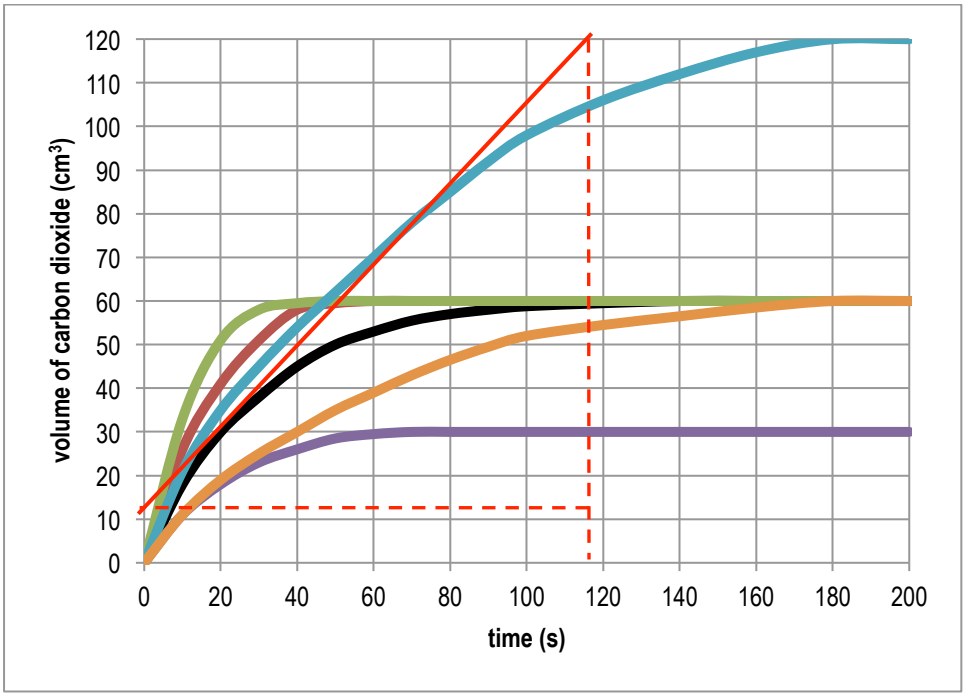
A student carried out a series of experiments to measure the volume of carbon dioxide gas formed when hydrochloric acid reacts with an excess of calcium carbonate.

$$CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$$

This line is when 50 cm^3 of 0.10 mol/dm^3 hydrochloric acid reacts with small calcium carbonate chips at 20°C.



1 Sketch and label lines for similar reactions done under the conditions shown.

A 50 cm^3 of 0.10 mol/dm^3 hydrochloric acid reacts with small calcium carbonate chips at 40°C

B 50 cm^3 of 0.10 mol/dm^3 hydrochloric acid reacts with calcium carbonate powder at 20°C

C 50 cm^3 of 0.05 mol/dm^3 hydrochloric acid reacts with small calcium carbonate chips at 20°C

D 50 cm^3 of 0.20 mol/dm^3 hydrochloric acid reacts with small calcium carbonate chips at 20°C

E 25 cm^3 of 0.20 mol/dm^3 hydrochloric acid reacts with small calcium carbonate chips at 10°C

2 For the original graph, find the mean rate during the first 20 seconds.

rate = $\frac{30}{20}$ = 1.5 cm^3/s

3 For the original graph, draw a tangent to find the rate at 20 seconds in cm^3/s

rate = $\frac{120-12}{115-0}$ = 0.94 cm^3/s