

## Preparing, collecting and testing for gases

### Preparing gases

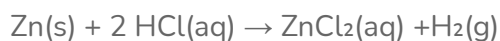
#### 1. Carbon dioxide

Calcium carbonate + dilute hydrochloric acid



#### 2. Hydrogen

Zinc pieces + dilute hydrochloric acid



#### 3. Oxygen

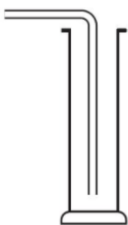

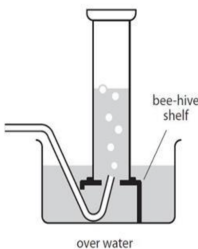
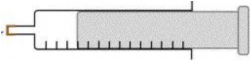
Hydrogen peroxide with manganese(IV) oxide as a catalyst



#### 4. Ammonia

Ammonium compound ( eg  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{NH}_4\text{Cl}$ ,  $\text{NH}_4\text{NO}_3$  ) + base ( eg  $\text{NaOH}$ ,  $\text{Ca}(\text{OH})_2$  );  
both solid; heat.

### Collecting gases

Method	Upward displacement of air	Downward displacement of air	Over water	Gas syringe
Apparatus				
Use when:	The gas is heavier than air	The gas is lighter than air	Gas is sparingly soluble in water	The volume of gas is to be measured accurately
Examples of gases	$\text{CO}_2$ , $\text{SO}_2$ , $\text{HCl}$	$\text{NH}_3$ , $\text{H}_2$	$\text{CO}_2$ , $\text{O}_2$ , $\text{H}_2$	Any gas

## Tests for gases

Gas	Properties	Test	Result
$\text{NH}_3$	Colourless, alkaline, strong sharp smell	Hold damp red litmus paper in it	Indicator paper turns blue/ sharp smell
$\text{CO}_2$	Colourless, weakly acidic, reacts with limewater ( $\text{Ca(OH)}_2$ (aq) ) to give a white ppt of Calcium carbonate ( $\text{CaCO}_3$ )	Bubble $\text{CO}_2$ through limewater	Limewater turns milky
$\text{Cl}_2$	Green, poisonous, bleaches dyes	Hold damp indicator paper in $\text{Cl}_2$ in a fume cupboard	Indicator paper turns white
$\text{H}_2$	Colourless, combines violently with oxygen when lit	Collect $\text{H}_2$ in a tube and hold a lighted splint to it	$\text{H}_2$ burns with a squeaky pop
$\text{O}_2$	Colourless, fuels burn in it more readily than in air	Collect in a test tube and hold a glowing splint to it	Splint immediately bursts into flame
$\text{SO}_2$	Colourless, poisonous, acidic, choking smell  Reduces purple potassium manganate(VII) ion to colourless potassium manganese(II) ion	Soak a piece of filter paper in acidified aqueous potassium manganate(VII).  Place it in $\text{SO}_2$	Colour of filter paper changes from purple to colourless

### Additional:

- Acidified : a little dilute acid has been added ( the acid is usually HCl )
- $\text{NO}_2$  is acidic and doesn't support burning
- Why one shouldn't rely on smell to test for a gas:
  - (i) May be too little to detect
  - (ii) May be harmful
- For adding acids :

(i) Use a thistle funnel for dilute acids



(ii) Use a dropping funnel for concentrated acids

