Ex 2

H_2SO_4/HNO_3

SALT ANALYSIS

classmate

Date

Page

1) Identification of cation and anions in given salt is called salt analysis
2) Salt analysis is test of cation and anions.
3) Diff test of cation and anions gives some specific observable changes which gives information about the cation and anions

(Mainly salts here)

Test of Ionic radial

Test of cation (basic radical)
- → Dry test
- → flame test
- → wet test

Test of anion (acidic radical) ion
- → Wet test

Interfering radicals Some of anions are act as interfering radical during the test of cations They are called interfering radicals. systematic

eg PO_4^{3-}, $C_2O_4^{2-}$, BO_3^{3-}, F^-, SiO_4^{4-}/SiO_3^{2-}

During salt analysis anions are identify before test of cations because some of anions are interfering and they can interfere during systemic procedure to identify cations

If any such radicals is present it must be removed by suitable method before test of cations

Test of Anions

Classification

Class A
ion which produce volatile product
ith H_2SO_4

- subgroup I (il H_2SO_4) imarily
  - O_3^{2-}
  - HCO_3^-
  - SO_3^{2-}
  - HSO_3^-
  - S^{2-}
  - $S_2O_3^{2-}$
  - NO_2^-
  - H_3COO^-
- subgroup II (conc H_2SO_4)
  - F^-
  - Cl^-
  - Br^-
  - I^-
  - NO_3^-
  - $C_2O_4^{2-}$
  - BO_3^{3-}

Class B
anions which doesn't produce volatile product with H_2SO_4

- subgroup I (By ppt for)
  - SO_4^{2-}
  - PO_4^{3-}
  - arsenate AsO_4^{3-}
  - CrO_4^{2-}
- subgroup II (which identify by redox)
  - (orange) $Cr_2O_7^{2-}$ chromate
  - (yellow) CrO_4^{2-} chromate
  - (purple) MnO_4^- Per manganate
  - (green) MnO_4^{2-} manganate

$\xrightarrow{1200^\circ C} Cu_2O + 1/2 O_2$

classmate
Date
Page

CLASS A

Subgroup (I) (dil H_2SO_4/dil HCl)

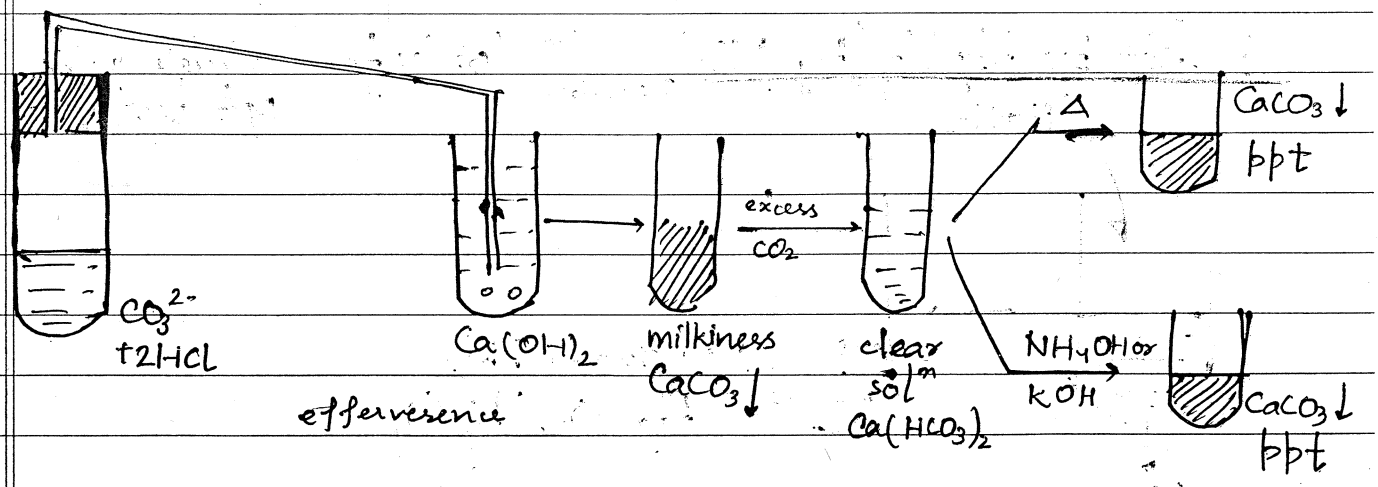
(Acids: non redox, non dehydrating)

TEST OF CO_3^{2-}

(1) All carbonates are water insoluble except IA carbonate $(NH_4)_2CO_3$. [Li_2CO_3 : insoluble / sparingly soluble]

by

Test (1) Dilute H_2SO_4/dil HCl → CO_2 (odourless)



- $CO_3^{2-} + 2H^+ \rightarrow H_2CO_3$
  $H_2CO_3 \rightarrow H_2O + CO_2\uparrow$

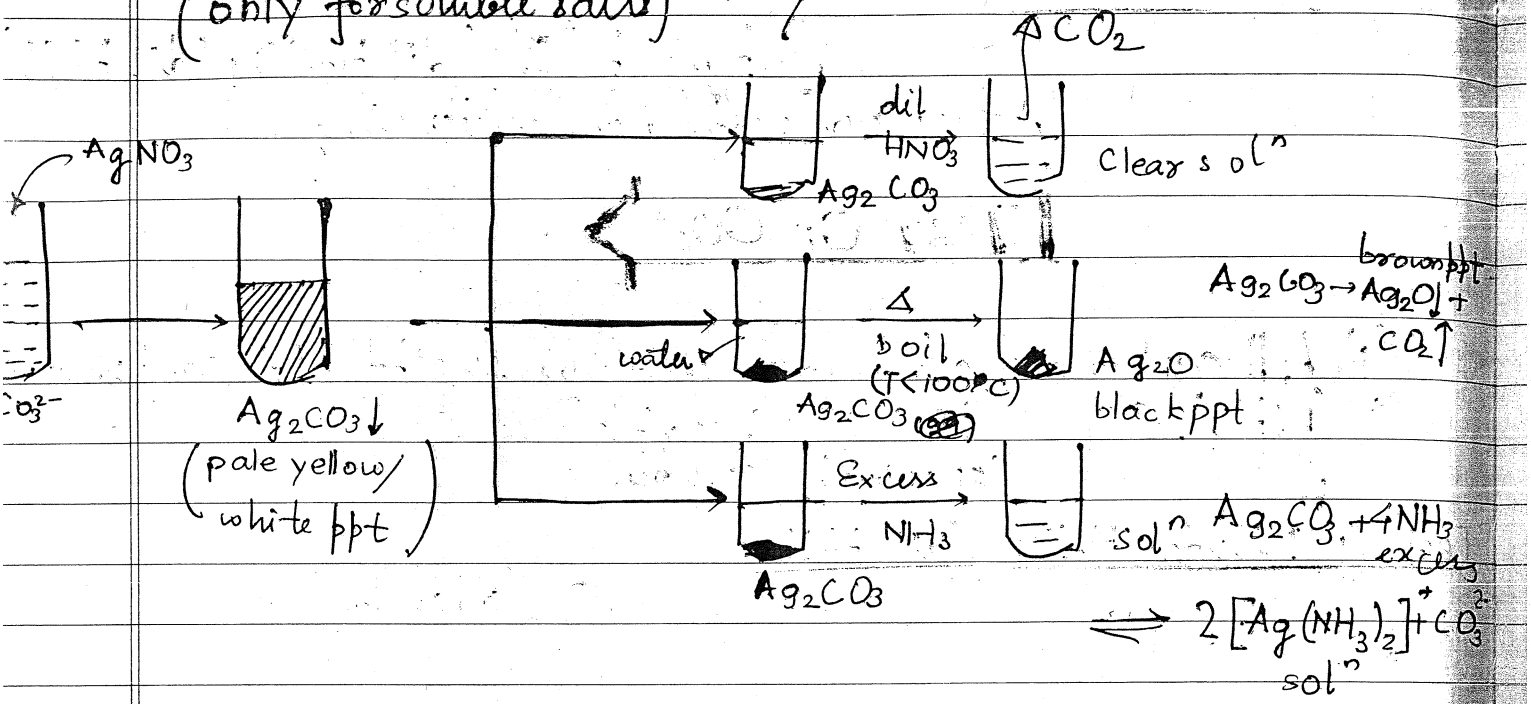
- $Ca(OH)_2 + CO_2 \rightarrow CaCO_3\downarrow + H_2O$
  $CaCO_3 + H_2O + CO_2 \xrightarrow[\text{excess}]{} Ca(HCO_3)_2$ (sol^m)
  $Ca(HCO_3)_2 \xrightarrow{\Delta} CaCO_3 + H_2O + CO_2\uparrow$

- $CO_2 + H_2O \rightleftharpoons H_2CO_3$
  $H^+ + CO_3^{2-} \rightleftharpoons H^+ + HCO$

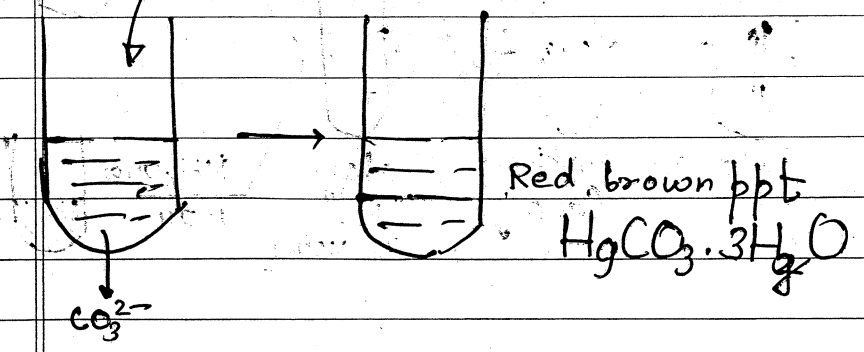
classmate
Date
Page

② Test by $AgNO_{3(aq)}$ (only for soluble salts)

diff. from AgCl, AgBr, AgI



③ Test by $HgCl_2$ / $Hg(NO_3)_2$ soluble (only for soluble salts ppt test)



$$4Hg^{+2} + CO_3^{2-} + H_2O \longrightarrow HgCO_3 \cdot 3H_2O + 6H^+$$

[Strong basic soln: $[OH^-]$ ↕ $Hg(OH)_2 \xrightarrow{\Delta} HgO + H_2O$ (unstable)]

TEST OF BICARBONATE

Solubility

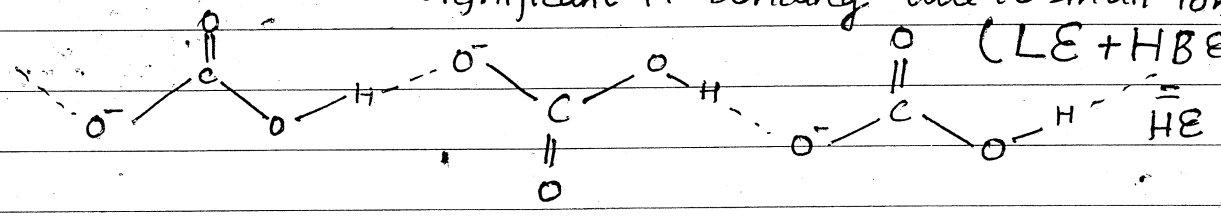
sparingly soluble ← $NaHCO_3$

highly soluble ← $KHCO_3$, $RbHCO_3$, $CsHCO_3$, NH_4CO_3

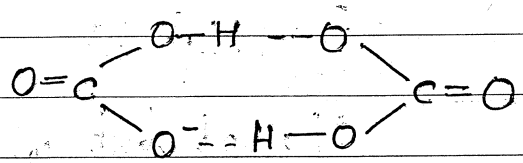
} Solid bicarbonate

$NaHCO_3$ (s)

significant H-bonding due to small ion (LE + HBE)



$KHCO_3$ (s)



However due to large size of K^+, extended H-bonding not possible

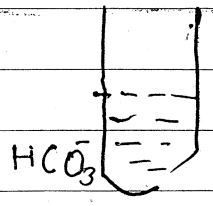
- II bicarbonates do not exist in solid form due to high polarisibility of cation (Thermal stability ↓)
- After potassium bicarbonate the separation becomes significant to prevent H bonding

classmate
Date
Page

t (1) Test by dil. HCl / dil H_2SO_4

$$HCO_3^- + H^+ \longrightarrow H_2CO_3$$
$$H_2CO_3 \longrightarrow H_2O + CO_2$$

t (2) Test by $BaCl_2$ / $CaCl_2$ (first dissolve in distill water)
Insolubele: carbonate If

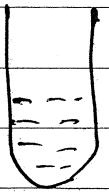


$CaCl_2$ → No ppt

$Ca(HCO_3)_2$ → Δ → $CaCO_3\downarrow$ white ppt (soluble)

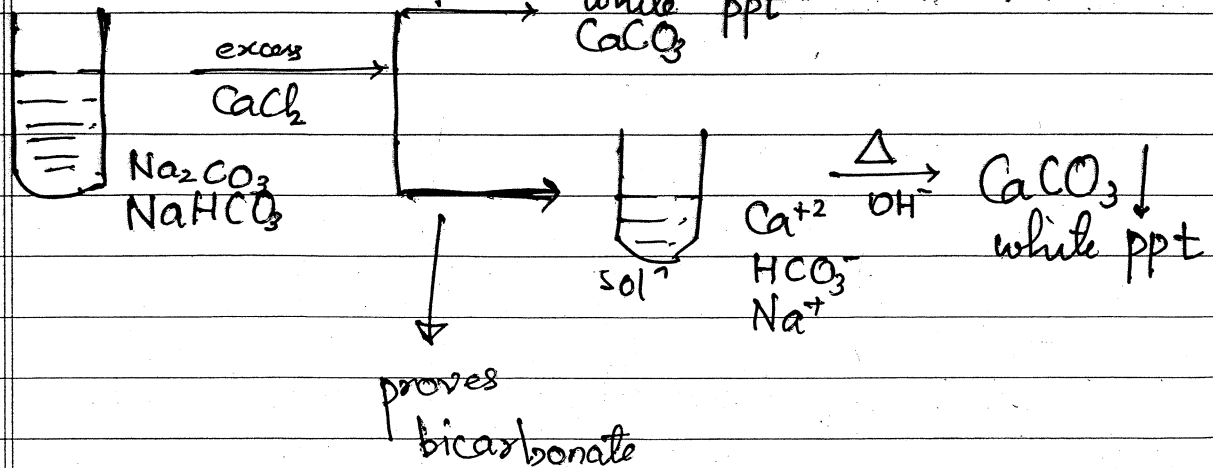
$Ca(HCO_3)_2$ → OH^- → $CaCO_3\downarrow$ white ppt

Q



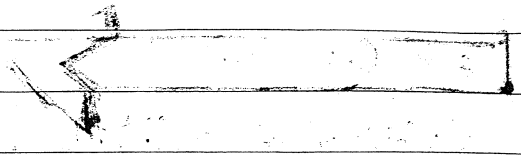
	Na_2CO_3	$NaHCO_3$
$CaCl_2$:	white ppt $CaCO_3$	No ppt but white ppt on Δ
$HgCl_2$:	Red brown ppt	No ppt
Ph	pink	colourless
n dpthalin)		
$(NO_3)_2$	white ppt	No ppt

Q To prove simultaneous presence



- also • Hph pink
  - Δ CO_2

(of solid crystals)



aqua regia

classmate
Date
Page

TEST OF SO_3^{2-}

solubility of sulphite salt same as carbonate salt
(Li_2SO_3) soluble

① Test by dil HCl

$SO_3^{2-} + 2H^+ \longrightarrow H_2SO_3 \longrightarrow H_2O + SO_2\uparrow$

$SO_2 + Ba(OH)_2 \longrightarrow BaSO_3\downarrow + H_2O$

white ppt (milky)

$BaSO_3 + SO_2 + H_2O \longrightarrow Ba(HSO_3)_2$

Sol^n

Δ ← $Ba(HSO_3)_2$ → OH^-

$BaSO_3\downarrow$ $BaSO_3\downarrow$

② Test of SO_2 based as its reducing agent

SO_2/SO_3^{2-} (RA)

$Cr_2O_7^{2-}/H^+ \rightarrow Cr^{+3} + SO_4^{2-}$ (orange)

$MnO_4^-/H^+ \rightarrow Mn^{+2} + SO_4^{2-}$

Br_2/water → brown → Br^- colourless $+ SO_4^{2-}$

Fe^{+3}/H^+ → yellow → Fe^{+2} green $+ SO_4^{2-}$

KIO_3 + starch, acidic → $I_2 + SO_4^{2-}$ → starch → blue black

(starch iodate test : all RA give test)

Cl_2 or (colourless)

$\frac{1}{2}O_2$

$SO_4^{2-} + Cl^-/H_2O$ (colourless)

Not test)

SO_2 solubility (fairly) $> SO_3$

SO_2 better RA

Q H_2S is only reducing agent but SO_2 is OA as well as RA. Explain?

A H_2S S^{2-} (-II to VI)

SO_2 S^{4+} (-II to VI) both possible

Q What happen when H_2S is passed through aq. sol^n of SO_2?

A $2H_2S + SO_2 \longrightarrow 3S\downarrow + 2H_2O$ (Comproportionation rxn)

(yellow / white ppt $\uparrow$ turbidity)

- Colloidal sulphur obtained in this rxn (fine particles)
- pure (coll) sulphur obtained by above rxn on heating

(3) Test of SO_2 based on its oxidising nature

(i) Test by H_2S

$SO_2 + 2H_2S \longrightarrow 3S + 2H_2O$

(ii) Test by (Zn + dil H_2SO_4): (Iron)

$Zn + H_2SO_4$ (dil) $\longrightarrow ZnSO_4 + 2[H]$

$SO_3^{2-} + 6[H] + 2H^+ \longrightarrow H_2S\uparrow + 3H_2O$

OA RA rotten egg

$Zn + SO_3^{2-} \xrightarrow{H^+} Zn^{+2} + H_2S\uparrow$

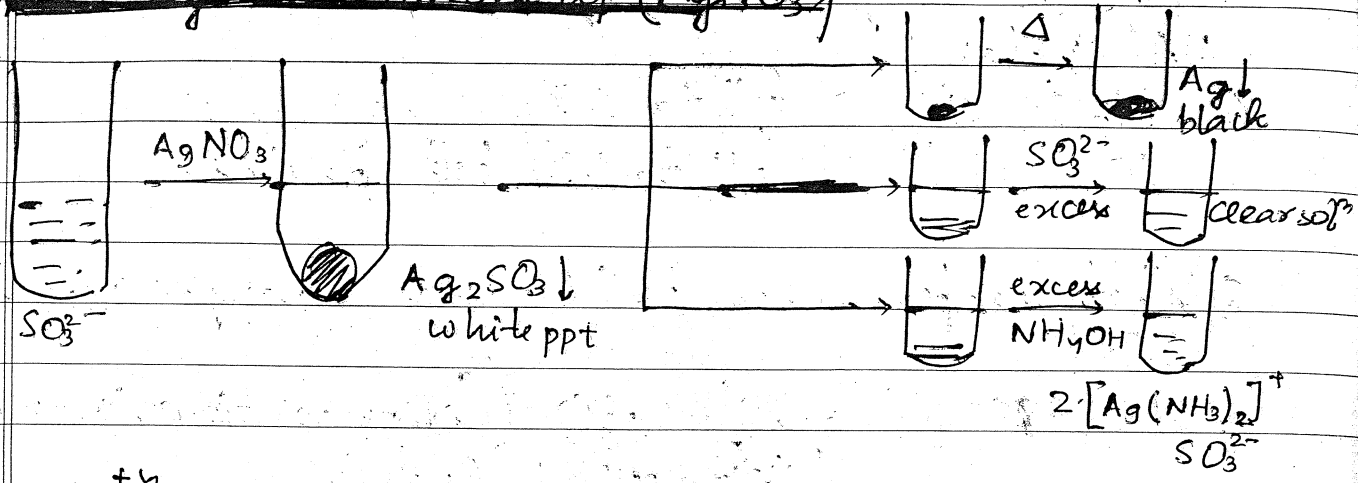
$Zn + SO_3^{2-} \xrightarrow{OH^-} ZnO_2^{2-} + S^{2-}$ (Not test (H_2S + NaOH react))

In nitric acid, ppt may dissolve to some extent (Ag_2SO_4 ppt]

classmate
Date
Page

(iv) Test by silver nitrate aq ($AgNO_3$)

a



$$Ag_2\overset{+4}{S}O_3 + H_2O \xrightarrow[\Delta]{H^+} 2Ag_{(black)} + SO_4^{2-} + 2H^+$$

(not soluble in excess NH_4OH)

learn $Ag_2SO_3 + \underset{\text{excess}}{SO_3^{2-}} \longrightarrow 2[AgSO_3]^-$

zinc

soluble ion

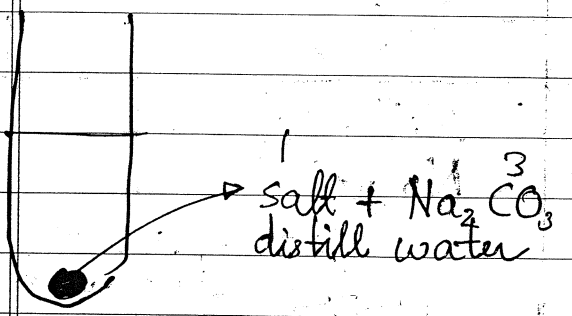
(v) Sodium nitroprusside test

$Zn[Fe(CN)_5NO]$

Salmon red colour of zinc nitroprusside is converted to red colour when it is placed with SO_2 or SO_3^{2-} due to formation of unknown composition

PREPARATION OF SODA EXTRACT

1. Preparation of sodium carbonate extract provide imp method for identification of anions which are given in form of insoluble salt
2. This method is based on ppt exchange rxn or double displacement method (very slow)
3. Sodium carbonate is preferred to prefer extract because of sodium salt are water soluble
4. Excess of sodium carbonate present in extract is neutralise by suitable acid
5. Soda extract is used for test of anions (except carbonates and biscarbonate)



boiling tube

boil 10 min

Residue
MSO_4
MCO_3

soda extraction sol^n

suitable acid

$MSO_4 \rightleftharpoons M^{+2} + SO_4^{2-}$

$K_{sp} = 10^{-15}$

$2Na^+ + M^{+2} + CO_3^{2-} \rightleftharpoons MCO_3\downarrow + 2Na^+$

$2Na^+ + MSO_4\downarrow + CO_3^{2-} \rightleftharpoons MCO_3\downarrow + 2Na^+ + SO_4^{2-}$

- Suitable acid so that anion of acid does not interfere during test of unknown anion
- Cation test not done because present in residue
- Reagent attack on solid slow (10min)

Test of HSO_3^- → (Solubility same as bicarbonate)

	Na_2SO_3	$NaHSO_3$
1. dil HCl	$SO_2\uparrow$	$SO_2\uparrow$
2. MnO_4^-/H^+	$Mn^{+2} + SO_4^{2-}$	$Mn^{+2} + SO_4^{2-}$
3 $BaCl_2$	$BaSO_3\downarrow$ white	No ppt
4 litmus	basic	neutral (HSO_4^- K_a)
5 H_2O_2 / litmus	neutral	acidic ($NaHSO_4$)
6 Zn/dil H_2SO_4	H_2S	H_2S

Na_2SO_4

- $Pb/BaSO_3 \xrightarrow{air} PbSO_4/BaSO_4$

$BaSO_3$ (white ppt) $\longrightarrow BaSO_4$ ppt

$SO_3^{2-} \xrightarrow{H_2O_2} SO_4^{2-} \xrightarrow[H_2O_2]{excess} SO_4^{2-}$

lime water : $Ca(OH)_2$

slaked lime : ppt of conc. solution of $Ca(OH)_2$ (More salt)

Test of S^{2-}

SOLUBILITY

All sulphide are water insoluble but sulphides of first A, and IIA are sparingly soluble and are fairly soluble

solubility of IIA sulphides gradually change on contact with water and $(NH_4)_2S$ water soluble

Solubility

- $CaO < SrO < BaO$

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

of O^{2-}, S^{2-} same as OH^-

BeS

- $CaS < SrS < BaS$

$$CaS + H_2O \longrightarrow Ca^{+2} + HS^- + OH^-$$

(form -OH)

soluble

- Cr_2S_3, Al_2S_3, MgS does not exist in water (in solid state present)

$$Al_2S_3 + 6H_2O \longrightarrow \underset{\text{white ppt}}{2Al(OH)_3\downarrow} + 3H_2S\uparrow$$

$$Cr_2S_3 + 6H_2O \longrightarrow \underset{\text{green ppt}}{2Cr(OH)_3\downarrow} + 3H_2S\uparrow$$

$$MgS + 2H_2O \longrightarrow \underset{\text{white ppt}}{Mg(OH)_2\downarrow} + H_2S\uparrow$$

violet | blue ↑ | red ↑ → B+R

purple

o reagent not in excess when not given No further

CLASSMATE Date Page

Tests

(1) dil HCl

$S^{2-} + 2H^+ \longrightarrow H_2S \uparrow$ (rotten egg)

- PbS ppt → HNO_3 ✗
- MnS not ppt → HNO_3 ✓

$Pb(NO_3)_2$ / $Hg - I_2$ ppt.

PbS (black) (HgS)

(2) Test based on its reducing nature of H_2S

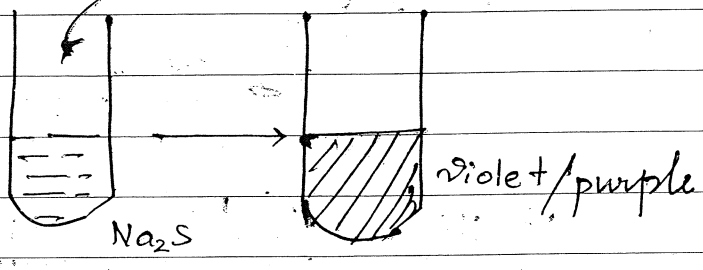
(RA) H_2S / S^{2-}

- $Cr_2O_7^{2-}/H^+$ → $Cr^{+3} + S$
- MnO_4^-/H^+ → $Mn^{+2} + S$
- Br_2 water → $Br^- + S$
- 1, 2 drops Cl_2 water → $S + Cl^-$ → turbidity
- KIO_3 + starch → $I_2 + S$ (blue black starch); excess → $I^- + S$
- Fe^{+3}/H^+ → $Fe^{+2} + S$
- SO_2 aq → $S + S$
- H_2O_2 → $H_2O + S$

③ Test by sodium nitroprusside

$Na_2[Fe(CN)_5NO]$

CaS responds



$$Na_2[\overset{II}{Fe}(CN)_5\overset{+}{N}O] + \overset{Na_2}{S} \longrightarrow Na_4[\overset{II}{Fe}(CN)_5(NOS)]$$

red sol^n — violet colouration

d^6 — d^6

- Sod. nitroprusside does not produce violet colouration with H_2S but in alkaline medium sodium nitroprusside can produce violet colouration with H_2S [alkaline medium $H_2S + 2OH^- \longrightarrow S^{2-} + 2H_2O$]
- It is not much sensitive and requires suff S^{2-} ion
- filter paper H_2S dissolve sufficiently but diss. less

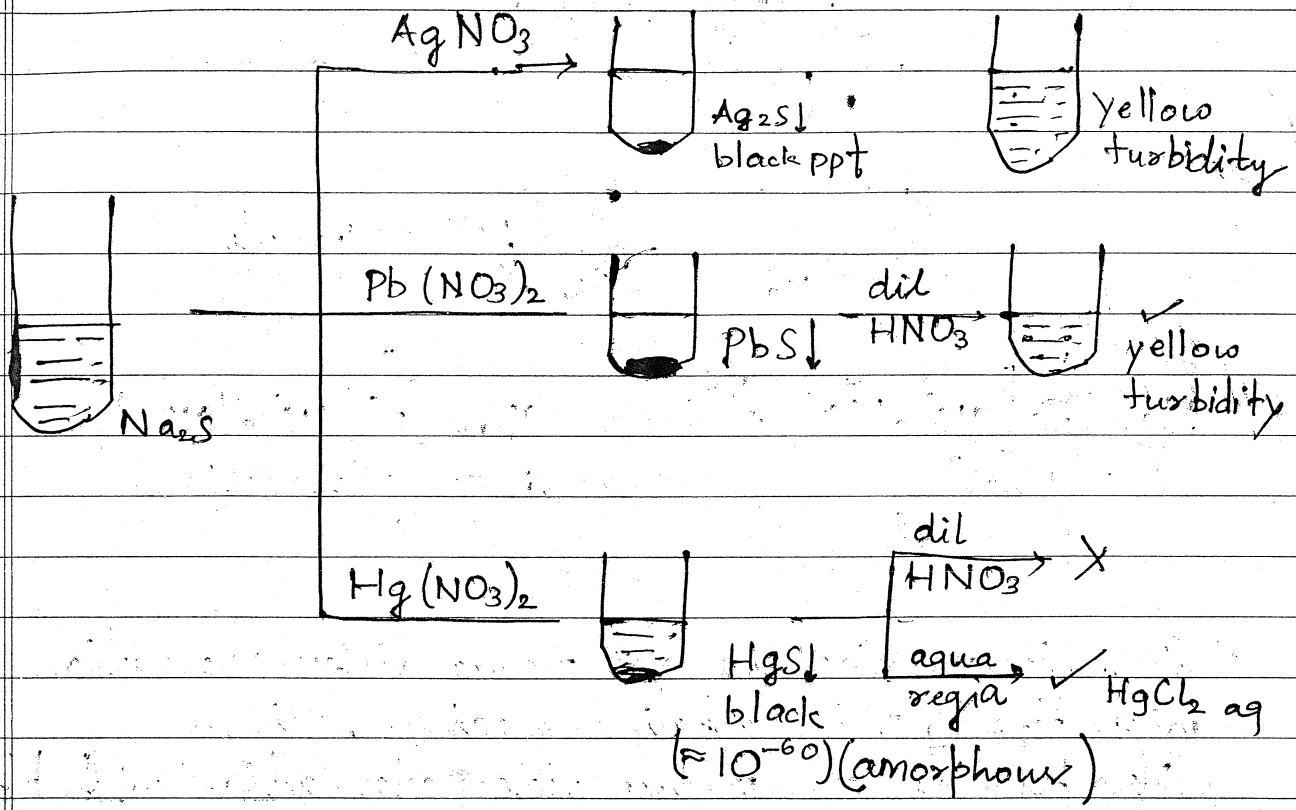
→ ∴ filter paper soaked with H_2S → No test

Medium basic necessary

$Ag_2S + HCl \not\rightarrow$ Not soluble

- To relate solubility see cation

(4) Test by $AgNO_3$ / $Pb(NO_3)_2$ / $Hg(NO_3)_2$



- $Ag_2S \rightleftharpoons 2Ag^+ + S^{2-}$

$$[S^{2-} \longrightarrow S + 2e^-] \times 3$$
$$[3H^+ + HNO_3 + 3e^- \longrightarrow NO + 2H_2O] \times 2$$
$$3S^{2-} + 2HNO_3 + 6H^+ \longrightarrow 2NO + 3S + 4H_2O$$

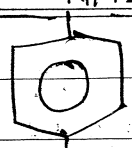
(NO liberated)

- $3Ag_2S + 8HNO_3 \longrightarrow 2NO + 3S + 4H_2O + 6AgNO_3$
- $3PbS + 8HNO_3 \longrightarrow 2NO + 3S + 4H_2O + 3Pb(NO_3)_2$

Race 3 4

→ No response to S^{2-}

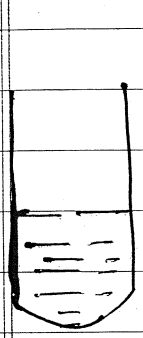
(5) Tat by



para am

N, N-dimethyl para amine aniline

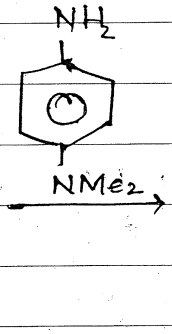
$+ Fe_2(SO_4)_3$:-



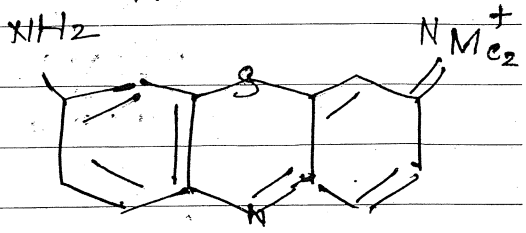
S^{2-}/H^+

Fe^{+3}

responds to [S] produced



Methylene blue (indicator dye stuff)



$+ Fe^{+2}$

- $Fe^{+3} + S^{2-} \xrightarrow{H^+} Fe^{+2} + S$

$Fe^{+3} + S^{2-} \xrightarrow{\text{Neutral}} FeS + S$

black ppt

$Fe^{+3} + S^{2-} \xrightarrow[\text{alkaline}]{\text{less}} Fe_2S_3\downarrow$

black ppt

$FeS \cdot FeS_2$

→ Black ppt of PbS convert to white $PbSO_4$

$PbS + O_3 \longrightarrow PbSO_4 + O_2$

$\downarrow H_2O_2$

$PbSO_4$

→ $2Pb^{+2} + H_2S + 2Cl^- \longrightarrow PbS \cdot PbCl_2$

excess

red ppt

$HBrO_2$, HIO_2 → salt stable acid not → chlorite, hyposulphurous, HNO_2 nitrous acid

NITRITE ION

All nitrites are water soluble except $AgNO_2$ (S.S) which is sparingly soluble)

① Test by dil HCl / dil H_2SO_4

$$NO_2^- + H^+ \longrightarrow HNO_2$$

$$3HNO_2 \longrightarrow HNO_3 + NO + H_2O$$

$$2NO + O_2 \longrightarrow 2NO_2\uparrow$$

(brown gas)

$$NO + NO_2 \xrightarrow[(-30^\circ C)]{\text{Cold}} N_2O_3\ (s)$$

at this temp dark blue nitrogen sesquioxide (1.5)

② Test by Zn/Al/ Devarda alloy + NaOH (Zn+Al+Cu)

NH_3 (pungent smelling)

NO_2^- + Zn + 2NaOH

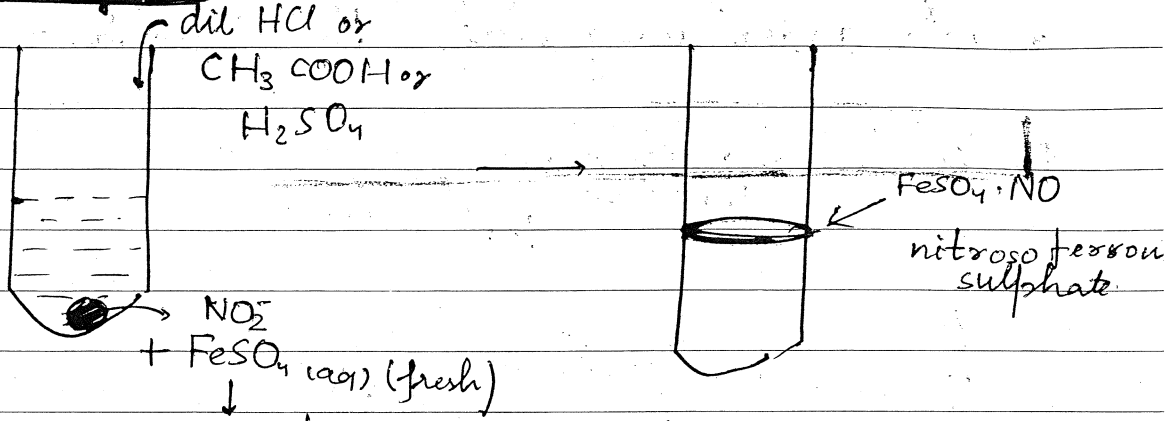
$$[\ Zn + 2NaOH \longrightarrow Na_2ZnO_2 + 2[H]$$
$$NO_2^- + 6[H] + H^+ \longrightarrow NH_3 + 2H_2O$$

$$[\ Zn + NO_2^- \xrightarrow{OH^-} NH_3 + ZnO_2^{2-}$$
$$Al + NO_2^- \xrightarrow{OH^-} NH_3 + AlO_2^-$$

$$[Zn + NO_3^- \xrightarrow{OH^-} NH_3 + ZnO_2^{2-}$$

- Test also given by Nitrate in same conditions

(8) Brown ring test

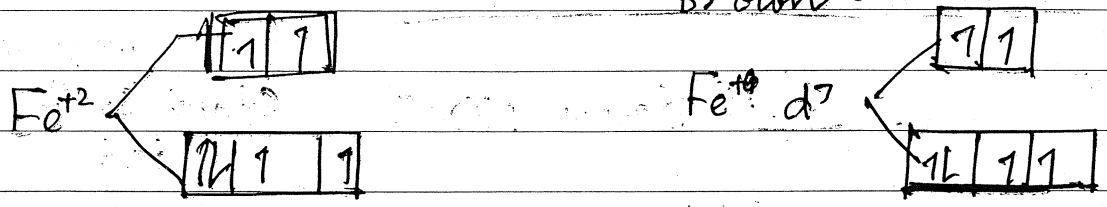


$$NO_2^- + H^+ \longrightarrow HNO_2$$

$$3HNO_2 \longrightarrow HNO_3 + H_2O + 2NO$$

$$[Fe^{II}(H_2O)_6]SO_4 + NO \longrightarrow [Fe^{I}(H_2O)_5\overset{+}{N}O]SO_4$$

brown (brown)



- brown ring test of nitrite is done by freshly prepared $FeSO_4$ ($Fe^{+2} \xrightarrow{air} Fe^{+3}$) and dil H_2SO_4
- brown ring test is actually due to absorption of NO by $FeSO_4$
- brown ring of nitrite is preferred to perform in soda extract because M^{n+} which produce insoluble sulphate create turbelence during test
- brown ring complex is unstable due to +1 oxidation state of iron
- on rapid mixing, standing or heating brown colour disappear and yellow colour of Fe^{+3} leaving behind in test tube.

SO_2 good RA

- $Fe^{+2} \xrightarrow{HNO_3} Fe^{+3}$
- long standing NO may be oxidised by NO_2
- acid added along sides No disturbance in medium

(4) Test based on its reducing nature

RA
NO_2^-

- $\xrightarrow{MnO_4^-/H^+} Mn^{+2} + NO_3^-$
- $\xrightarrow{Cr_2O_7^{2-}/H^+} Cr^{+3} + NO_3^-$
- $\xrightarrow{Br_2/water} Br^- + NO_3^-$
- $\xrightarrow[\text{(Not test)}]{H_2O_2} H_2O + NO_3^-$

(5) Test based on its oxidising nature

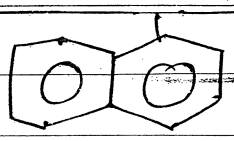
(OA)
NO_2^-

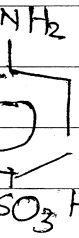
- $\xrightarrow{I^-/H^+ \text{ starch}} NO + I_2$
- $\xrightarrow{Fe^{+2}/H^+} NO + Fe^{+3}$
- $\xrightarrow{Zn + KOH} NH_3 + ZnO_2^{-2}$
- $\xrightarrow[\text{(in acid)}]{R-NH_2} N_2 + R-OH$ → Test by organic reagent
- $\xrightarrow[H^+]{NH_2-C(=O)-NH_2} N_2 + CO_2$

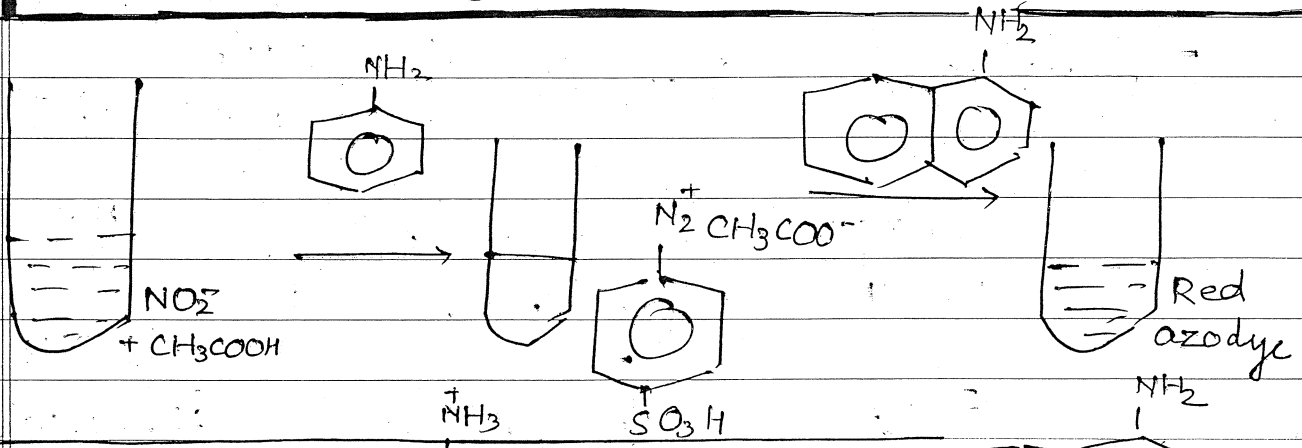
★ always individual remember

Starch/Iodate test	RA → I_2
Starch/Iodide Test	OA → I_2

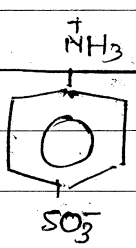
NH_2 1 naphthylamine test

(6) Test by sulphanilic acid +  (Griess Illosavay test)

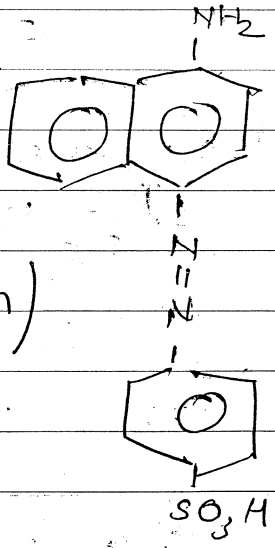




- Its zwitterion

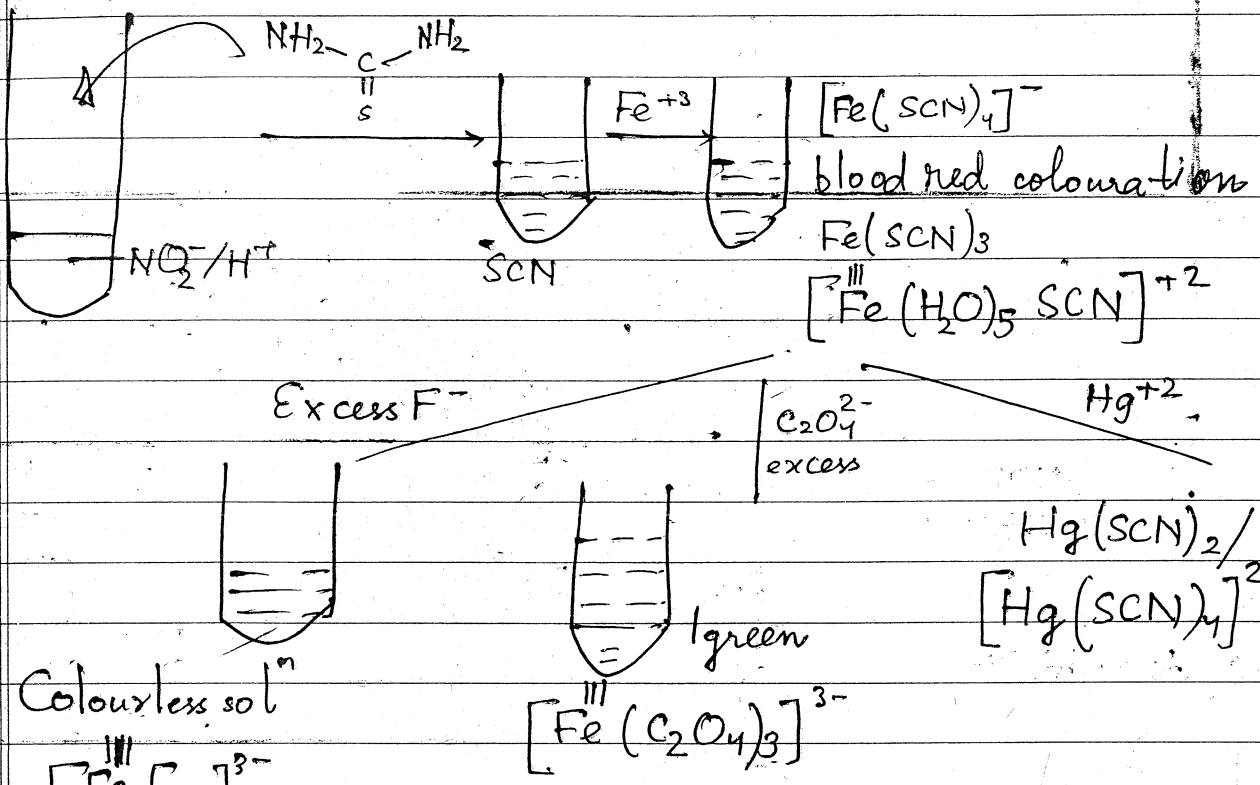


To keep it in deprotonated form (for rxn) CH_3COOH added



15 configuration nearly colourless [Laporte forbidden transitions spin

(7) Test by thio urea



$$NH_2-\underset{\underset{S}{\|}}{C}-NH_2 + NO_2^- \xrightarrow{H^+} SCN^- + N_2 + 2H_2O$$

(8) Test by $AgNO_3$

$$\underset{\text{conc.}}{NO_2^-} + AgNO_3 \longrightarrow \underset{\text{white ppt}}{AgNO_2\downarrow} + NO_3^-$$

classmate Date Page

TEST OF CH_3COO^-

All acetates are water soluble except Hg_2^{2+}, Cu^{2+}, Ag^+

(1) Test by dil H_2SO_4

$$CH_3COO^- + H^+ \longrightarrow CH_3COOH$$

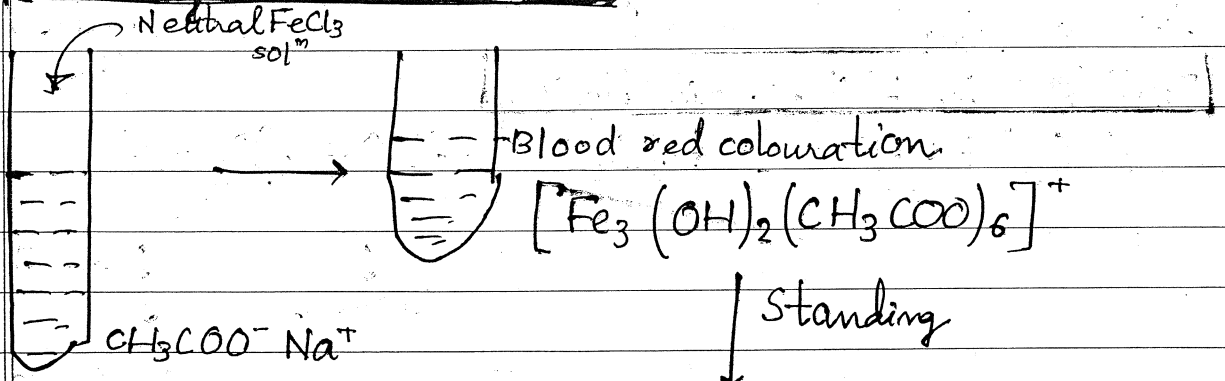
vinegar like odour

(2) Test by C_2H_5OH + Conc. H_2SO_4

$$CH_3COOH + C_2H_5OH \xrightarrow[H_2O]{H_2SO_4} CH_3COOC_2H_5$$

fruity smell (ester)

(3) Test by neutral $FeCl_3$ sol^m



→ Neutral sol^m added since initially basic $FeCl_3$ acidic

→ When acetate ions are identified by $FeCl_3$, $FeCl_3$ sol^n must be neutralised by suitable base (1 to 2 drop NH_4OH) because $FeCl_3$ sol^m is acidic which can protonate acetate ion and decrease concentration of OH^- ion

$Al(OH)_x(OAc)_y$ ↓ white gelatinous

$Cr(OH)_x(OAc)_y$ ↓ green

li $(en)_3$]

olet

Classmate

Date

Page

(4) Test by As_2O_3 (Cacodyl test)

$$4CH_3COO^-Na^+ + As_2O_3 \xrightarrow{\Delta} (CH_3)_2As-O-As(CH_3)_2 + 2Na_2CO_3 + 2CO_2\uparrow$$

(Cacodyl oxide)

(organometallic)

(poisonous irritating gas)

(acid not ~~present~~ isolated)

Test of thiosulphate ($S_2O_3^{2-}$)

~~some~~

IA : Soluble

IIA : Soluble (except : BaS_2O_3)

(Some other Pb^{+2}, Bi^{+3}, Ag^+, Hg^{+2}, Cu^+ all are insoluble)

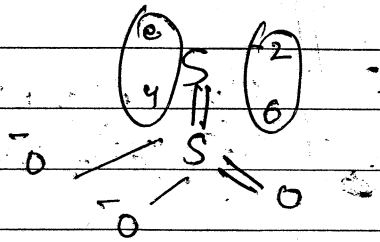
Fe^{+2} : soluble There is only one $S_2O_3^{2-}$ which exist in hydrate form ($Na_2S_2O_3 \cdot 5H_2O$)

(1) Test by dil HCl or dil H_2SO_4

$$S_2O_3^{2-} + 2H^+ \longrightarrow H_2S_2O_3 \rightarrow H_2O + SO_2 + S$$

SO_2 → $Ca(OH)_2$ → $CaSO_3$ milkiness

SO_2 → $Cr_2O_7^{2-}/H^+$ → $Cr^{+3} + SO_4^{2-}$



(5)

- $Cl_2 + H_2O \rightarrow HOCl$ (Less stable Cl)
- OX^- stable

Class Name
Date
Page

(2) Test of $S_2O_3^{2-}$ based on its reducing nature

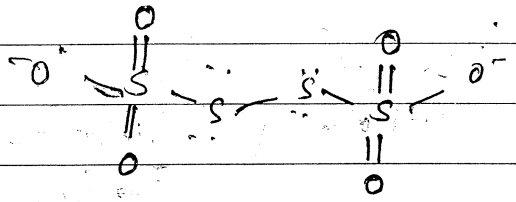
Strong OA

① $MnO_4^-/H^+ \rightarrow SO_4^{2-} + S$
② $Cr_2O_7^{2-}/H^+$
③ MnO_4^-/OH^- (No S)
④ Cl_2 /water
⑤ Br_2 /water
⑥ H_2O_2

$S_2O_3^{2-}$ →

Mild oxidising agent

① Fe^{+3}/H^+ → $S_4O_6^{2-}$
② Cu^{+2} →
③ I_2/I_3^-
↓ violet
↳ brown



- KIO_3 starch no significant test

I^-
↓
I_2
↓
I^-

soft base

Tincture iodine KI_3 ($KI + I_2$)

classmate Date Page

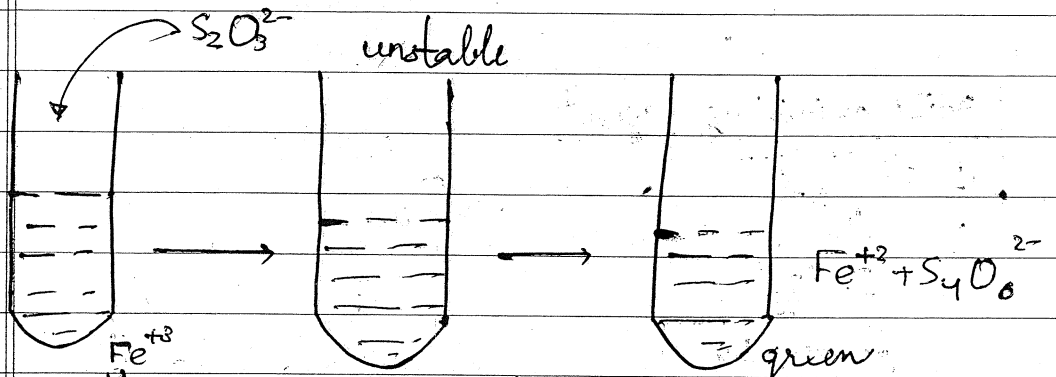
→ $2S_2O_3^{2-} + I_3^- \longrightarrow S_4O_6^{2-} + 2I^-$

brown colourless

→ ○ Used as antichlor in bleaching industry
● removes excess chlorine

→ $Na_2S_2O_3$ (hypo) ~~use~~

→ Removes excess I_2 ✱

→ 

$[Fe^{III}(S_2O_3)_2]^- \rightarrow$ (d^5 ~~Laporte~~ No centre of symmetry)

$2Fe^{+3} + 2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2Fe^{+2}$

(3) $2Cu^{+2} + 2S_2O_3^{2-} \longrightarrow S_4O_6^{2-} + 2Cu^+$

blue excess

$\downarrow S_2O_3^{2-}$

$Cu_2S_2O_3\downarrow$

white ppt (Cu^+)

$\downarrow$ excess $S_2O_3^{2-}$

$[Cu_6(S_2O_3)_5]^{4-}$

(bridging ~~ligand~~ complex ~~structure~~)

$Ag_2S_{aq} \xrightleftharpoons{\Delta} X$

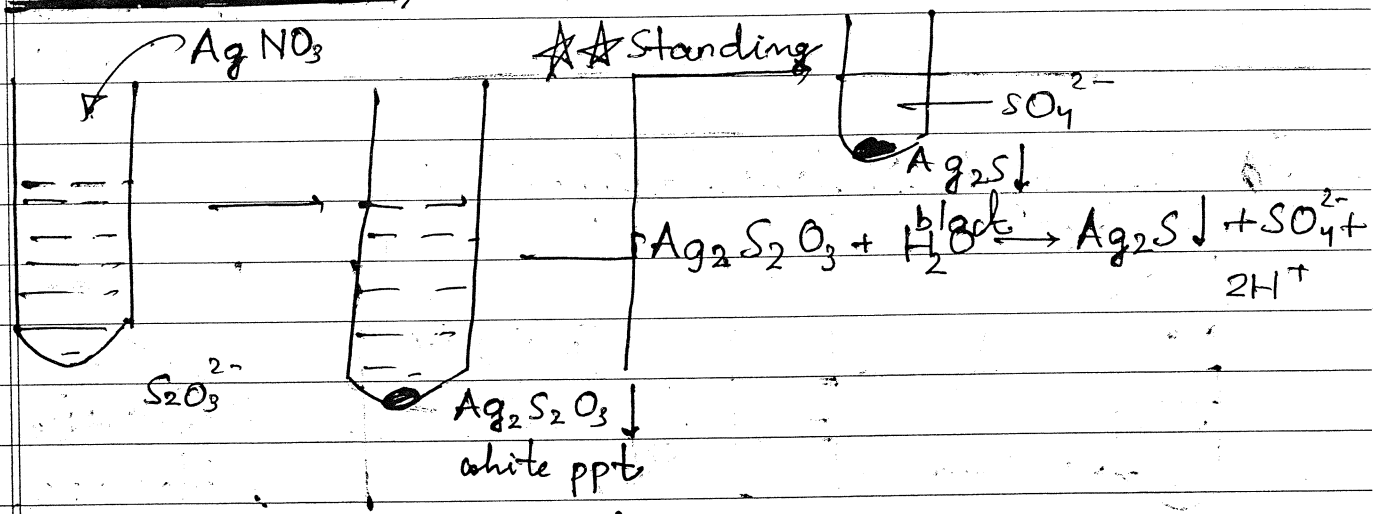
$Ag_2S \xrightarrow[\Delta]{air} 4Ag + SO_2$ roasting

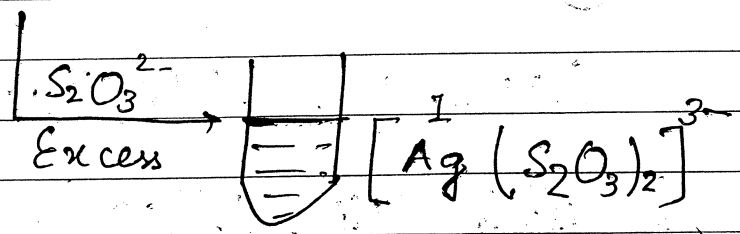
classmate Date Page

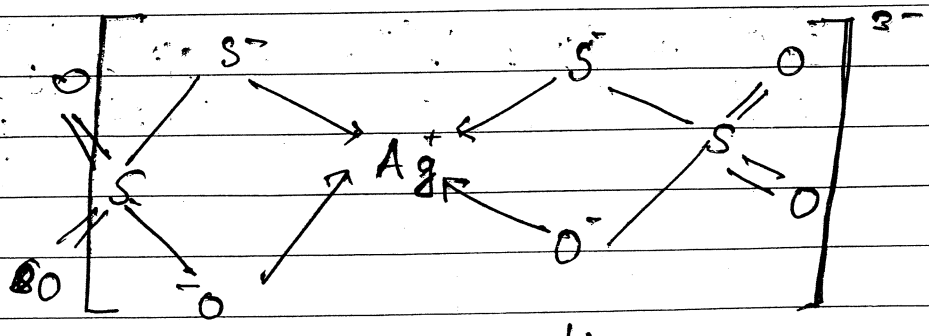
(3) Test by $CaCl_2$ / $BaCl_2$

	$CaCl_2$	$BaCl_2$
CO_3^{2-}	$CaCO_3\downarrow$	$BaCO_3\downarrow$
SO_3^{2-}	$CaSO_3\downarrow$	$BaSO_3\downarrow$
$S_2O_3^{2-}$	No ppt	$BaS_2O_3\downarrow$ white

(4) Test by $AgNO_3$





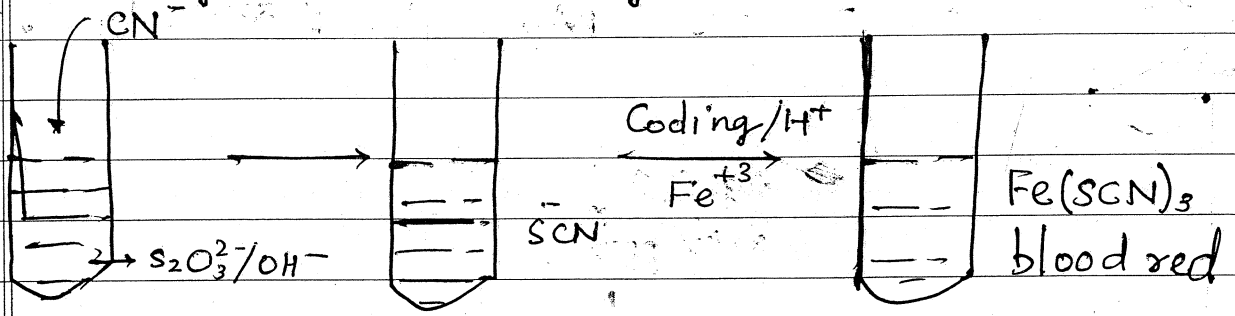


active

tetrahedral

	$S_2O_3^{2-}$	Standing of white ppt	White ppt react with excess $S_2O_3^{2-}$
$b(NO_3)_2$	$PbS_2O_3\downarrow$ white ppt	$PbS\downarrow$ black	$[Pb(S_2O_3)_2]^{2-}$
$:Cl_3$	$Bi_2(S_2O_3)_3\downarrow$ white ppt	$Bi_2S_3\downarrow$ black/brown	$[Bi(S_2O_3)_2]^-$
gCl_2	$HgS_2O_3\downarrow$ white ppt	$HgS\downarrow$ black	$[Hg(S_2O_3)_2]^{2-}$ all colourless sol^n

5 Test by KCN followed by Fe^{+3}



$$\bar{C}N + S_2O_3^{2-} \xrightleftharpoons{OH^-} \bar{S}CN + SO_3^{2-}$$

6 Test by $[Ni(en)_3]SO_4$ violet

$$S_2O_3^{2-}_{\text{sol}^n} + [Ni(en)_3]^{2+} \longrightarrow [Ni(en)_3]S_2O_3\downarrow$$
violet ppt

(7) Iodatalytic test

$$N_3^- + I_{3\,aq}^- \longrightarrow X$$

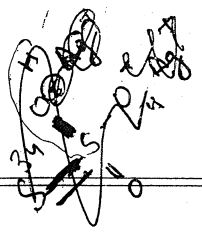
$$2N_3^- + I_3^- \xrightarrow[S^{2-} \text{ or } SCN^-]{S_2O_3^{2-} \text{ or}} 3N_2 + 3I^-$$

(brown)

(8) Blue ring test

$(NH_4)_2MoO_4$ + conc. H_2SO_4

Thiosulphate soln when treated it produce a temporary blue colour at jn pt and is called blue ring test



classmate
Date
Page

agraph

dium thiosulphate is prepared by following two methods

(i) Rxn of sulphur with conc. NaOH

(ii) $Na_2SO_{3\,aq} + S \xrightarrow{Boil} Na_2S_2O_{3\,aq} \xrightarrow{cooling} Na_2S_2O_3 \cdot 5H_2O$ crystals

1. $Na_2SO_{3\,aq} + S^{34} \xrightarrow{boil} (Product-X)$

(Product-X) when react with $AgNO_3$ gives white ppt (Y) which becomes black on standing.

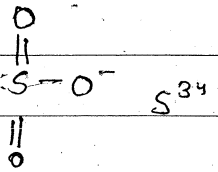
Z is

(A) Ag_2S

(B) Ag_2S^{34}

(C) $Ag_2S + Ag_2S^{34}$

(D) Ag_2O



2 $(Product-X) \xrightarrow[Hq]{dil} NaCl + \underline{P} + \underline{Q}$

P and Q are

(A) $SO_2 + S^{34}$

(B) $^{34}SO_2 + S$

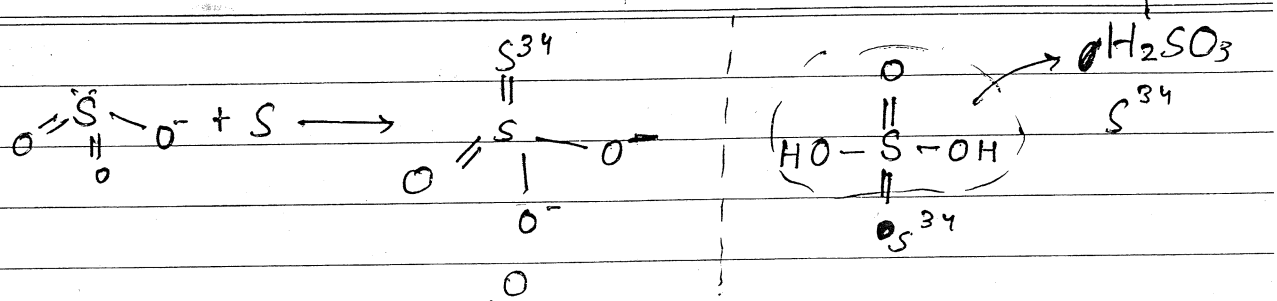
(C) $SO_2 + S$

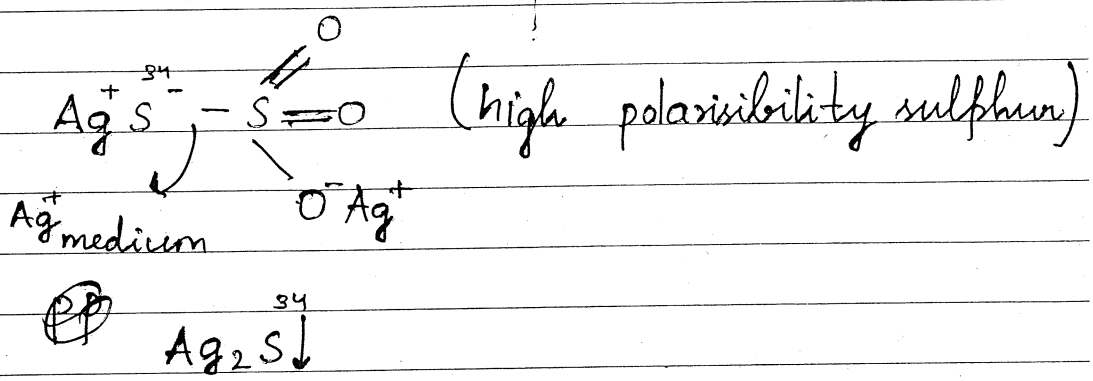
(D) $SO_2 + S^{34}$

3 What is ON of sulphur in product $Na_2S_2O_3$ is strongly heated

(A) 0 (B) −1 (C) +6 (D) +4

~~EXI~~





$Ag_2S\downarrow$

Q3

- $Na_2S_2O_3 + S^0 \longrightarrow Na_2S_2O_3$ (+2)
  $Ag_2S_2O_3 \longrightarrow Ag_2S + SO_4^{2-}$ } −2, 6
  $Na_2S_2O_3 + HCl \longrightarrow H_2O + SO_2 + S^{34}$ } 0, 4

Any One Can be taken as redox

Q3 $4Na_2S_2O_3 \xrightarrow{\Delta} 3Na_2SO_4 + Na_2S_5$