

KENDRIYA VIDYALAYA



SUBJECT – CHEMISTRY

**PROJECT – TO DETECT THE PRESENCE OF
RADICAL ACIDIC IN GIVEN
SALT.**

SUBMITTED BY-

SUSHIL KUMAR

XII-A

SUBMITTED TO-

DR.MS MEENA

PGT CHEMISTRY

THEORY-

Identification Of Acid Radicals (Anions)

The identification of the acid radicals is first done on the basis of preliminary tests. Dry heating test is one of the preliminary tests performed earlier which may give some important information about the acid radical present. The other preliminary tests are based upon the fact that:

1. CO_3^{2-} , S^{2-} , SO_3^{2-} and NO_2^- react with dil. H_2SO_4 to give out CO_2 , H_2S , SO_2 and NO_2 gas respectively which can be identified by certain tests.
2. Cl^- , Br^- , I^- , NO_3^- , $\text{C}_2\text{O}_4^{2-}$ and CH_3COO^- react with cone. H_2SO_4 but not with dil. H_2SO_4 to produce characteristic gases.
3. SO_4^{2-} and PO_4^{3-} react neither with dil. H_2SO_4 nor with cone. H_2SO_4 . These are therefore, identified by individual tests.

Thus, the acid radicals may be identified by performing the following tests in the order given below :

(i) **Dil. H_2SO_4 test.** Treat a pinch of the salt with dil. H_2SO_4 and identify the gas evolved.

(ii) **Cone. H_2SO_4 test.** If no action takes place with dil. H_2SO_4 , warm a pinch of the salt with cone. H_2SO_4 and identify the gas evolved.

(iii) **Independent Group.** (SO_4^{2-} and PO_4^{3-}). If the salt does not react with dil. H_2SO_4 as well as with cone. H_2SO_4 , test for SO_4^{2-} and PO_4^{3-} by performing their individual tests.

Let us now discuss these tests in detail one by one.



Dilute Sulphuric Acid Test-

Take a small quantity of the salt in a test-tube and add 1-2 ml of dilute sulphuric acid. Observe whether some gas is evolved or not. If some gas is evolved, identify the gas and draw inferences from Table .

S.NO	OBSERVATION	INFERENCE	
		GAS EVOLVED	POSSIBLE RADICAL
1	Colourless, odourless gas with brisk effervescence, turns lime water milky.	CO ₂	CO ₃ ²⁻
2	Colourless gas, smell like that of rotten eggs, turns ' lead acetate paper black.	H ₂ S	S ²⁻
3	Colourless gas, smell like that of burning sulphur, turns acidified potassium dichromate paper green.	SO ₂	SO ₃ ²⁻
4	Reddish brown gas, pungent smell, turns ferrous sulphate solution black.	NO ₂	NO ₂ ⁻
5	No gas is evolve	----- -----	CO ₃ ²⁻ , S ²⁻ , SO ₃ ²⁻ , NO ₂ ⁻ absent

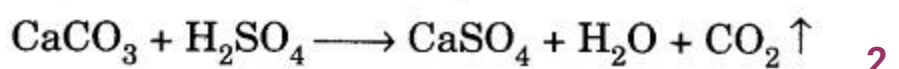
Note:

1. Do not treat the salt with a large quantity of dilute acid.
2. Do not heat the salt with dilute acid.

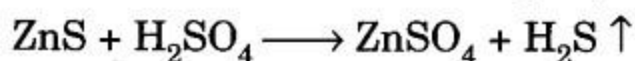
Chemical Reactions Involved in Dil. H₂SO₄ Test-

Dilute H₂SO₄ (or dilute HCl) decomposes carbonates, sulphides sulphites and nitrites in cold to and liberates different gases. These gases on identification indicate the nature of the acid radical present in the salt.

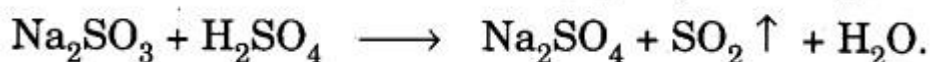
1. Carbonates. On treating the solid carbonate, CO₂ is given off in the cold with brisk effervescence.



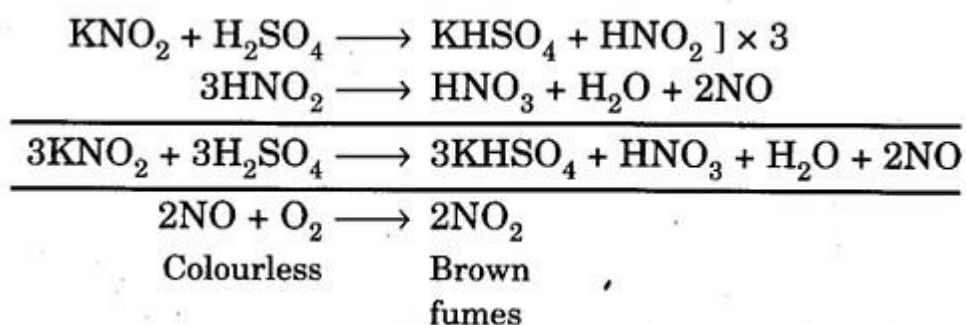
Sulphides. Sulphides when treated with dil. H₂SO₄ give H₂S gas.



Sulphites. Sulphites when treated with dil. H₂SO₄ give SO₂ gas.



4. Nitrites. On treating the solid nitrite with dil. H₂SO₄, nitric oxide (NO) gas is evolved which readily gives dense brown fumes of NO₂ with oxygen of the air.



Potassium Permanganate Test-

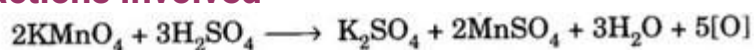
To a pinch of salt in test tube add about 2 ml of dilute sulphuric acid. Boil off any gas evolved, add little more of dilute acid and then potassium permanganate solution dropwise. Note the changes as given in Table . This test helps in detection of Cl^- , Br^- , I^- , $\text{C}_2\text{O}_4^{2-}$, and Fe^{2+} radicals.

S.NO	OBSERVATION	INFERENCE
1	Potassium permanganate decolourised without the evolution of any gas.	Presence of Fe^{2+} salts.
2	Potassium permanganate decolourised : (a) In cold (i) With the evolution of chlorine. (ii) With the evolution of bromine. (iii) With the evolution of iodine. (b) On warming (i) With the evolution of carbon dioxide	Cl^- Br^- I^- $\text{C}_2\text{O}_4^{2-}$
3	KMnO_4 not decolourised.	Absence of Cl^- , Br^- , I^- , $\text{C}_2\text{O}_4^{2-}$ and Fe^{2+}

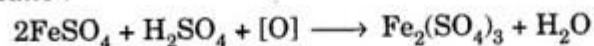
Note:

Do not perform this test if the salt reacts with dilute sulphuric acid because sulphides, sulphites and nitrites also decolourise KMnO₄ solution.

Chemical Reactions Involved



1. *Ferrous salts* :



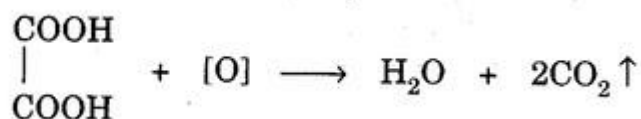
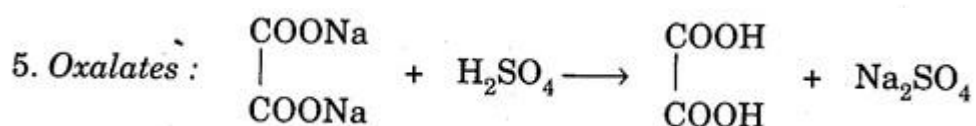
2. *Chlorides* :



3. *Bromides* :



4. *Iodides* :



Concentrated Sulphuric Acid Test-

This test is performed by treating small quantity of the salt with cone, sulphuric acid (2-3 ml) in a test tube. Identify the gas evolved in cold and then on heating. Draw inferences from Table . Cone. Sulphuric Acid Test.

S.NO	OBSERVATION	GAS EVOLVED	POSSIBLE RADICALS
1	Colourless gas with pungent smell. The gas gives white fumes with aqueous ammonia (NH ₄ OH) and white ppt. with AgNO ₃ solution.	HCL	Cl ⁻
2	Reddish brown vapours with pungent smell, turns starch paper yellow. It does not turn FeSO ₄ solution black.	Br ₂	Br ⁻
3	Deep violet vapours with pungent smell, turns starch paper blue. A sublimate is formed on the sides of the tube.	I ₂ vapours	I ⁻

4	Reddish brown gas with pungent smell, turns FeSO_4 solution black.	NO_2	NO_2^-
5	Colourless gas which turns lime water milky and a gas which burns with blue flame.	CO_2 and CO	$\text{C}_2\text{O}_4^{2-}$
6	No gas/vapours evolved.		Cl^- , Br^- , I^- , CH_3COO^- , $\text{C}_2\text{O}_4^{2-}$ absent

Note :

1. If some gas is evolved with dilute sulphuric acid, then there is no need for performing cone, sulphuric acid test.
2. Do not boil the salt with cone, sulphuric acid. On boiling, the acid may decompose to give SO_2 gas.
3. Nitrates give vapours of nitric acid (colourless) when heated with cone, sulphuric acid. When a paper pellet or copper chips is added, dense brown fumes evolve. Paper pellet acts as a reducing agent and reduces nitric acid to NO_2 (Reddish brown gas).

S.NO	EXPERIMENT	OBSERVATION	INFERENCE
1	PHYSICAL EXAMINATION Colour of the sample is noted	White colour	$\text{Cu}_2^+, \text{Fe}_2^+, \text{Fe}_3^+, \text{Ni}_2^+, \text{Mn}_2^+, \text{Co}_2^+$, are absent
2	A little amount of the sample is rubbed between thumb and finger.	Pungent smell evolved	NH_4^+ may be present
3	Dry Test Tube Heating : Heated small amount of the sample in a dry test tube.	Pungent gas evolved along with formation of white sublimate	$\text{NH}_4^+, \text{Cl}^-$ may be present
4	Flame test was performed	No characteristic colour in the flame	$\text{Ca}_2^+, \text{Ba}^{2+}, \text{Cu}^{2+}$ may be absent.
5	Charcoal activity test was performed.	No characteristic bead but white incrustation around the edge of cavity.	$\text{Pb}^{2+}, \text{Cu}^{2+}, \text{Zn}^{2+}, \text{As}^{3+}$ may be absent and NH_4^+ may be present
6	Small amount of the sample is treated with dilute H_2SO_4 and and pass the gas through lime wate	Effervescence with evolution of colourless, odourless gas	$\text{S}^{2-}, \text{NO}_2^-$, may be absent. CO_3^{2-} may be present.
7	Small amount of the solid sample is treated with	Colourless and odourless gas evolved with effervescence	$\text{NO}_3^-, \text{Cl}^-, \text{Br}^-$ be absent. Co_3^{2-} be present.

	concentrated H₂SO₄		
8	Small amount of the solid sample is treated with Dilute H₂SO₄ and the evolved gas is passed through lime water.	Effervescence with evolution of colourless, odourless gas which turns lime water milky.	Co₃²⁻ is present and confirmed.
Preparation of aqueous extract : Aqueous extract of the sample was prepared and following test for acid radical was performed.			
9	Small amount of the sample is treated with dilute H₂SO₄ and and pass the gas through lime water	Lime water turns milky and milkiness disappears on passing excess lime water	Co₃²⁻ is present and confirmed
10	To the aqueous solution of sample MgSO₄ solution was added	White precipitate was formed	Co₃²⁻ is present and confirmed
11	Acidified the solution with dilute HNO₃ and AgNO₃ solution was added	No precipitate formed	Cl⁻ is absent
12	Acidified the solution with dilute HCl and BaCl₂ solution was added	No precipitate formed	SO₄²⁻ is absent.
13	Freshly prepared FeSO₄ solution is added to the sample solution	No brown ring was formed	NO³⁻ was absent.

	and 2ml of conc.H ₂ SO ₄ was added carefully along the wall of the container		
14	Acidified the solution with conc. HNO ₃ and a pinch of ammonium molybdate was added to it.	No precipitate is produced	PO ₄ ³⁻ is absent
15	To the aqueous solution of sample MgSO ₄ solution was added	No precipitate was formed	CO ₃ ²⁻ is absent
16	Acidified the solution with dilute HNO ₃ and AgNO ₃ solution was added.	Curdy White precipitate formed which dissolved in excess NH ₄ OH	Cl ⁻ is present and confirmed
17	Freshly prepared FeSO ₄ solution is added to the sample solution and 2ml of conc.H ₂ SO ₄ was added carefully along the wall of the container.	No brown ring was formed	NO ₃ ⁻ was absent.