Test for Different Gases.

(1) **Colourless gases**

(i) **Tests for CO_2 :**It is colourless and odourless gas. It gives white ppt. with lime water which dissolves on passing excess of CO_2. $\underset{\text{Lime water}}{Ca(OH)_2} + CO_2 \rightarrow \underset{\text{White ppt.}}{CaCO_3} \downarrow + H_2O$;

$\underset{\text{White ppt.}}{CaCO_3} + \underset{\text{Excess}}{CO_2} + H_2O \rightarrow \underset{\text{Soluble}}{Ca(HCO_3)_2}$

(ii) **Test for CO :**It is colourless and odourless gas. It burns with a blue flame. $2CO + O_2 \rightarrow 2CO_2$

Note: CO is highly poisonous gas.

(iii) **Test for O_2 :**It is colourless and odourless gas. It rekindles a glowing splinter.

(iv) **Tests for H_2S :**It is a colourless gas with a smell of rotten eggs. It turns moist lead acetate paper black.

$(CH_3COO)_2Pb + H_2S \rightarrow 2CH_3COOH + \underset{\text{Black}}{PbS}$

(v) **Tests for SO_2 :**It is a colourless gas with a suffocating odour of burning sulphur. It turns acidified $K_2Cr_2O_7$ solution green. $3SO_2 + K_2Cr_2O_7 + H_2SO_4 \rightarrow K_2SO_4 + \underset{\text{Green}}{Cr_2(SO_4)_3} + H_2O$

(vi) **Tests for NH_3 :**It is a colourless gas with a characteristic ammonical smell. It gives white fumes of NH_4Cl with HCl, $NH_3 + HCl \rightarrow \underset{\text{White fumes}}{NH_4Cl}$. With Nessler's reagents, it gives brown ppt.

$\underset{\text{Nessler's reagent}}{2K_2[HgI_4]} + NH_3 + KOH \rightarrow \underset{\text{(Brown ppt)}}{\underset{\text{Iodine of Millon's base}}{NH_2HgOHgI}} + 7KI + 2H_2O$

It gives deep blue colour with $CuSO_4$ solution, $CuSO_4 + 4NH_3 \rightarrow \underset{\text{Deep blue}}{[Cu(NH_3)_4]}SO_4$. NH_3 dissolves in water to give NH_4OH, which being basic, turns red litmus blue,

$NH_3 + H_2O \rightarrow NH_4OH \rightleftharpoons NH_4^+ + OH^-$.

(vii) **Tests for HCl gas :**It is colourless gas with a pungent irritating smell. It turns moist blue litmus paper red i.e., it is acidic in nature. It gives white ppt. with $AgNO_3$ solution. This white ppt. is soluble in NH_4OH. $HCl + AgNO_3 \rightarrow \underset{White\ ppt.}{AgCl} + HNO_3$;

$AgCl + 2NH_4OH \rightarrow \underset{\text{Soluble}}{\left[Ag(NH_3)_2\right]} + 2H_2O$.

(viii) **Test for** CH_3COOH **vapours** :These vapours are colourless with a vinegar like smell.

(2) **Coloured gases**

(i) **Tests for Cl_2 :**It is a greenish yellow gas with a pungent smell. In small quantity it appears almost colourless. It bleaches a moist litmus paper, $Cl_2 + H_2O \rightarrow 2HCl + [O]$;
$Colour + [O] \rightarrow Colourless$. Blue litmus paper first turns red and then becomes colourless.

(ii) **Tests for Br_2 :**Brown vapours with a pungent smell. It turns moist starch paper yellow.

(iii) **Tests for I_2 :**Violet vapours with a pungent smell. It turns moist starch paper blue.

(iv) **Tests for NO_2 :**Brown coloured pungent smelling gas. It turns moist starch KI paper blue
$2KI + 2NO_2 \rightarrow 2KNO_2 + I_2$; $I_2 + Starch \rightarrow Blue\ colour$.
It turns ferrous sulphate solution black,
$3FeSO_4 + NO_2 + H_2SO_4 \rightarrow Fe_2(SO_4)_3 + \underset{Black\ brown}{FeSO_4.NO} + H_2O$