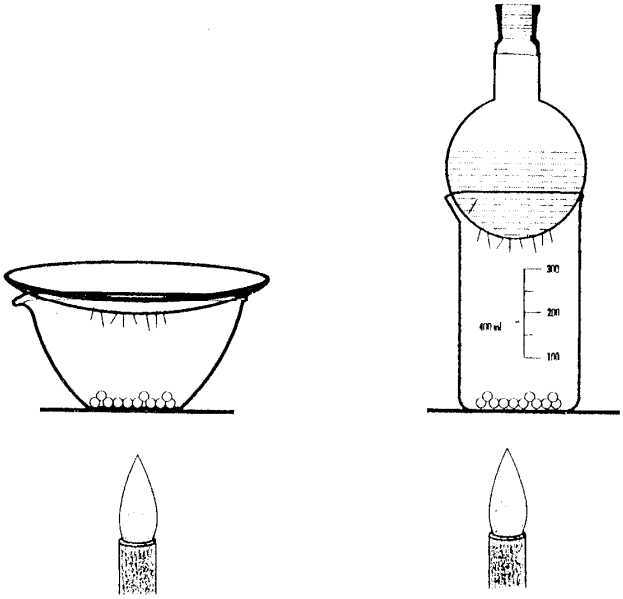
Crystallization is essentially solid-liquid separation technique. It is a process of formation of solid crystals from a homogeneous solution. This method is used to isolate and purify the required component of a reaction mixture. For crystallization to occur, the solution ought to be supersaturated. This can be achieved by solvent evaporation or cooling.

Sublimation of an element or substance is a conversion between the solid and the gaseous phases of matter, with no intermediate liquid stage. The element (iodine) is sublimed by heating of the reaction vessel and crystallization of the (iodine) vapour using an ice-cooled watch glass.



Preparation of gases

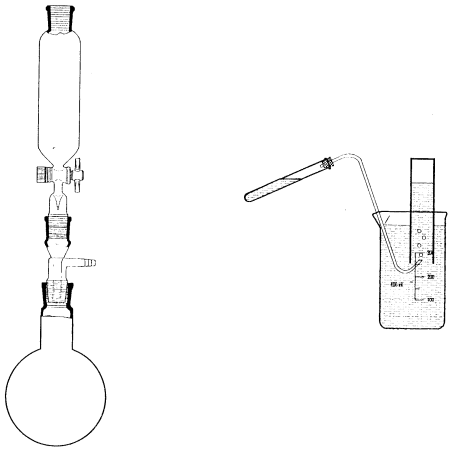
Gases are produced as products in many chemical reactions. Several common elements (H_2, He, N_2, O_2, F_2, Cl_2) and compounds (NH_3, CO_2, H_2S, SO_2) are present in the form of gases at room temperature.

The gases are prepared by temperature decomposition of solid compounds (NH_4NO_2, $Pb(NO_3)_2$, HgO) or by reaction of solid compounds with liquid ($CaCO_3$ + HCl, FeS + HCl, Zn + HCl).

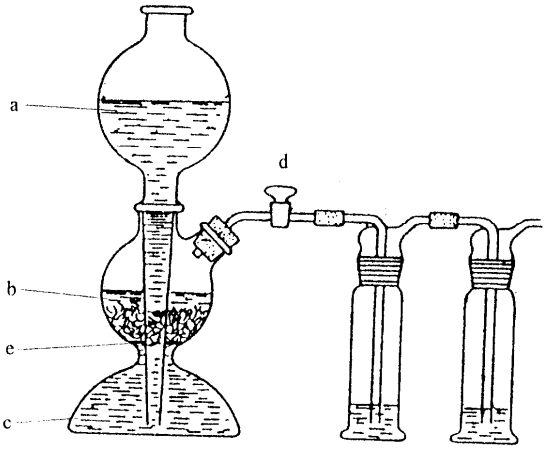
The suitable apparatus depends on the desired amount of evolved gas.

One of the most convenient apparatus for preparation of larger amounts of gas, or when it is desired to have the gas always ready for use, is the **Kipp generator.**

The apparatus is made of three vertically stacked cylinders. The solid material (eg. iron sulfide) is placed into the middle cylinder (b), the acid is put into the top cylinder (a). A tube (e) extends from the top cylinder into the bottom cylinder. The middle cylinder has a tube with a stopcock (d) attached, which is used to draw off the evolved gas. When the stopcock is closed, the pressure of the gas in the middle cylinder rises and expels the acid back into the top cylinder, until it is not in contact with the solid material anymore, and the chemical reaction stops.



gas production apparatus



Kipp apparatus

Compressed Gas Cylinders

In most laboratory applications, gases are bled from compressed gas cylinders into systems that are near atmospheric pressure and that are provided with a sort of safety outlet in case an exceedingly high pressure is reached.

There are three cases: i) the substances that remain gaseous at standard temperature and increased pressure (acetylene, air, argon, helium, oxygen), ii) the substances that are liquidized at standard temperature and increased pressure (butane, propane) and iii) the substances that are liquidized at reduced temperature and increased pressure (liquid He, N_2, O_2).

Cylinder shoulder colours

By hazard property		
Flammable	Red	
Toxic/corrosive	Yellow	
Inert	Bright green	
Oxidising	Pale blue	

Note: More than one hazard property may be shown on the cylinder shoulder e.g. red and yellow

By specific gas		
Argon	Dark green	
Carbon dioxide	Dusty grey	
Helium	Brown	
Nitrogen	Black	
Nitrous oxide	Dark blue	
Oxygen	White	

PROPER PROCEDURE OF OPENING OF CYLINDER VALVES

Make sure that the regulator outlet valve (**A**) is shut. Screw it clockwise until it seats. Do not over tighten it or you may damage the valve seat.

Make sure that the regulator control valve (**B**) is shut.

Open the tank valve slowly (counter clockwise). Watch the tank pressure on the regulator (**C**).

Slowly turn the regulator control valve (**B**) until the regulator pressure (**D**) is at the desired level.

Open the regulator outlet valve (**A**). You can regulate flow with this valve, but the ultimate pressure depends on the setting of the regulator control valve!