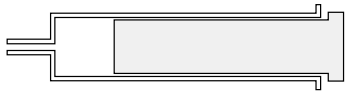
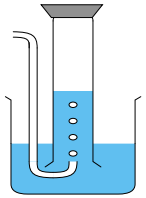
Method 1



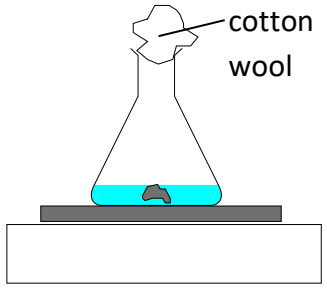
Collect the gas given off in a syringe.
Record mL of gas / time.

Method 2



Collect gas given off in an upturned measuring cylinder & measure using the scale markings. Record mL of gas / time.

Method 3



Let the gas produced escape & measure the decrease in mass on a balance. The decrease in mass = mass of gas that escaped. Record g of gas / time.

Changing concentration

If the solution e.g. the acid, is more concentrated there are more acid particles/volume…. so there will be more particle collisions / time e.g. between the acid and metal ….. and so the rate of reaction will increase.

Changing surface area

If the surface area of a solid is increased there are more particles immediately available / exposed for collision …. so there will now be more particle collisions/time….. and so the rate of reaction will increase.

Changing temperature

If the temperature is increased the particles (of the liquid) have greater kinetic energy – move faster …. so there are more collisions/time… and so the rate of reaction will increase.
Since the particles have more energy more of the collisions are successful collisions (have enough energy for a reaction to occur).

Rates of reaction revision.

Rates increase or decrease. ☺

They don't get longer or shorter (that's the times!) 😐

Rates don't get quicker or slower – (that's the reactions) 😐

The three examples (methods 4-6) are NOT strictly measuring rate (which is an amount / time) as they measure the time for a "whole event" to occur, but never the less they are still useful to allow for comparisons of "rate".*

The student could vary

- Concentration of one of the solutions
- Temperature of the solutions
- Addition of same amount of different catalysts
- Surface area of the solid (method 6 only).

*You should plot time data as 1/T but we don't usually do this at level 1.

Examples for method 3:

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
$Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

The student could vary

- Concentration of acid, OR
- Surface area of calcium carbonate (marble chip), OR
- Temperature of the acid

Note: Not so good a method for reactions making H_2 as H_2 is such a light gas that the mass changes are very, very small.

Examples for method 6:

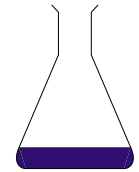
$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$

The student could vary

- Concentration of acid, OR
- Surface area of calcium carbonate OR Mg
- Temperature of the acid

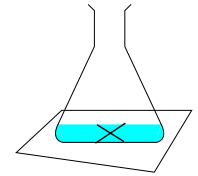
Note: Do NOT say time until the reaction stops – say time until the reaction is complete!! $CaCO_3$ or Mg has all "dissolved"** i.e. cannot be seen.
** The stuff doesn't really dissolve – it reacts to make soluble substances you can't see.

Method 4



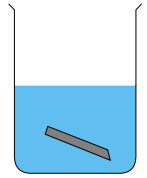
Time until the colourless solution changes colour e.g. colourless to purple or blue. Record time (for the event).

Method 5



Time until the colourless solution becomes so cloudy that an X cannot be seen. Record time (for the event).

Method 6



Time until the piece of metal / piece of tablet completely disappears (all has reacted). Record time (for the event). Again the stuff doesn't really dissolve – it reacts to make soluble substances you can't see.