

NCS  
Halogen  
 $\text{ClSO}_3^-$

# SALT ANALYSIS

$\text{BaCl}_2$  aq. classmate

$\text{Hg}(\text{SCN})_2$  colourless

Date \_\_\_\_\_

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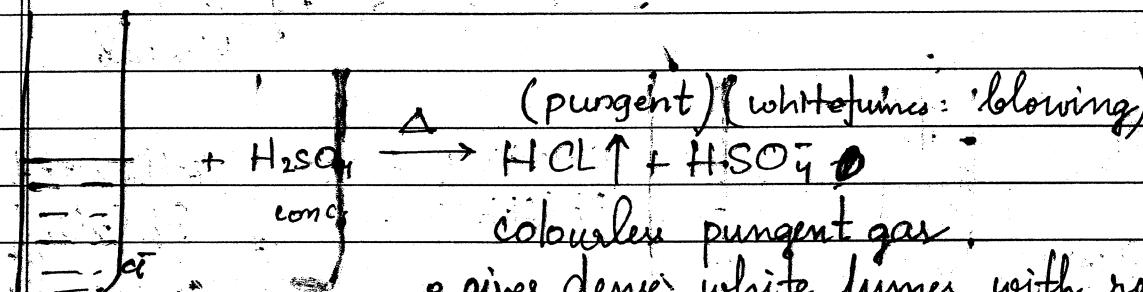
## CLASS-A SUBGROUP II

### TEST OF CHLORIDE

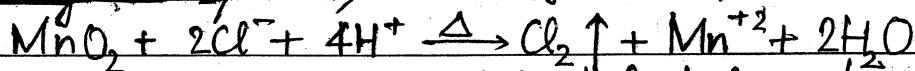
#### Solubility

All chlorides are soluble except  $\text{AgCl}$ ,  $\text{PbCl}_2$ ,  $\text{Hg}_2\text{Cl}_2$ ,  $\text{Cu}_2\text{Cl}_2$ ,  
( $\text{CuCl}$ )

#### 1 Test by conc. $\text{H}_2\text{SO}_4$



#### 2 Test by $\text{MnO}_2/\text{H}^+$ (greenish yellow)



(identified by its bleaching action on coloured organic substances)

#### 3 Test by $\text{AgNO}_3$

dil  $\text{HNO}_3$

No change

$\xrightarrow{\Delta \text{m water}}$  No change

$[\text{Ag}(\text{NH}_3)_2]\text{Cl}$

$\xrightarrow{\text{NH}_4\text{OH}}$  clear soln

Ex

$\xrightarrow{\Delta \text{m water}}$

$\xrightarrow{\text{NH}_4\text{OH}}$

Ex

$\xrightarrow{\text{CN}^-}$

$[\text{Ag}(\text{CN})_2]^-$

Ex

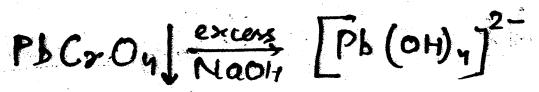
$\xrightarrow{\text{S}_2\text{O}_3^{2-}}$

$[\text{Ag}^+(\text{S}_2\text{O}_3)_2]^3-$

Excess

Nace

$\text{AgCl} \downarrow$   
white

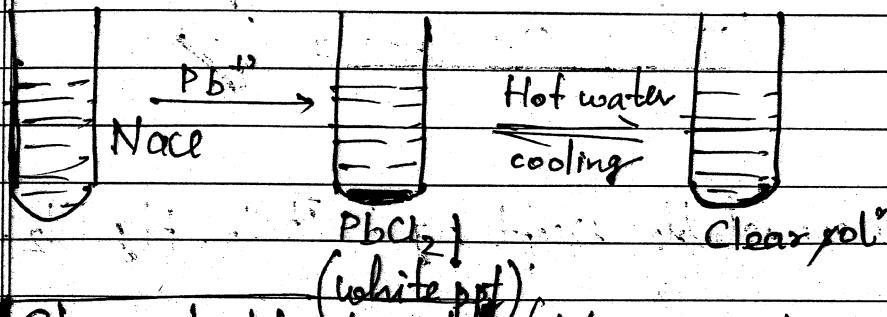


classmate

Date \_\_\_\_\_

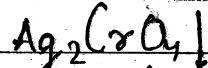
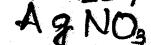
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(4) Test by  $\text{Pb}(\text{NO}_3)_2$

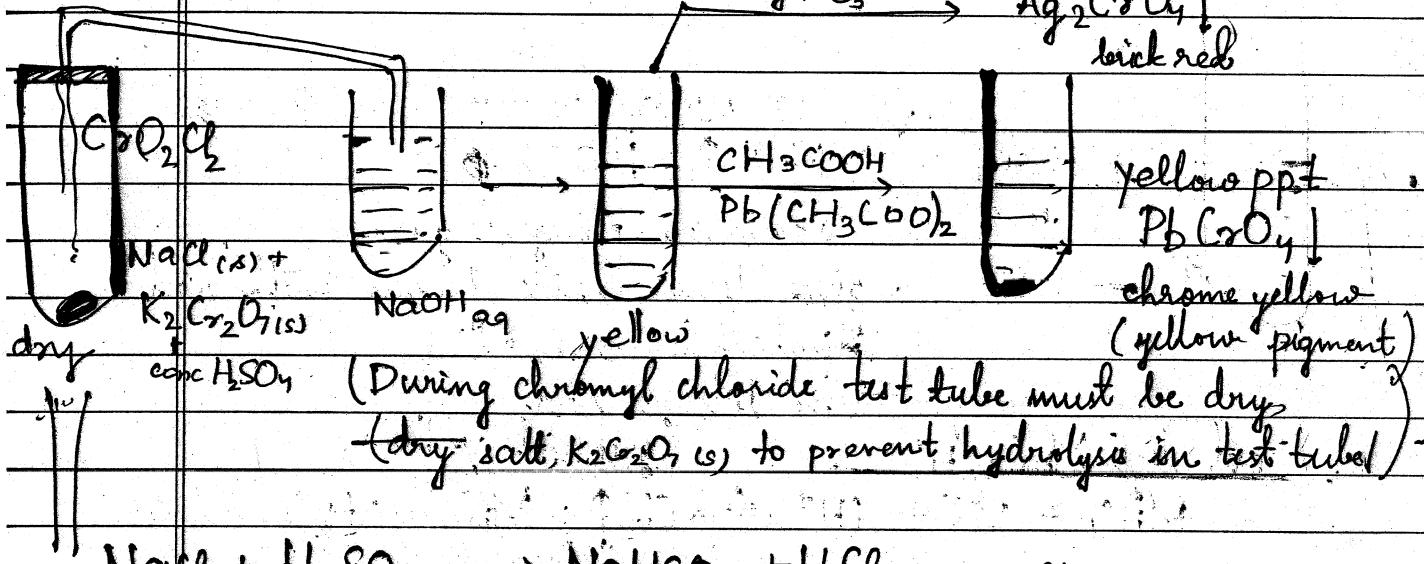


(5) Chromyl chloride Test (Minor product  $\text{Cl}_2$ )

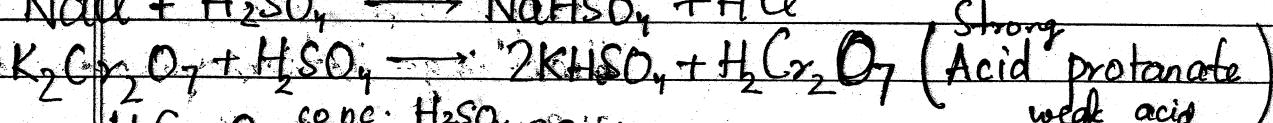
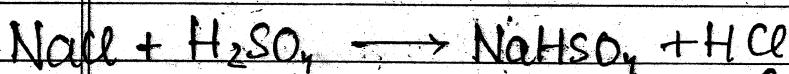
Minor:  $\text{Cl}_2$



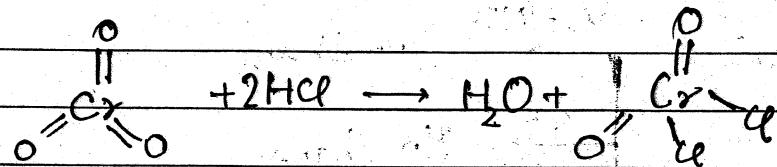
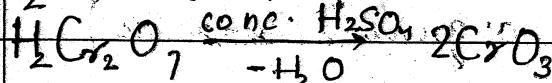
pink red



dry conc  $\text{H}_2\text{SO}_4$  (During chromyl chloride test tube must be dry)  
(dry salt,  $\text{K}_2\text{Cr}_2\text{O}_7$  (s) to prevent hydrolysis in test tube)



Strong acid  
weak acid



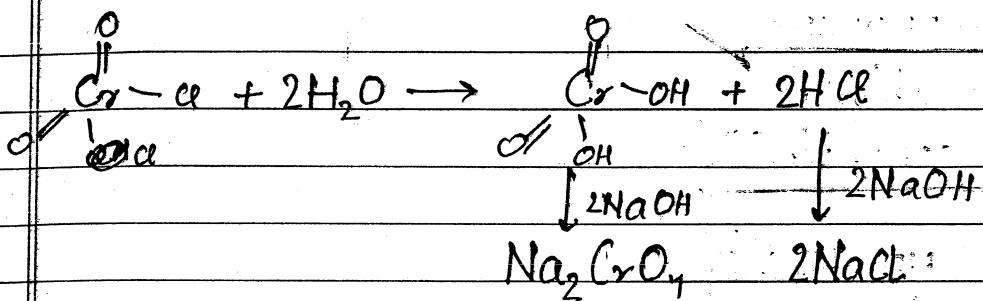
(Red Brion)

(liquid at room temp)

# No Chromyl bromide/nitride test ( $\text{Br}_2, \text{I}_2$ evolved)

Date \_\_\_\_\_

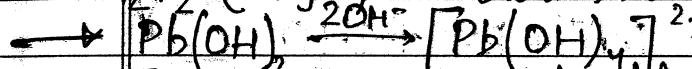
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Chlorides which do not give test:  $\text{AgCl}, \text{PbCl}_2, \text{Hg}_2\text{Cl}_2, \text{HgCl}_2$ ,  
 (Covalent chlorides) (due to less dissociation)  $\text{Cu}_2\text{Cl}_2, \text{BiCl}_3, \text{SnCl}_4, \text{SbCl}_5$   
 (Done by soda extract)

These chlorides do not decompose in dry conditions. Thus  
 No HCl formed  $\rightarrow$  No chromyl chloride formed.

$\rightarrow$  Only two chromium salts are volatile  $\text{CrO}_2\text{Cl}_2$  and  
 $\text{CrO}_2\text{F}_2$  (Highly unstable under given conditions)



If  $\text{CH}_3\text{COO}^-$  not added, Alkaline medium.  $\rightarrow$  Ppt  
 No test

(i) In chromyl chloride chloride test, when crystals of given salt is heated with  $\text{K}_2\text{Cr}_2\text{O}_7$  solid and conc  $\text{H}_2\text{SO}_4$ ,

ii) When given salt is chloride deep red fuma of  $\text{CrO}_2\text{Cl}_2$  is evolved  
 which is hydrolysed in  $\text{NaOH}$  sol<sup>-</sup> and gives sodium chromate

iii) presence of chromate ions in yellow sol<sup>-</sup> indicate formation of  
 chromyl chloride

iv) When chromate ions are identified by  $\text{Pb}^{+2}$  excess of  $\text{NaOH}$  must be  
 neutralise by acetic acid to prevent formation of  $[\text{Pb}(\text{OH})_4]^-$

v) for above chlorides, test is formed by using residue obtained by  
 vapourisation of soda extract

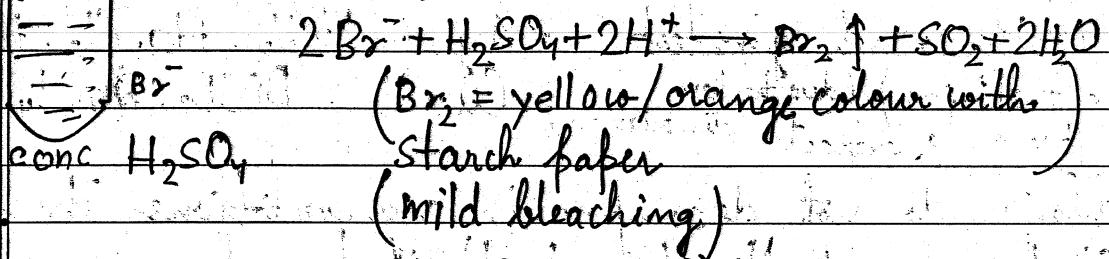
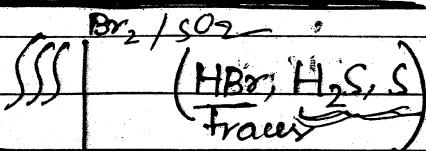
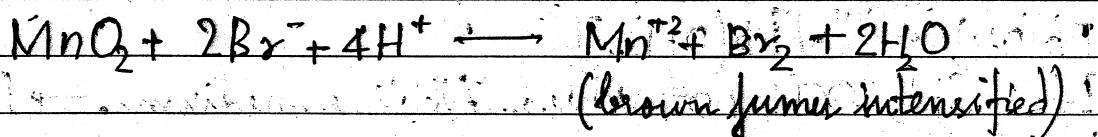
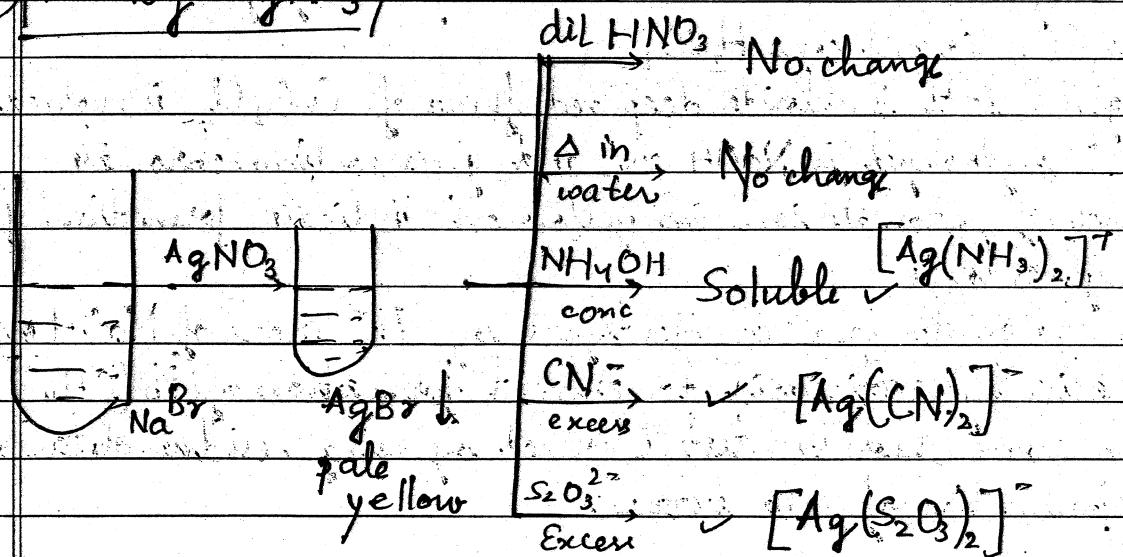
6) I aye. Test

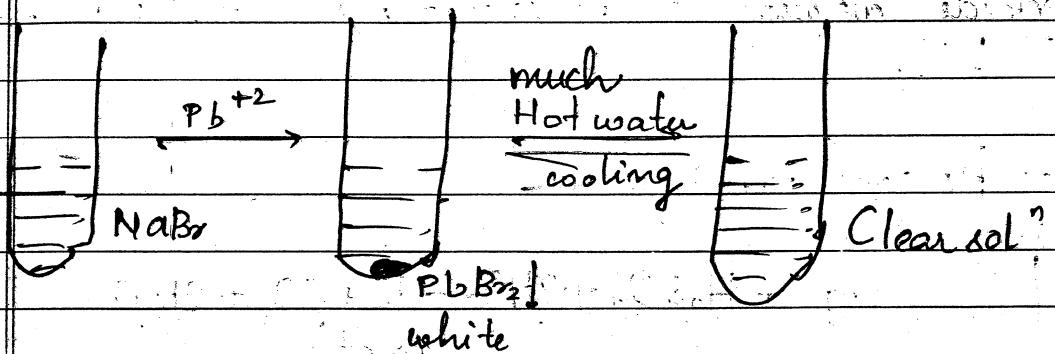
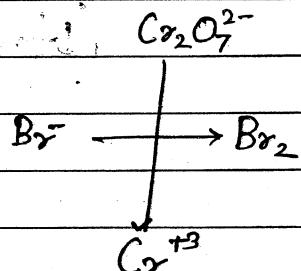
Not applicable

$\text{F}_2$  not afft laboratory reagent

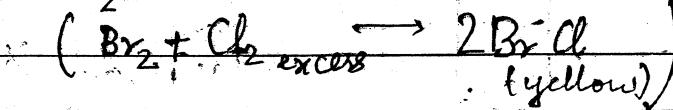
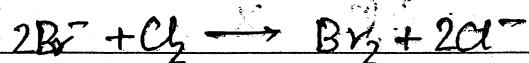
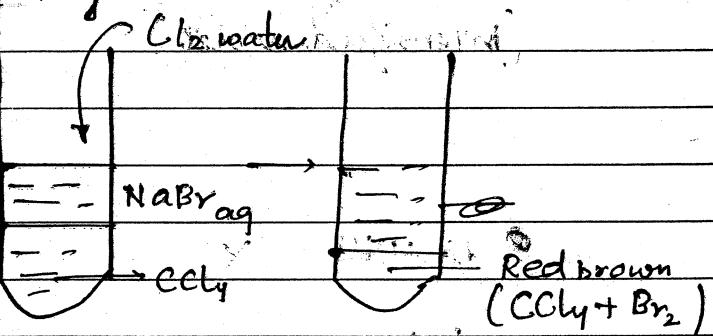
TEST OF BROMIDE

Same as chloride

① Test by conc.  $H_2SO_4$ ② Test.  $MnO_2 + H^+$ ③ Test by  $AgNO_3$ 

(4) Test by  $\text{Pb}(\text{NO}_3)_2$ (5) Test by  $\text{K}_2\text{Cr}_2\text{O}_7$ 

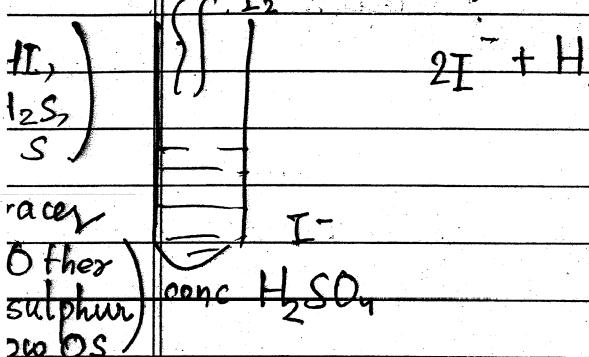
## (6) Layer test



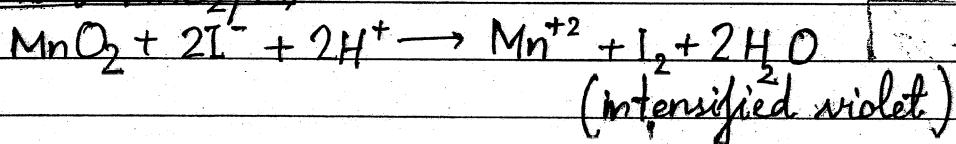
• TEST OF IODIDE }

All iodide are water soluble except AgI, PbI<sub>2</sub>, Hg<sub>2</sub>I<sub>2</sub>, HgI<sub>2</sub>, CuI, BiI<sub>3</sub>

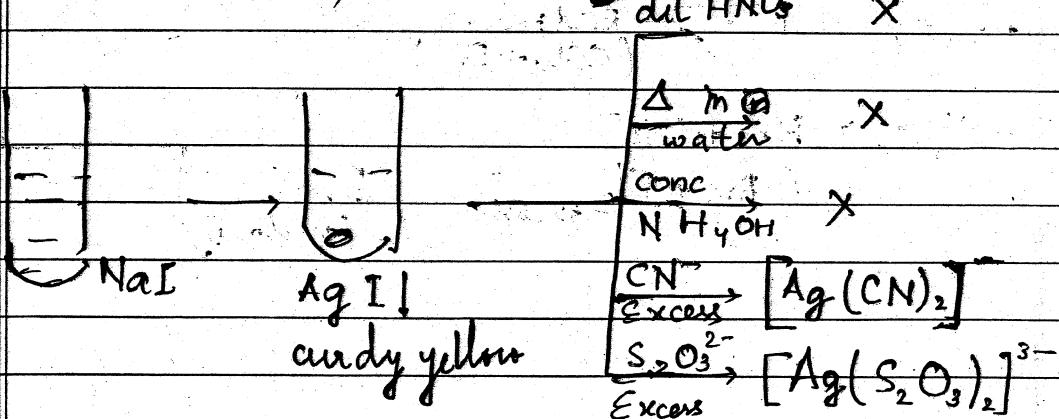
① Test by conc H<sub>2</sub>SO<sub>4</sub>}



② Test MnO<sub>2</sub>/H<sup>+</sup>



③ Test by AgNO<sub>3</sub>



• Solubility AgF > AgCl > AgBr > AgI  
soluble

(R)

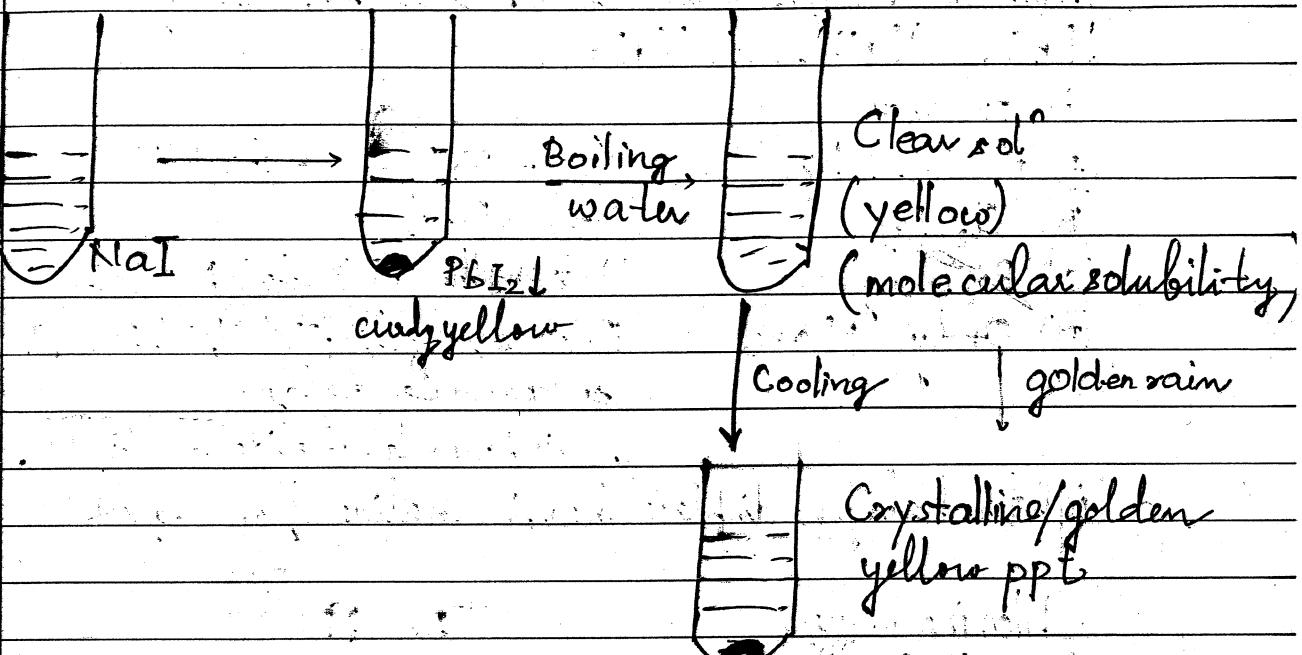
HNO<sub>3</sub> weaker acid than HCl, HBr, HCl, classmate

HI

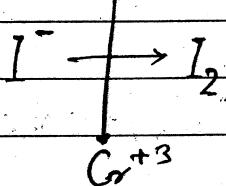
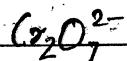
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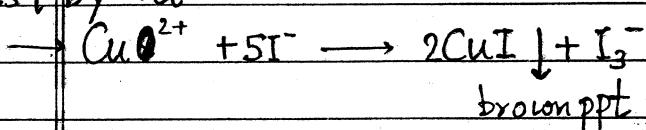
④ Test by Pb(NO<sub>3</sub>)<sub>2</sub>



⑤ Test by K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>



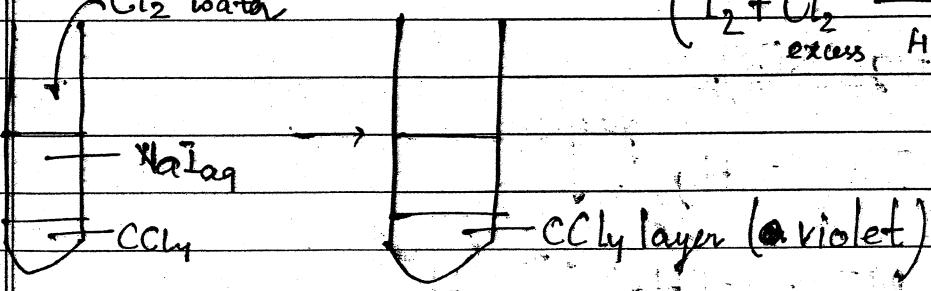
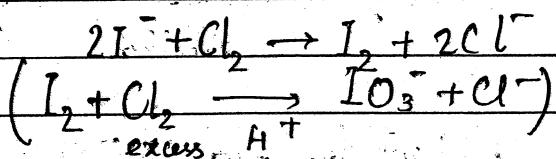
⑥ Test by Cu<sup>2+</sup>

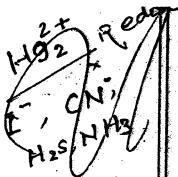


⑥ Layer test

Layer test

Cl<sub>2</sub> water





$\text{CHCl}_3$ , toluene less  $\times$  soluble

Insoluble due to less polarity

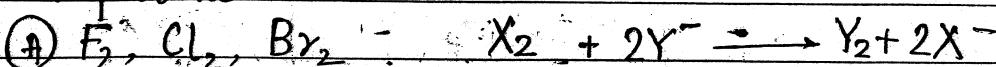
classmate

Date \_\_\_\_\_

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### 6 Layer Test

Q When  $\text{I}_2$  vapours passed in separated soln. in of  $\text{NaF}_{\text{aq}}$ ,  $\text{NaCl}_{\text{aq}}$ ,  $\text{NaBr}_{\text{aq}}$  it. produce



(B)  $\text{Cl}_2, \text{Br}_2$  (O.A.) (R.A.)

(C)  $\text{Br}_2$  only

(D) Only None

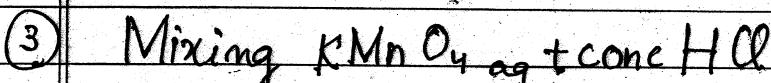
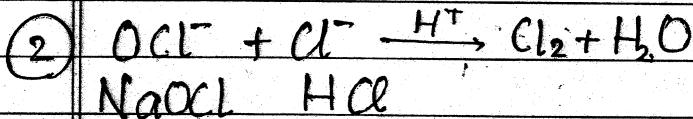
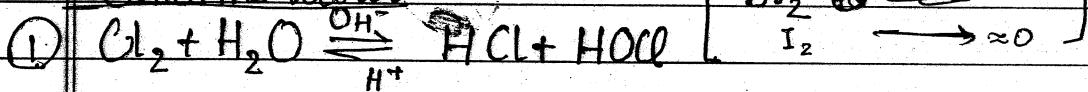
O strength  $\text{F}_2 > \text{Cl}_2 > \text{Br}_2 > \text{I}_2$

R.A. strength  $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$

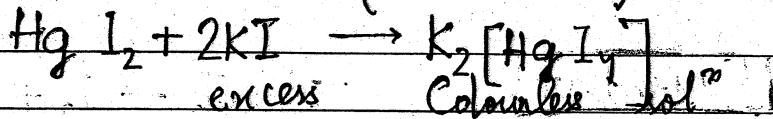
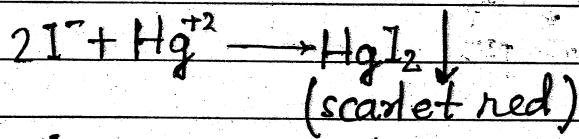
( $\Rightarrow$  upar wala halogen  
richa wala halide ko displace)

Lighter halogen displace heavier halide from aq. soln.

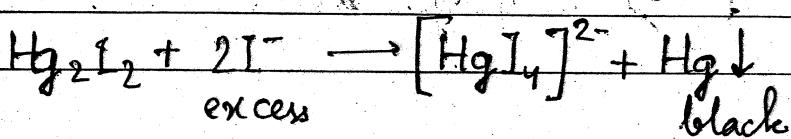
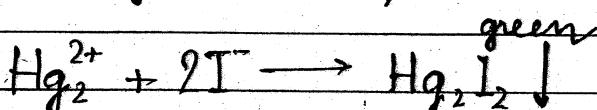
Chlorine water

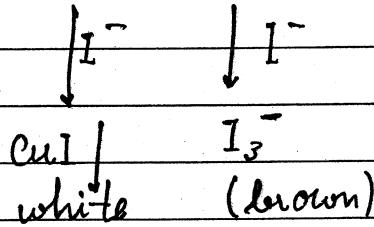
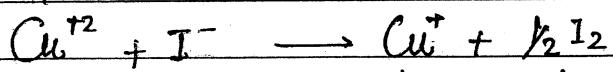
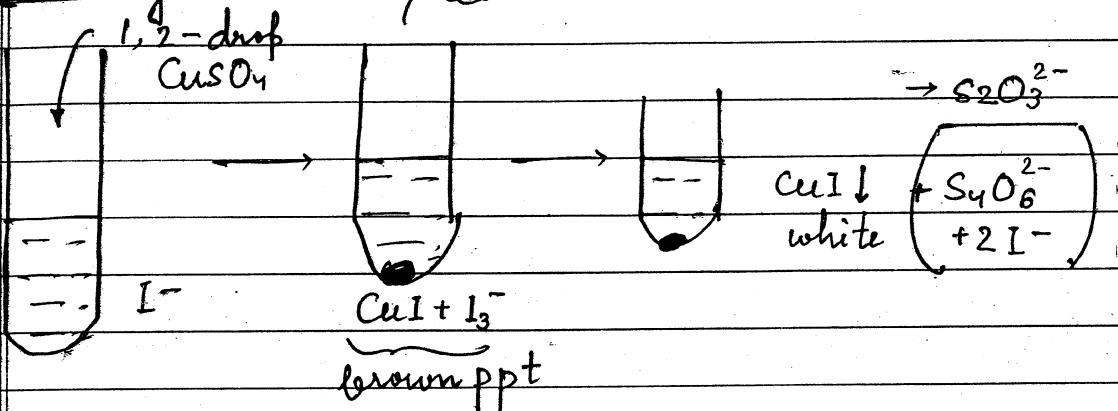


7) Test by  $\text{HgCl}_2$



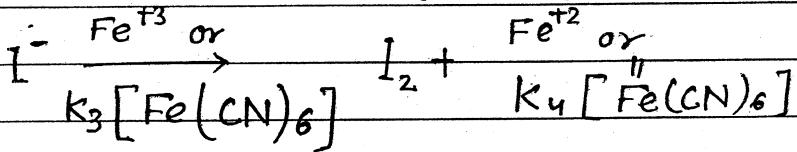
8) Test by  $\text{Hg}_2(\text{NO}_3)_2$



(9) Test by  $\text{CuSO}_4$  $\text{I}_3$  adsorbed on  $\text{CuI}$  (brown)

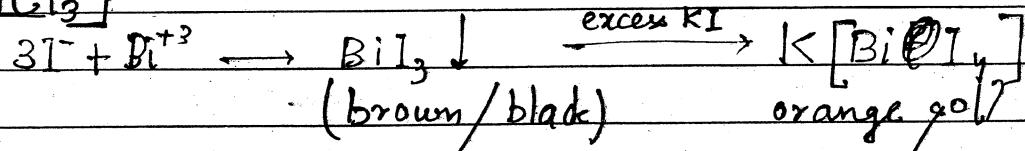
brownish appearance due to adsorption of  
 $\text{I}_3^-$  on  $\text{CuI}$

(10)



$[\text{FeI}_3^{+3}]$  cannot exist under any condition

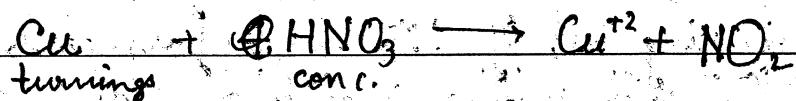
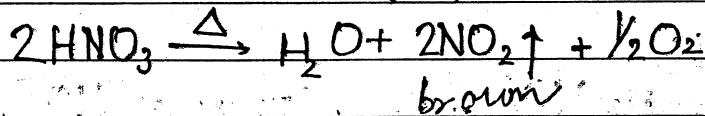
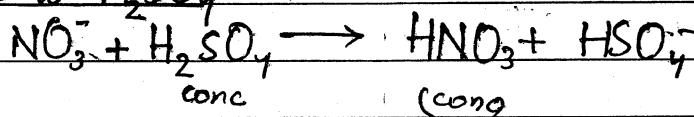
(11)

Test by  $\text{BiCl}_3$ 

## TEST OF NITRATES

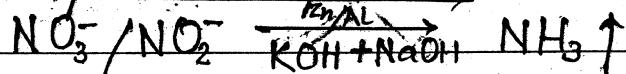
All nitrates are water soluble.

(1) Test by conc  $H_2SO_4$

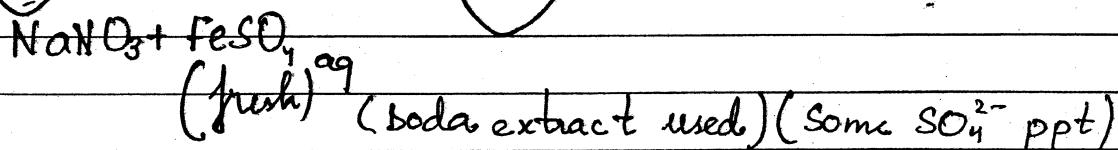
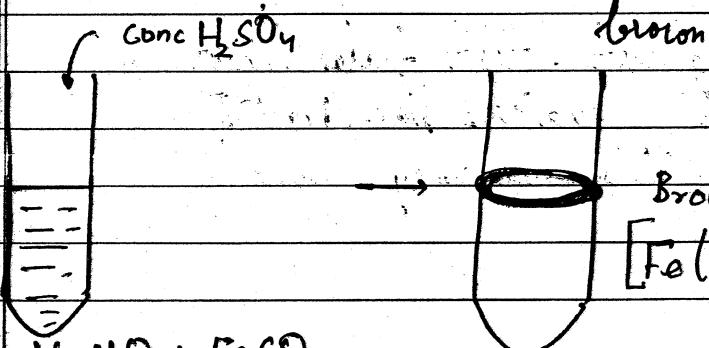
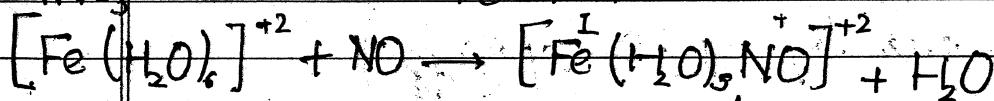
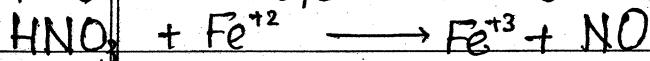
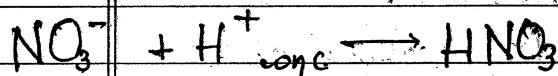


Brown fumes intensified by paper balls due to oxidation of cellulose

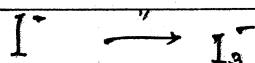
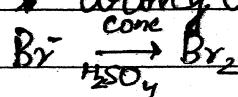
(2) Test by  $Tn/Al + KOH/NaOH$  by nitric acid

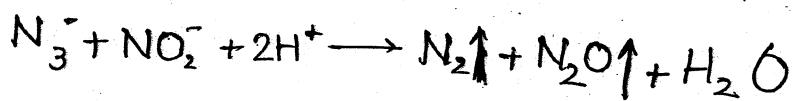


(3) Brown Ring test



To separate  $Br^-$ ,  $I^-$  wrong observations

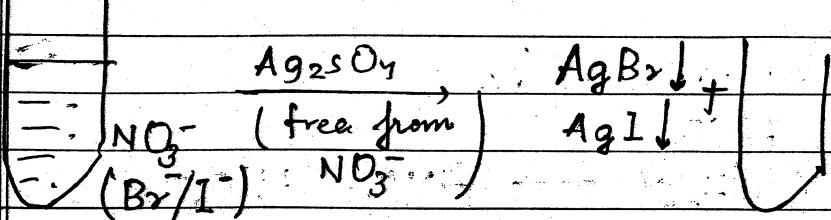




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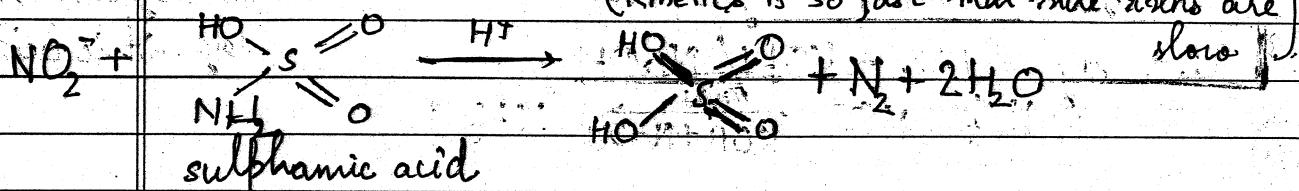
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If

- To separate  $NO_2^-$  from mixture of  $NO_2^-$ ,  $NO_3^-$  then brown ring test of  $NO_3^-$  is performed by reaction of  $NO_2^-$  with sulphamic acid or sodium azide.

(Kinetics is so fast that side reactions are slow.)



- Brown ring test of  $NO_3^-$  is not reliable in presence of  $Br^-$  and  $I^-$  ions because  $Br^-$  and  $I^-$  can produce brown  $\rightarrow$  product  $Br_2$  (soluble) and  $I_3^-$  with conc.  $H_2SO_4$ .
- $Br^-$ ,  $I^-$  removed by  $Ag_2SO_4$  (sparingly soluble)
- During brown ring test, test tube must be free from oxidising radicals like  $MnO_4^-$ ,  $C_2O_4^{2-}$ ,  $ClO_3^-$ ,  $OCl$  etc because they can oxidise  $Fe^{+2} \rightarrow Fe^{+3}$
- Brown fumes.

$\text{F}_2$   
table tills  
 $10^\circ\text{C}$

Quiz 27

$\text{CaF}_2$ : strength of teeth

classmate

Date \_\_\_\_\_

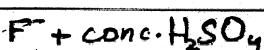
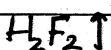
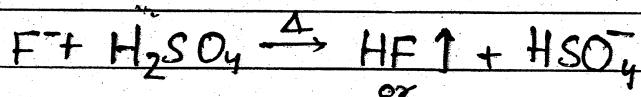
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$\text{MgF}_2$   
 $\text{AlF}_3$

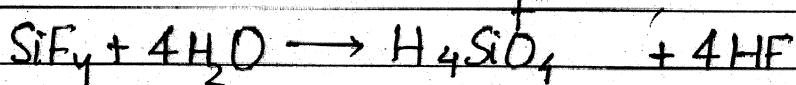
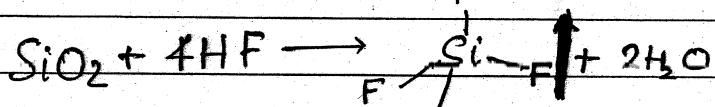
### Fluoride Ion

all fluorides are water insoluble except IA,  
 $\text{NH}_4\text{F}$ ,  $\text{AgF}$ ,  $\text{PbF}_2$ ,  $\text{BeF}_2$ ,  $\text{NiF}_2$ ,  $\text{FeF}_3$ ,  $\text{FeF}_2$  etc.

#### 1 Test by conc. $\text{H}_2\text{SO}_4$

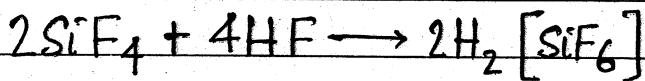


#### 2 Test by $\text{SiO}_2$ + conc. $\text{H}_2\text{SO}_4$



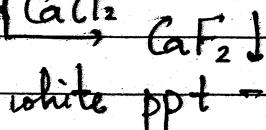
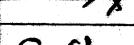
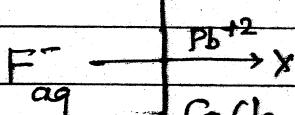
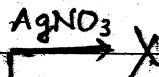
(waxy acid)

or (silicates)

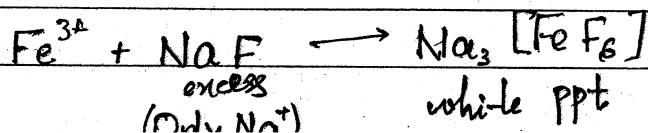
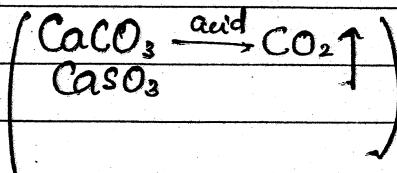


3

#### PPT test



white ppt =

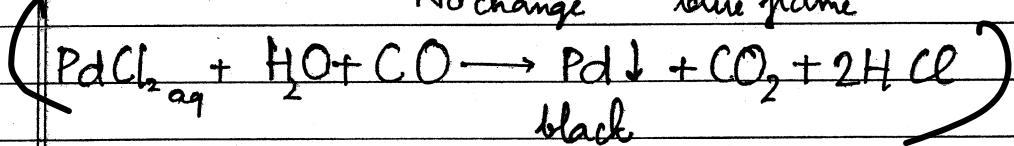
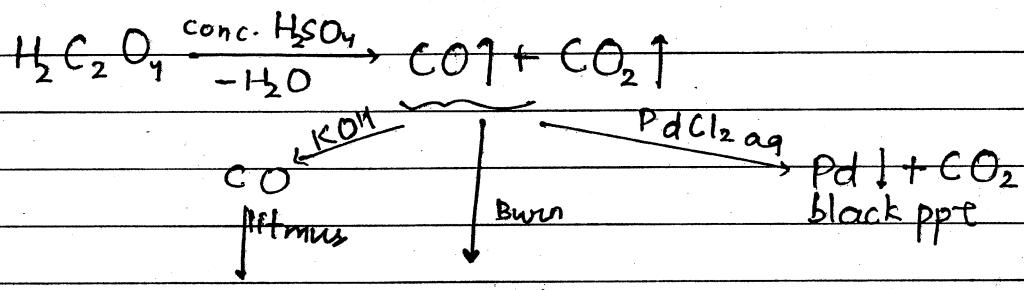
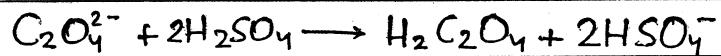


(white ppt)

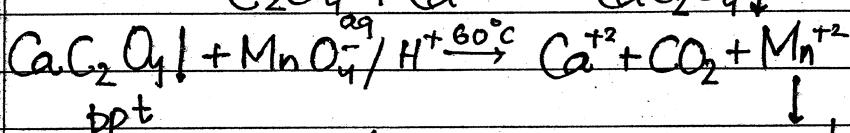
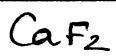
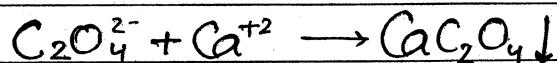
## TEST OF $C_2O_4^{2-}$ (oxalate)

All oxalates are water insoluble except IA, ammonium oxalate,  $BeC_2O_4$ ,  $FeC_2O_4$

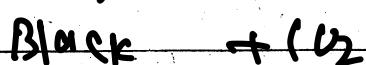
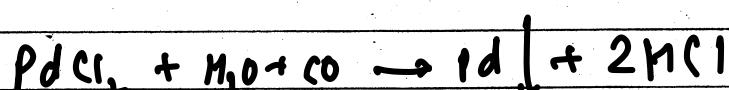
### ① Test by conc $H_2SO_4$



white



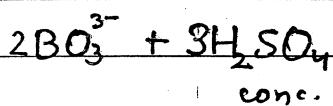
(Oxalic acid  
 titration with  $KMnO_4$ )  $\downarrow$  autocatalysis



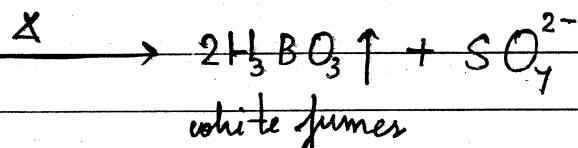
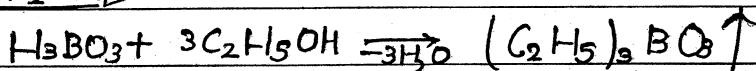
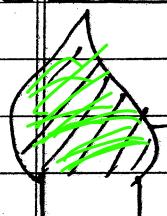
Ag.

TEST OF  $\text{BO}_3^{3-}$ 

IA borates soluble

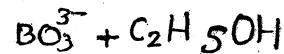
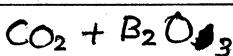
(1) Test by conc.  $\text{H}_2\text{SO}_4$ 

No heating No volatile product  
( $\text{H}_3\text{BO}_3$  is at room temp)

(2) Test by  $\text{C}_2\text{H}_5\text{OH}$  + conc.  $\text{H}_2\text{SO}_4$ 

(ethyl borate)

(burn with green flame)



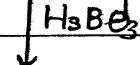
useo

green

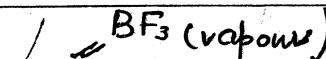
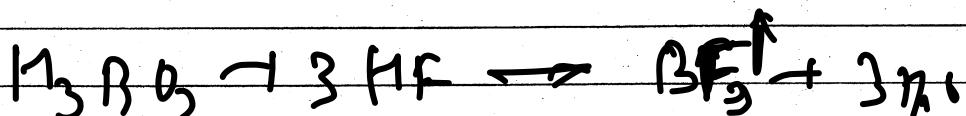
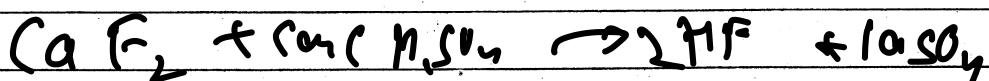
$\text{H}_3\text{BO}_3$  burn blue flame

green

If of  $\text{Ba}^{+2}$  present [  $\text{F}^-$  added  $\rightarrow \text{HF}$  ]



green flame

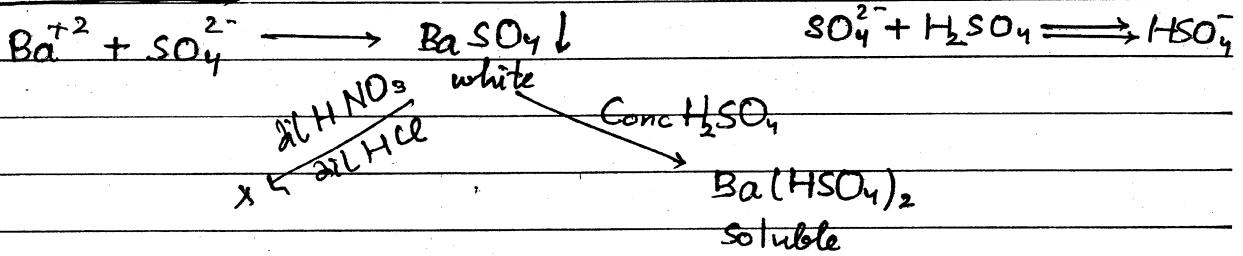
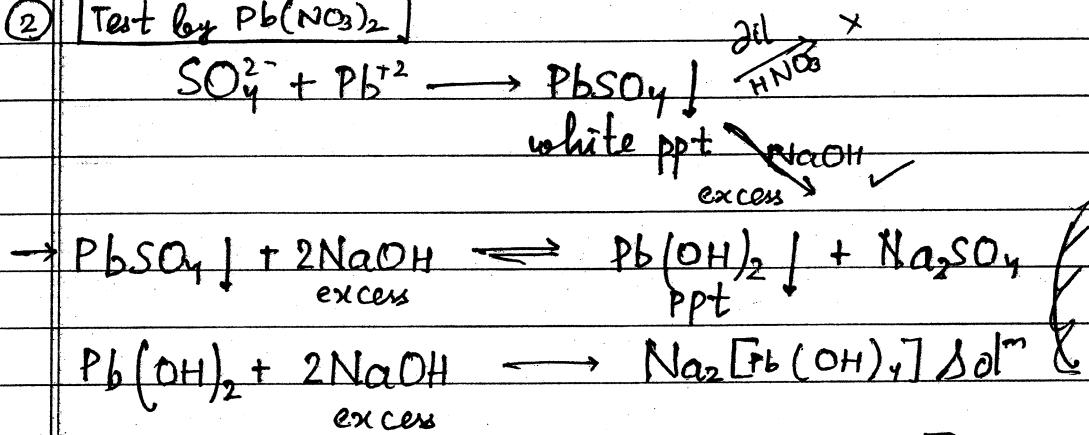
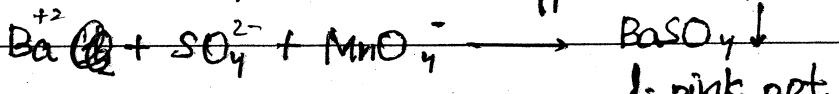
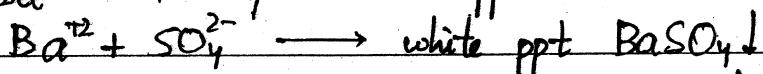
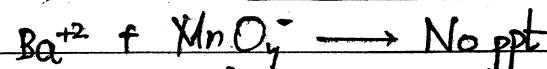
BF<sub>3</sub> $\text{C}_2\text{H}_5\text{OH}$  added

(green flame)  
on burning

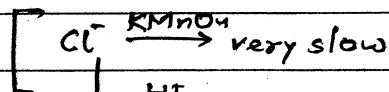
## GROUP B

## TEST OF SULPHATES

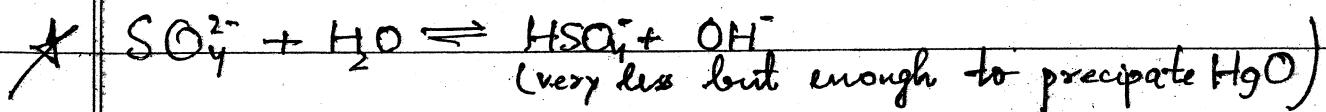
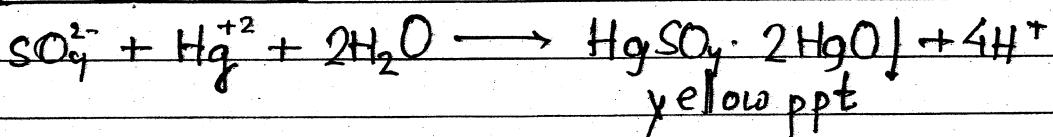
All sulphates are water soluble except  $\text{Ca}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Ba}^{+2}$ ,  $\text{Pb}^{+2}$ ,  $\text{Hg}^{2+}$ ,  $\text{Ag}^{+}$   
 $(\text{CaSO}_4, \text{Ag}_2\text{SO}_4, \text{Cs}_2\text{SO}_4)$

(1) Test by  $\text{BaCl}_2$ (2) Test by  $\text{Pb}(\text{NO}_3)_2$ (3) Test by  $\text{KMnO}_4 + \text{Ba}(\text{NO}_3)_2$ 

(due to ~~Pb~~ chemisorption of  
 $\text{MnO}_4^-$ )



$\text{BaCl}_2$   
can be used

(4) Test by  $\text{HgCl}_2$ 

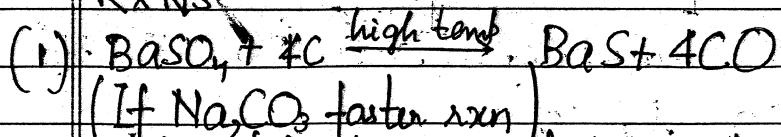
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classmate

Date \_\_\_\_\_

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Rxns



o alkali metals do sulphates do not decompose  
alkali earth metal sulphates  $T > 800^\circ\text{C}$   $\text{MO} + \text{SO}_2 + \frac{1}{2}\text{O}_2$

Ppt of  
color of  
phosphate same as that of  
except  $\text{Ag}_3\text{PO}_4$   
yellow.

$\text{CrO}_4^{2-}$  chromate classmate  
 $\text{MnO}_4^{2-}$  manganate Page  
 $\text{WO}_4^{2-}$  tungstate

Test of  $\text{PO}_4^{3-}$

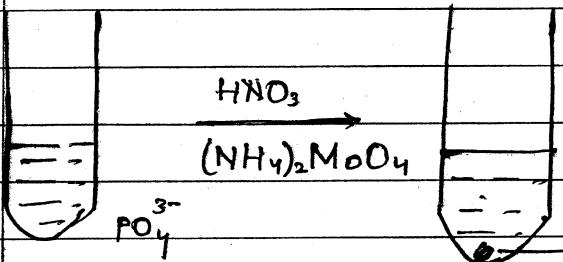
Quiz 27

Race 38  
Q1  $\text{Na}_2\text{SO}_3$

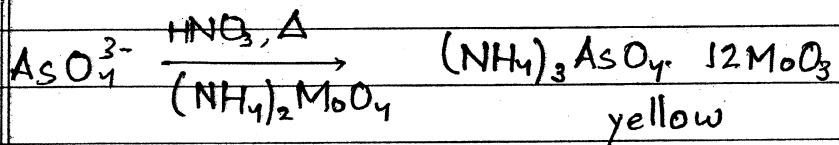
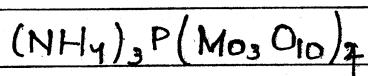
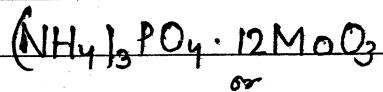
① Test by ammonium molybdate

$$\sin^2 \theta$$

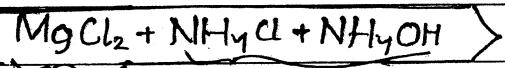
$$\frac{1}{2} \left( \frac{1}{2} \right) \left( \frac{1}{2} \right) (20)$$



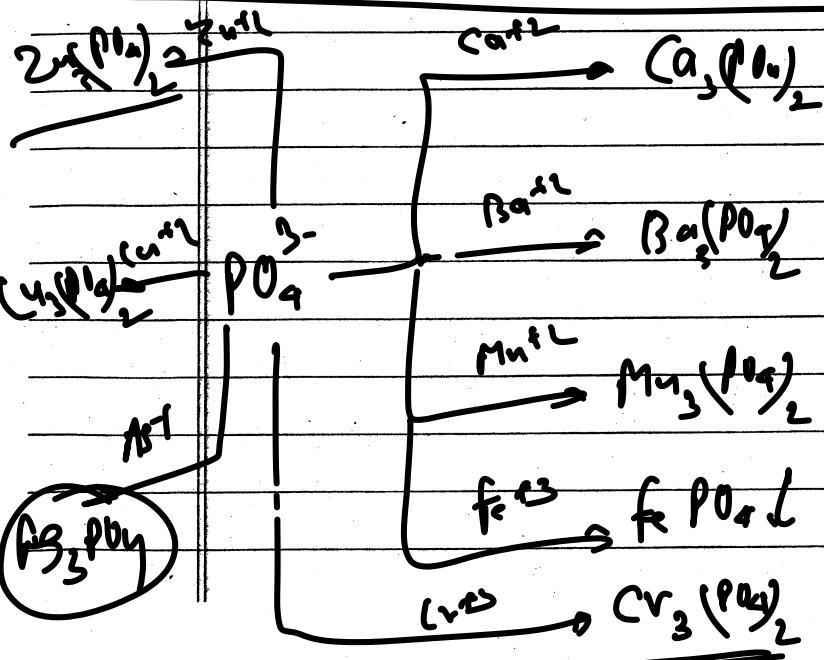
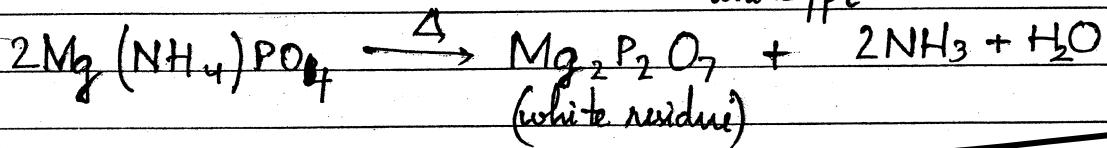
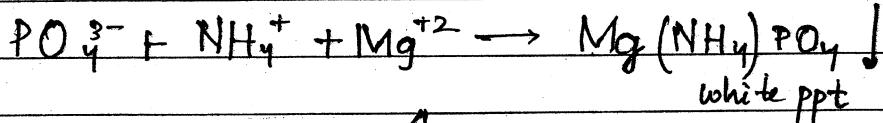
Canary yellow ppt



② Test by Magnesia mixture



acidic basic medium less protonation of  $\text{PO}_4^{3-}$



## Heating in Oxidising Flame

flame

Gold

Blue

reddish brown

light violet

yellow

$\text{Co}^{+3}$

$\text{Co}^{2+}$

Cold

Hot

red opaque

yellow

light violet

yellowish brown

dark yellow

Hot

colours

grey

colours

green

green

Cold

colours

grey

colours

green

Hot

colours

grey

colours

green

Cold

colours

grey

colours

green

## Reducing Flame

flame

Hot

green

yellow

light violet

yellowish brown

dark yellow

blue

Cold

colours

grey

colours

green

Hot

colours

grey

colours

green

Cold

colours

grey

colours

green

Hot

colours

grey

colours

green

Cold

colours

grey

colours

green

classmate

Date \_\_\_\_\_

Page \_\_\_\_\_

# TEST OF CATION

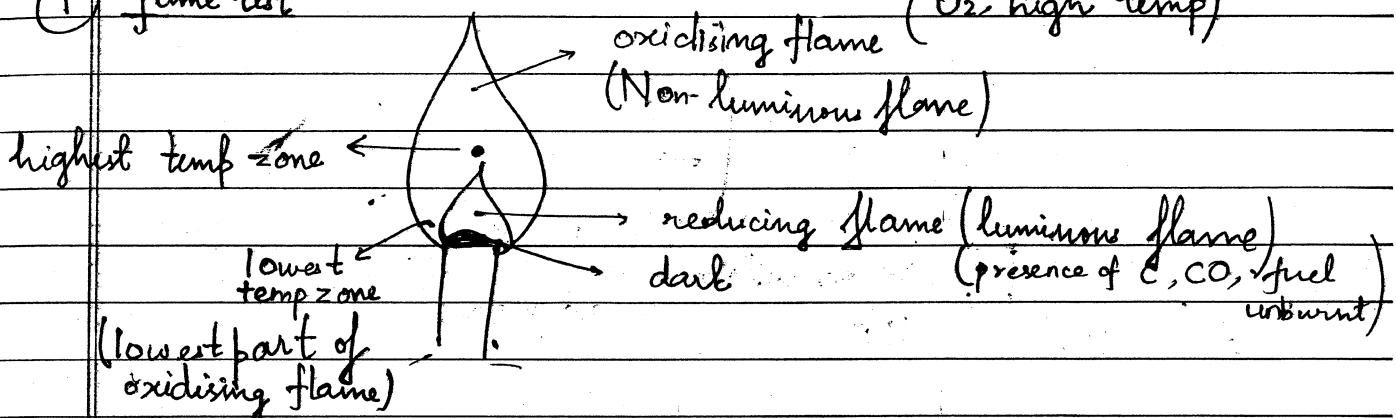
classmate \_\_\_\_\_

Date \_\_\_\_\_

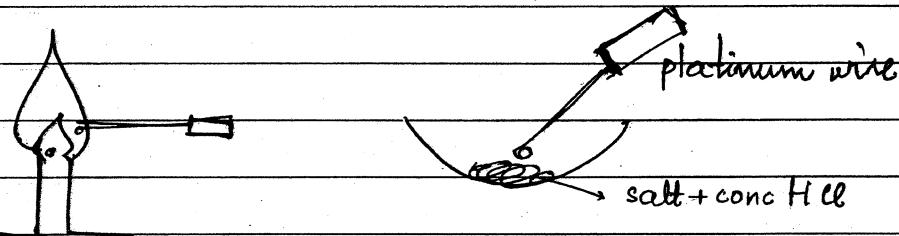
Page \_\_\_\_\_

## Flame Test

(i) flame test



flame



Li Crimson red

Na Golden yellow

K Lilac/violet

Rb Ruby red

Cs Blue

Be } x

Mg }

Ca : Brick red

Sr : Crimson red

Ba : apple green

Pb : Blue

Cu : blue green

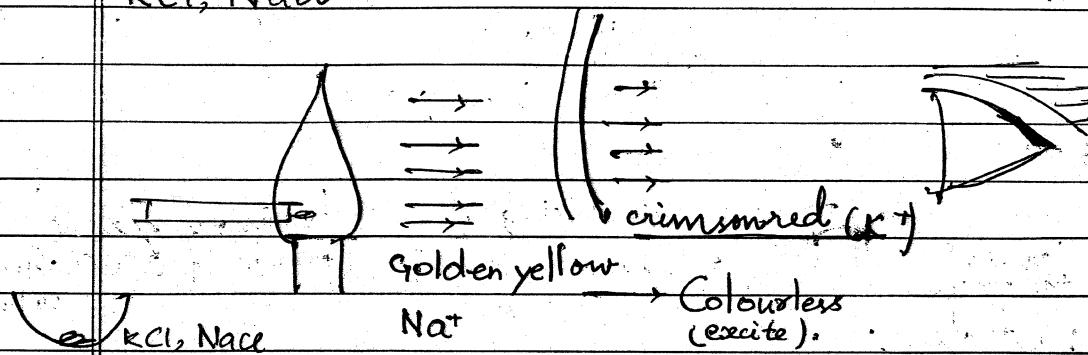
$\text{BO}_3^{3-}$  : green

(i) conc. HCl is used to prepare paste of salt because chlorides are relatively more volatile on flame. This is example of emission spectra.

(ii) platinum used since it inert

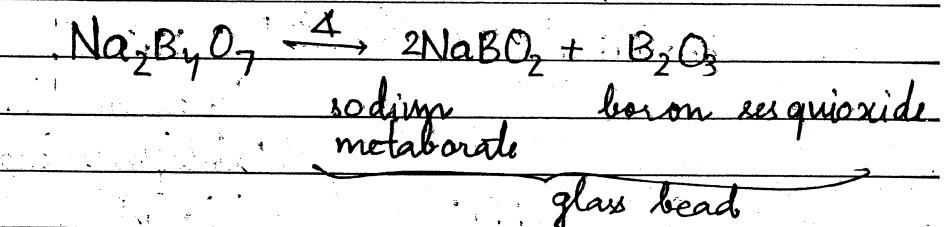
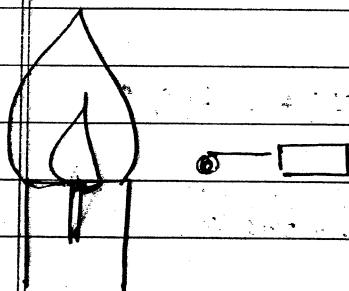
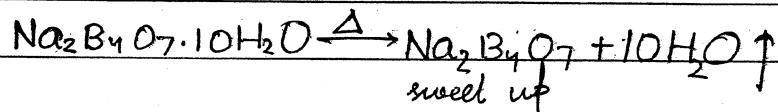
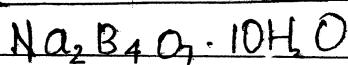
- Inferences when both present.

KCl, NaCl

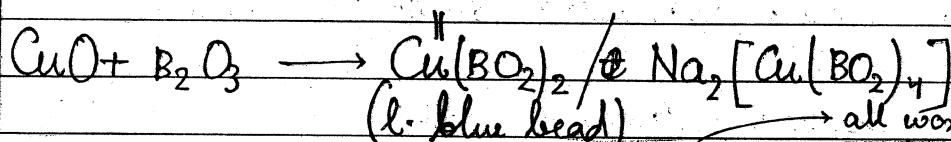
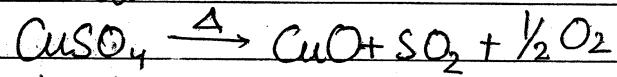


Colour of flame through Inference  
blue cobalt glass



DryBorax Bead Test

- dip in salt

Fe(B)

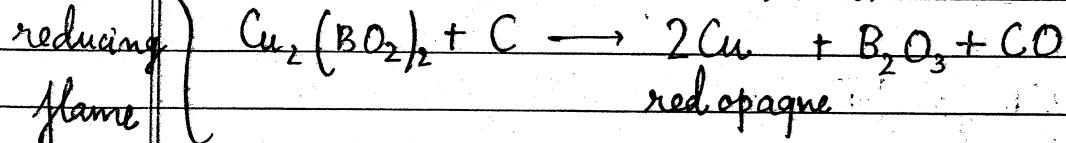
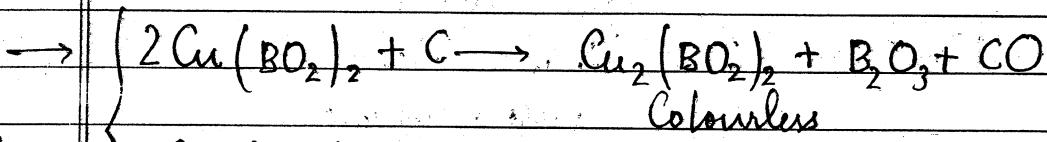
$$\text{Fe}(\text{BO}_2)_3 : \text{yellow bead} \quad \text{colour of bead}$$

$$\text{Ni}(\text{BO}_2)_2 : \text{brown} \quad " \quad \text{when cold}$$

$$\text{Cr}(\text{BO}_2)_3 : \text{green} \quad "$$

$$\text{Cu}(\text{BO}_2)_2 : \text{l. blue} \quad "$$

$$\text{Co}(\text{BO}_2)_2 : \text{d. blue} \quad "$$

$$\text{Mn}(\text{BO}_2)_2 : \text{light pink/violet} \quad "$$


- The colour above appears in silicates, sulphates etc. due to same ligand  $\text{O}^{2-}$ .

2

## Test of metal ion.

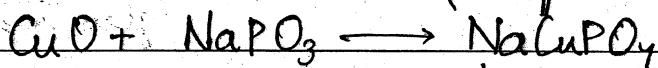
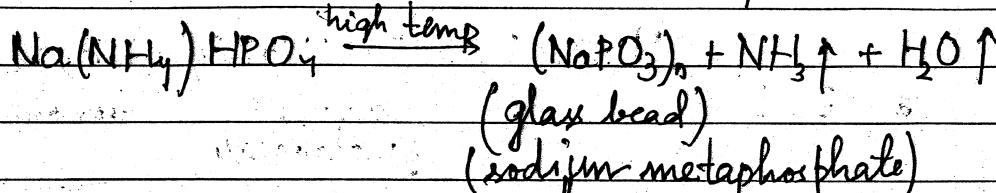
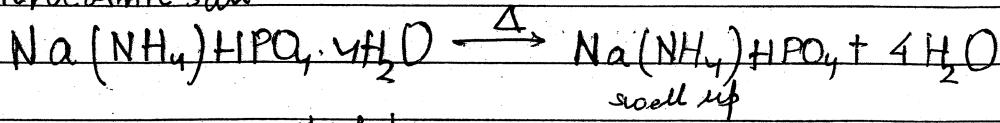
classmate

Date \_\_\_\_\_

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### (3) MICROSCOPIC SALT BEAD TEST

microscopic salt

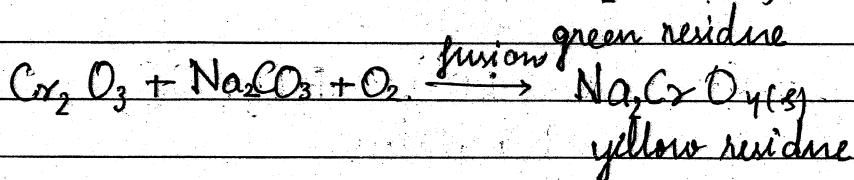
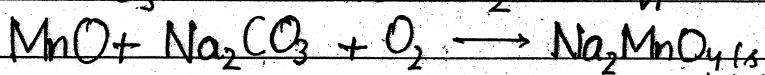
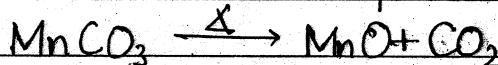
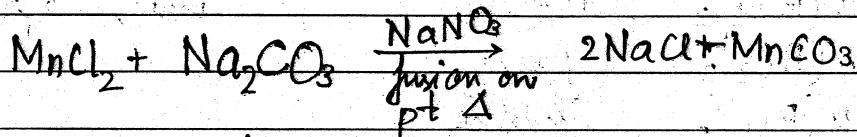


1. blue  
(phosphatic)

- phosphate, silicate, aluminate, borate same colour

### (4) $\text{Na}_2\text{CO}_3$ bead test or fusion mix test

Fusion Mix:  $\text{Na}_2\text{CO}_3 + \text{NaNO}_3$  or  
 $\text{KNO}_3$

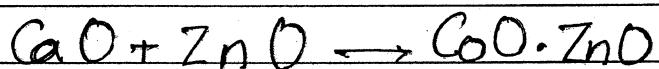
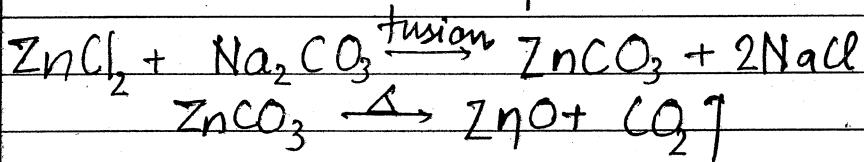
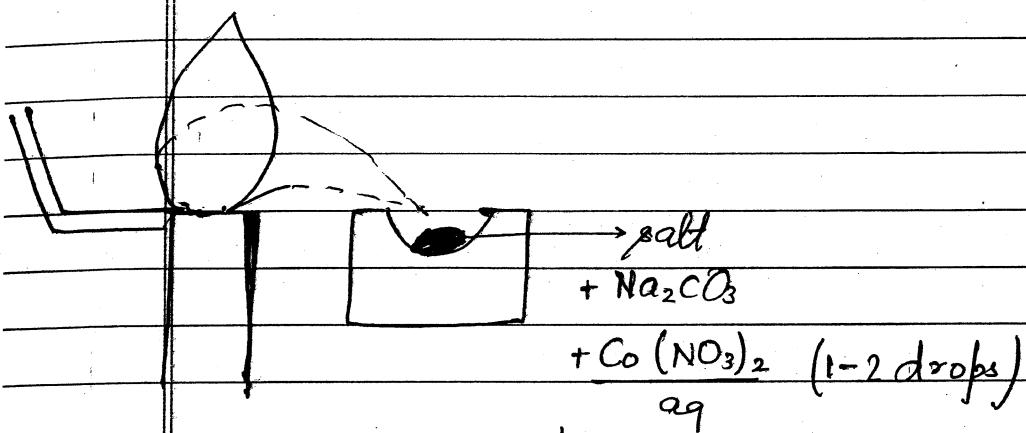


Only valid for  $\text{Mn}^{+2}$ ,  $\text{Cr}^{+3}$

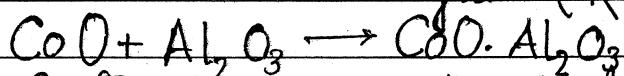
Date \_\_\_\_\_  
Page \_\_\_\_\_

(Yellow residue when hot, Charcoal cavity test  
grey metal when cold)  $Pb^{2+}$

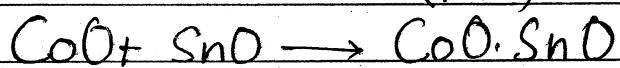
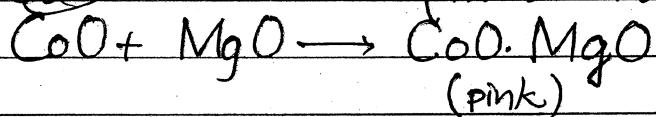
### (5) Cobalt nitrate charcoal cavity test



green (Raiemian green)



~~CoO~~ (Thimard blue)



(bluish white)

- Charcoal cavity used to prevent oxidation of  $CoO \rightarrow Co_2O_3$  by oxidising flame
- ~~CoO~~ used due to unique colour with ions

(6) WET TEST

## CLASSIFICATION OF CATIONS

GP No.

Cations

group reagents

ppt and colour

I  $\text{Ag}^+$ ,  $\text{Hg}_2^{2+}$ ,  $\text{Pb}^{2+}$ 

dil HCl

 $\text{AgCl}$ ,  $\text{Hg}_2\text{Cl}_2$ ,  $\text{PbCl}_2$ 

orange honge punjabi

white ppt

II. (A)  $\text{Pb}^{2+}$ ,  $\text{Cu}^{+2}$ ,  $\text{Bi}^{+3}$ ,  $\text{Hg}^{+2}$ ,  $\text{Cd}^{+2}$ violet  $\xrightarrow{\text{Hg}} \text{S}^2-$   $\xrightarrow{\text{Hg}} \text{Hg}^{+2}$ 

dil. HCl

black ppt:  $\text{PbS}$ ,  $\text{HgS}$ ,  $\text{CuS}$ ,  $\text{Bi}_2\text{S}_3$ brown:  $\text{Bi}_2\text{S}_3$ ,  $\text{SnS}$ yellow:  $\text{SnS}_2$ ,  $\text{As}_2\text{S}_3$ ,  $\text{As}_2\text{S}_5$ (B)  $\text{As}^{+3/+5}$ ,  $\text{Sb}^{+3/+5}$ ,  $\text{Sn}^{+2}$ ,  $\text{Sn}^{+4}$ 3 $\xrightarrow{\text{Hg}}$  2 $\xrightarrow{\text{Hg}}$  2 $\xrightarrow{\text{Hg}}$  2 $\xrightarrow{\text{Hg}}$ orange:  $\text{Sb}_2\text{S}_3$ ,  $\text{Sb}_2\text{S}_5$ III  $\text{Al}^{+3}$ ,  $\text{Cr}^{+3}$ ,  $\text{Fe}^{+3}$ 

all creepsati fakin

 $\text{NH}_4\text{Cl}$  $\text{Al(OH)}_3$ : white $\text{NH}_4\text{OH}$  $\text{Cr(OH)}_3$ : green $\text{Fe(OH)}_3$ : red brownIV  $\text{Ni}^{+2}$ ,  $\text{Co}^{+2}$ ,  $\text{Mn}^{+2}$ ,  $\text{Zn}^{+2}$ 

nicemanjan

 $\text{NH}_4\text{Cl}$  $\text{CoS}$ ,  $\text{NiS}$ : black $\text{NH}_4\text{OH}$  $\text{ZnS}$ : white $\xrightarrow{\text{Hg}}$   
 $\text{H}_2\text{S}$  $\text{MnS}$ : buff

V

 $\text{Ba}^{+2}$ ,  $\text{Sr}^{+2}$ ,  $\text{Ca}^{+2}$ 3 $\xrightarrow{\text{Hg}}$  2 $\xrightarrow{\text{Hg}}$   $\xrightarrow{\text{Hg}}$  $\text{NH}_4\text{Cl}$  $\text{BaCO}_3$  $\text{NH}_4\text{OH}$  $\text{SrCO}_3$  $(\text{NH}_4)_2\text{CO}_3$  $\text{CaCO}_3$ 

VI

 $\text{Na}^+$ ,  $\text{Mg}^{+2}$ ,  $\text{K}^+$ 

Na mango-m kaju

Zero:

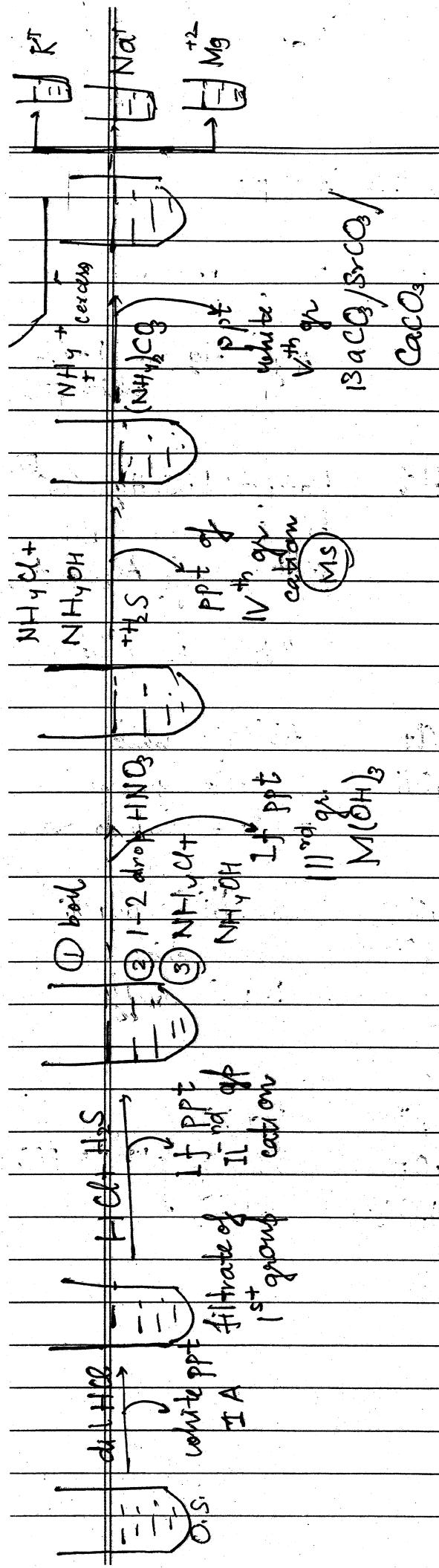
 $\text{NH}_4^+$

Quiz  
Ex 1-28

classmate

Date \_\_\_\_\_

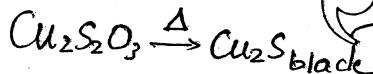
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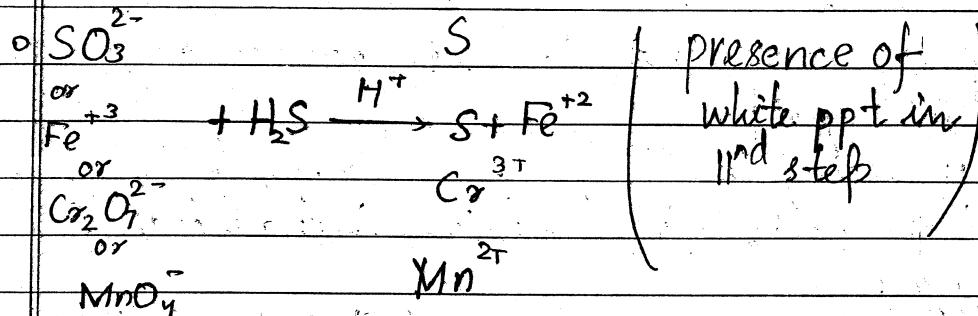
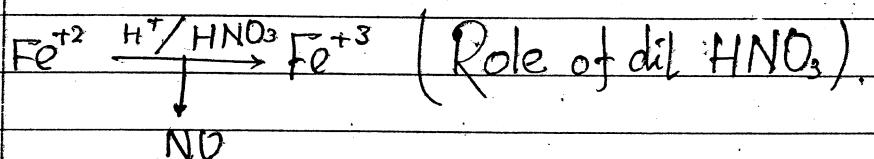
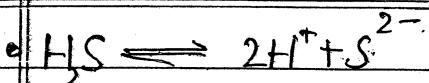
(C)(D) Normn

$[\text{Ni}(\text{en})_3]^{2+}$  imperfect to  $\text{S}^{2-}$  classmate

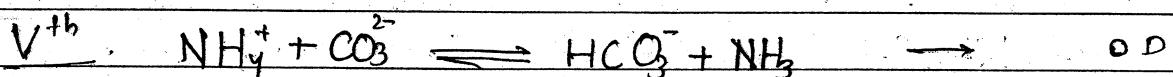
OS Sheet



Date \_\_\_\_\_  
Page \_\_\_\_\_



Q which is correct order of solubility  
 $\text{Na}_2\text{S} > \text{ZnS} > \text{CuS}$



- Pts:
- Classification of cations is based on selective precipitation
  - Groups I to VI are based on selective precipitation. Group O is not related to this classification.
  - all the test perform in clear sol<sup>n</sup> of given salt (O.S.)
  - In first group dil. HCl ppt only. 1<sup>st</sup> group cations OS because all chlorides are water soluble

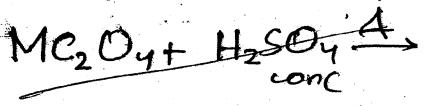
→  $\text{Cu}_2\text{Cl}_2$   $\text{Cu}^{+2}$ : not unable to maintain in ag medium

5) Do not use conc HCl in 1<sup>st</sup> group due to following two reason

(i)  $[\text{AgCl}_2]^-$ ,  $[\text{PbCl}_4]^{2-}$

(ii) Some of sulphides of second group can be decomposed by conc HCl

e.g.  $\text{CdS}$ ,  $\text{Bi}_2\text{S}_3$ ,  $\text{As}_2\text{S}_3$



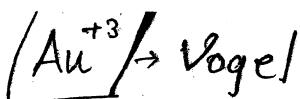
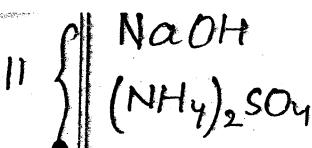
classmate

Date \_\_\_\_\_

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Keep's apparatus

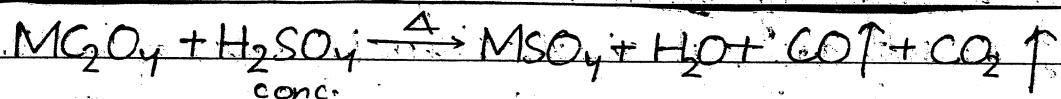
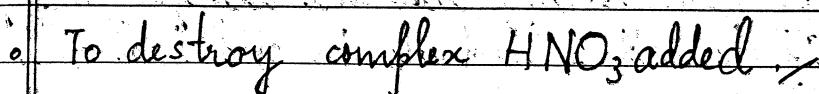
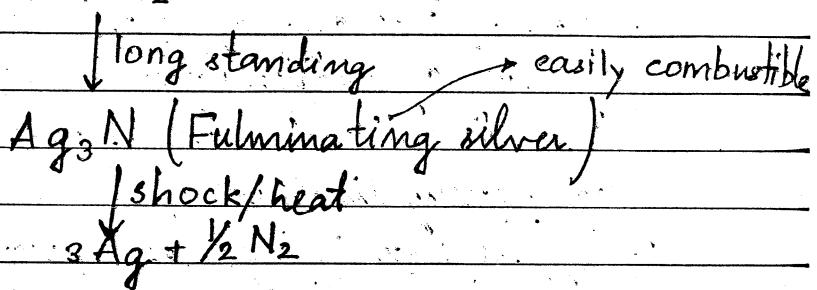
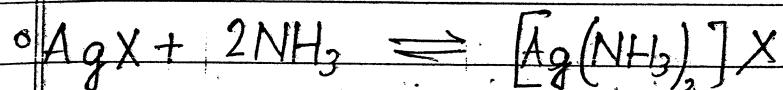
- 6 In 2<sup>nd</sup> group when H<sub>2</sub>S is passed in 1<sup>st</sup> previous group filtrate only those metal ions are ppt which have very low K<sub>sp</sub> (Due to less dissociation of H<sub>2</sub>S in presence of HCl) (acidic)
  - 7 Pb<sup>+2</sup> is also observed in 2<sup>nd</sup> group because PbCl<sub>2</sub> is sparingly soluble so that Pb<sup>+2</sup> not possible to separate in 1<sup>st</sup> group
  - 8 Before proceeding in 3<sup>rd</sup> group second group filtrate is boiled to remove H<sub>2</sub>S (basic medium introduced [S<sup>2-</sup>]↑ all 4<sup>th</sup> group come here) and resulting sol<sup>n</sup> is treated with 1-2 drops dil. HNO<sub>3</sub>
  - 9 The role of NH<sub>4</sub>Cl in 3<sup>rd</sup> group is to decrease dissociation of NH<sub>4</sub>OH so that other hydroxide ppt not present in 3<sup>rd</sup> group
  - 10 In 4<sup>th</sup> group dissociation of H<sub>2</sub>S increase so that remaining metal ions which can produce insoluble sulphide are precipitate in this group (basic = more [S<sup>2-</sup>]↑)
  - 11 In 4<sup>th</sup> group (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub> is added in presence of excess NH<sub>4</sub><sup>+</sup> ion, to stabilise following equilibrium
- $$\text{CO}_3^{2-} + \text{NH}_4^+ \rightleftharpoons \text{HCO}_3^- + \text{NH}_3$$
- 12 In 4<sup>th</sup> group MgCO<sub>3</sub> is not precipitate due to decrease in CO<sub>3</sub><sup>2-</sup> concentration according to given equilibrium
  - 13 Interfering radical must be removed by suitable method before proceeding in 3<sup>rd</sup> group  
Upto 2<sup>nd</sup> group interfering radical (A<sup>-</sup> of weak [HAA]) in undissociate form like HF
  - 14 Zero group not in sequence Large [NH<sub>4</sub><sup>+</sup>] added



classmate

Date \_\_\_\_\_

Page \_\_\_\_\_



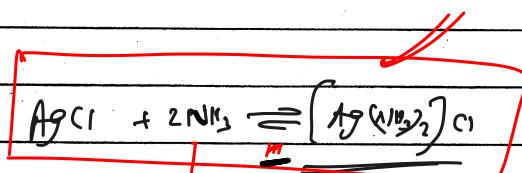
Oxalates interfering:

Third group ~~large~~ ppt of insoluble oxalates

III<sup>rd</sup> o NaOH not used in III<sup>rd</sup> group (no common effect)  
 ppt of insoluble hydroxides

o  $(\text{NH}_4)_2\text{SO}_4$  not used in II<sup>nd</sup> group  $\text{MSO}_4$  insoluble

o  $\text{Na}_2\text{CO}_3$  not in place in 4<sup>th</sup> group  
 basic enough to ppt  $\text{Mg}^{2+}$



M  
 NH<sub>3</sub>

Stably

$\text{Ag}_3\text{N}$

Fulminating  
silver

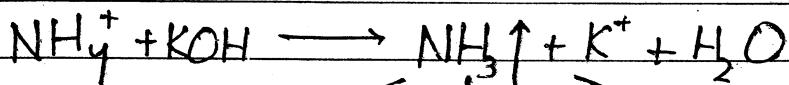
$3\text{Ag} + \frac{1}{2}\text{N}_2$   
 $\text{NEN}$

o Preparation of original solution (O.S.)

1. Take a little amt of salt in clean boiling tube and add a few ml of distilled water and shake it. If the salt does not dissolve, heat the content of boiling tube till salt completely dissolves.
2. If the salt is insoluble in water as detailed above, take fresh salt in clean boiling tube and add few ml of dil HCl to it. If the salt is insoluble in cold heat till salt is completely dissolved.
3. If the salt does not dissolve either in water or in dil HCl even on heating, try to dissolve in a few mL of conc HCl on heating.
4. If the salt does not dissolve in conc HCl, then dissolve in dil  $\text{HNO}_3$ .
5. If Dissolve in aqua regia.

ZERO GROUPTest of  $\text{NH}_4^+$  ion

## (1) Test by KOH/NaOH



Red

HCl aq

 $\text{MnSO}_4 \text{ aq} + \text{H}_2\text{O}_2$ 

[Does not  
oxidise in acidic med]  
after basic

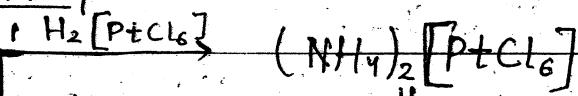
blue  $\text{NH}_4\text{Cl}_{(\text{s})}$ 

dense white

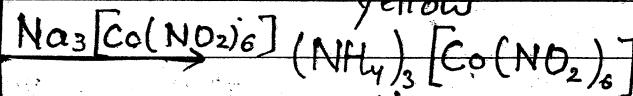
 $\text{MnO}_2 \cdot \text{H}_2\text{O}$ 

fumes

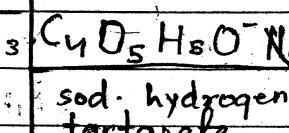
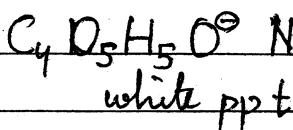
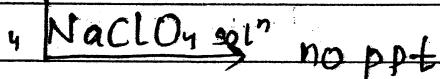
brown ppt

(produced by fine  
particles)(2) ppt test of  $\text{NH}_4^+$ 

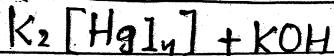
yellow



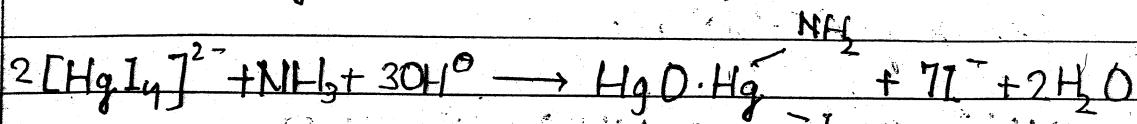
yellow

sodium cobalti  
nitratesod. hydrogen  
tartarateC<sub>4</sub>O<sub>4</sub><sup>2-</sup>COO<sup>-</sup>Na<sup>+</sup>Sodium  
hydrogen  
tartarateTest 1, 2, 3 are also given by  $\text{K}^+$

## (3) Test Nessler's reagent

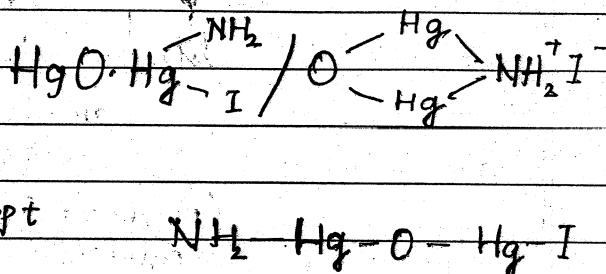
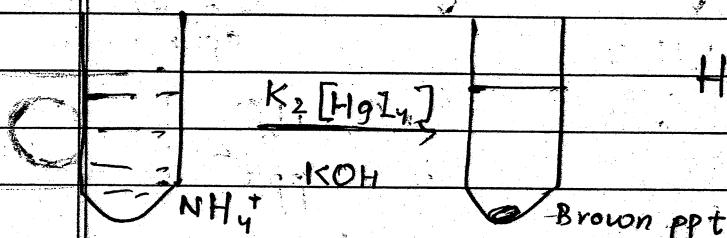


Nessler's reagent

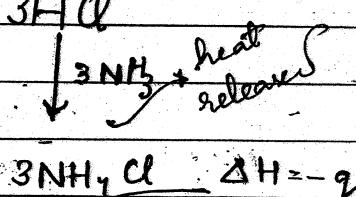
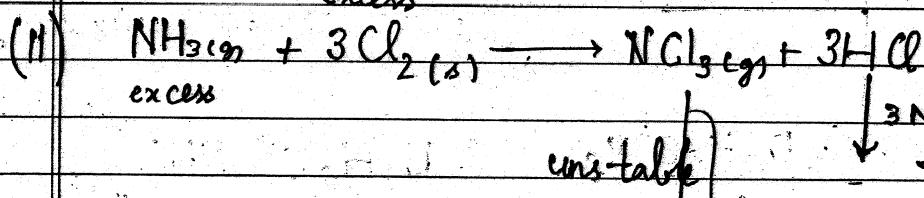
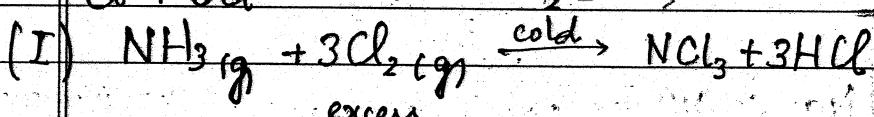
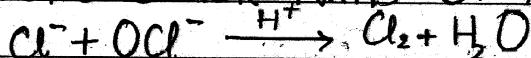


\* iodide of melan's base

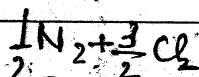
\* basic mercuric amido iodide.



## SOME OTHER RXNS OF AMMONIA



decomposes



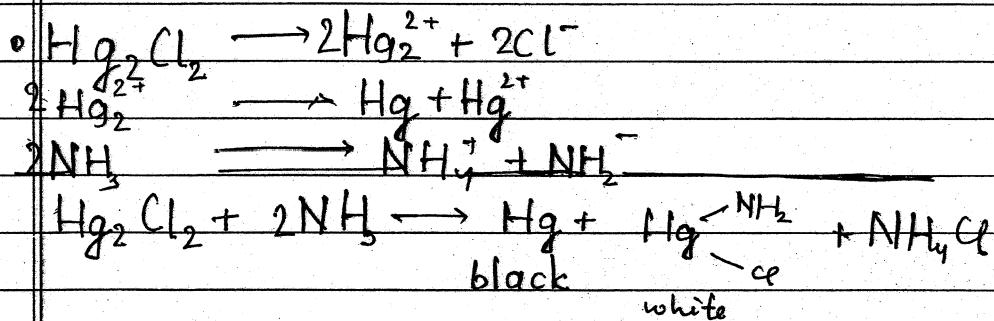
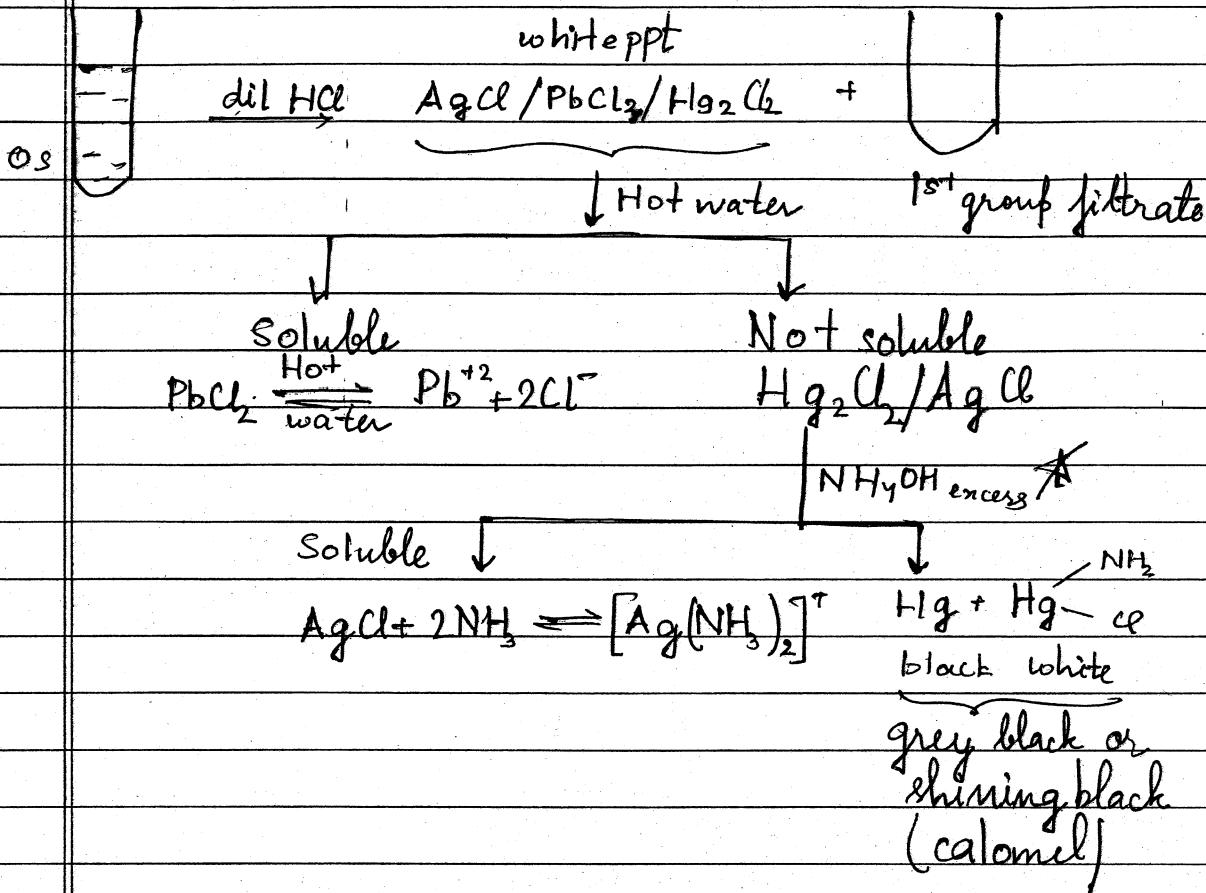
Hg<sub>2</sub>Cl<sub>2</sub>

Cu<sup>+</sup> stable in NH<sub>3</sub>, ~~H<sub>2</sub>O~~ CN<sup>-</sup> unstable in H<sub>2</sub>O  
Hg<sup>2+</sup> unstable in NH<sub>3</sub>, H<sub>2</sub>S, KI stable in H<sub>2</sub>O

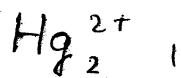
classmate

Date \_\_\_\_\_  
Page \_\_\_\_\_

## 1st GP Cations



HgO not formed due to insufficient Hg<sup>2+</sup>



classmate

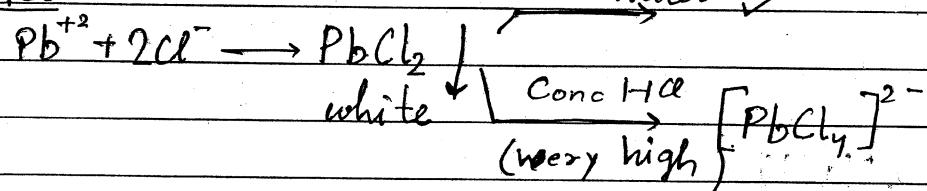
Date \_\_\_\_\_

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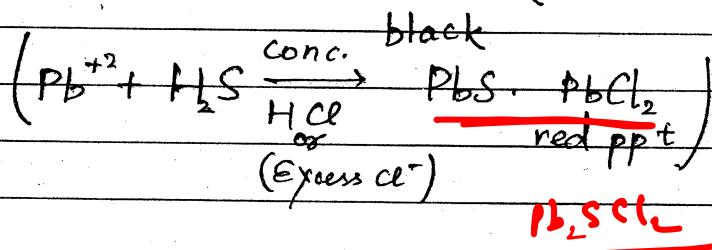
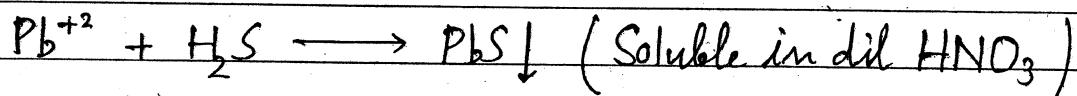
- (white)  
 o  $\text{HgCl}_2$ : corrosive sublimate (Corrodes metal surface)  
 $\text{Hg}_2\text{Cl}_2$ : Calomel

### Test of $\text{Pb}^{2+}$

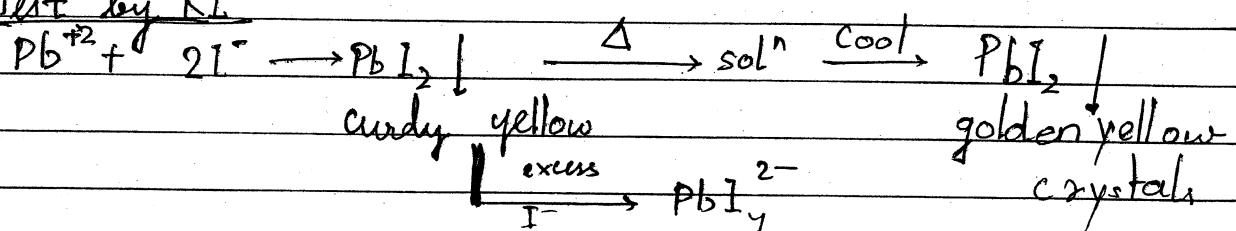
#### ① Test by $\text{HCl}$



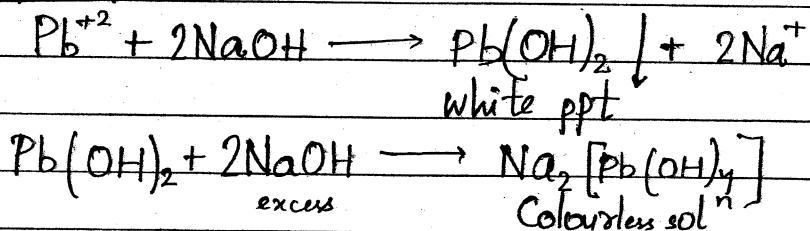
#### ② Test by $\text{H}_2\text{S}$



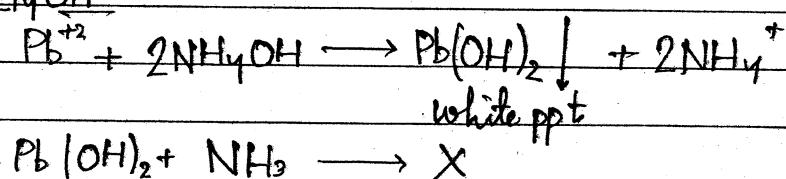
#### ③ Test by $\text{KI}$



#### ④ Test by $\text{NaOH}$



#### ⑤ Test by $\text{NH}_4\text{OH}$



Ex II 1-11

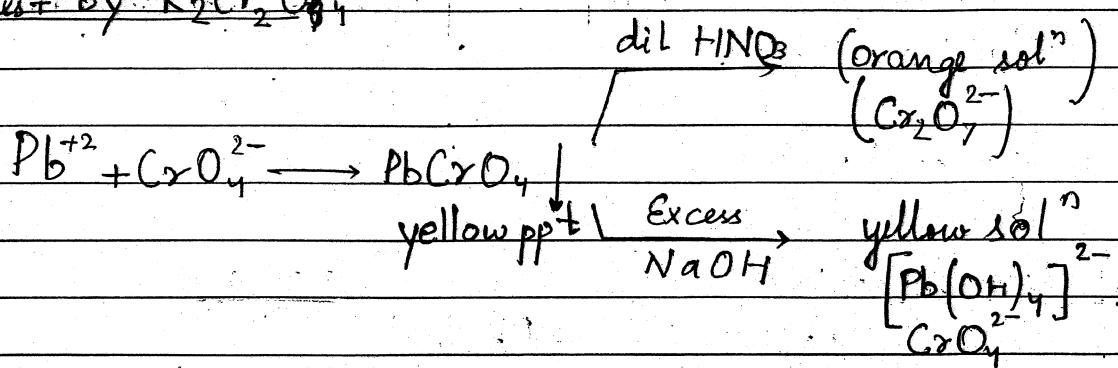
HW

classmate

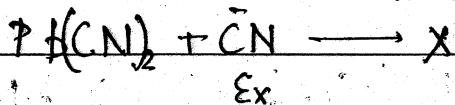
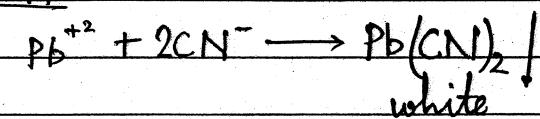
Date \_\_\_\_\_

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⑥ Test by  $K_2Cr_2O_7$



⑦ NaCN



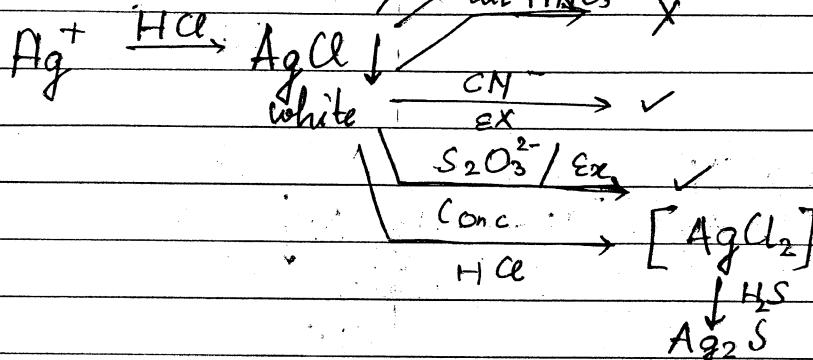
Race

P.B  
C.N.I, NH  
classmate  
Date \_\_\_\_\_  
Page \_\_\_\_\_  
  
(N) pseudo  
halide

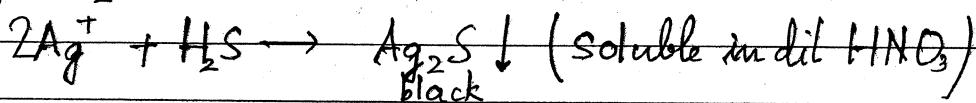
$\text{AgI}, \text{Ag}_2\text{S}$  Do not dissolve in ammonia

Test by  $\text{Ag}^+$

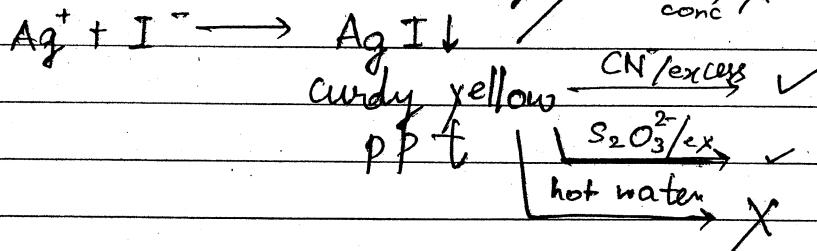
① Test by HCl



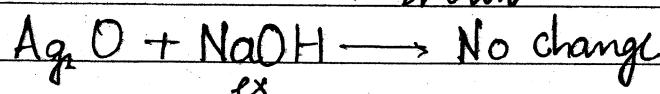
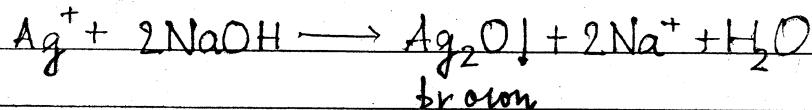
② Test by HS



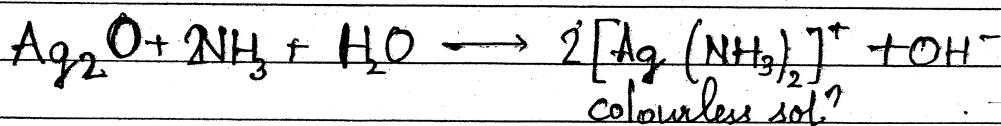
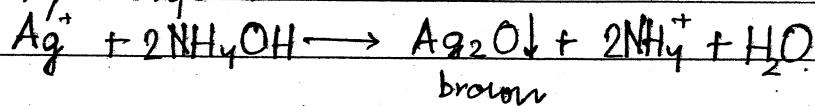
③ Test by KI



④ Test by NaOH



⑤ Test by  $\text{NH}_4\text{OH}$



$\text{CN}^-$ ,  $\text{NH}_3$  complexes not of p-block

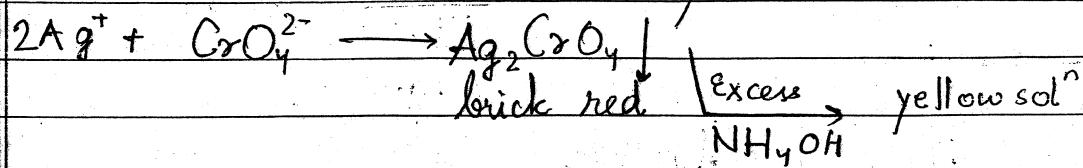
$\text{CN}^-$  pseudo halide same colour of ppt

classmate

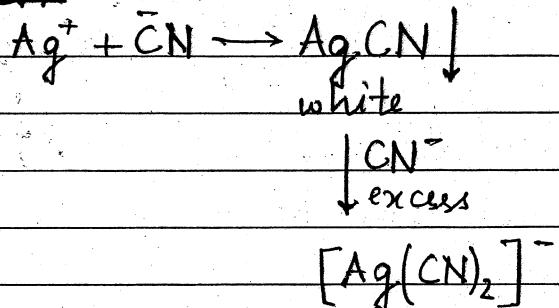
Date \_\_\_\_\_

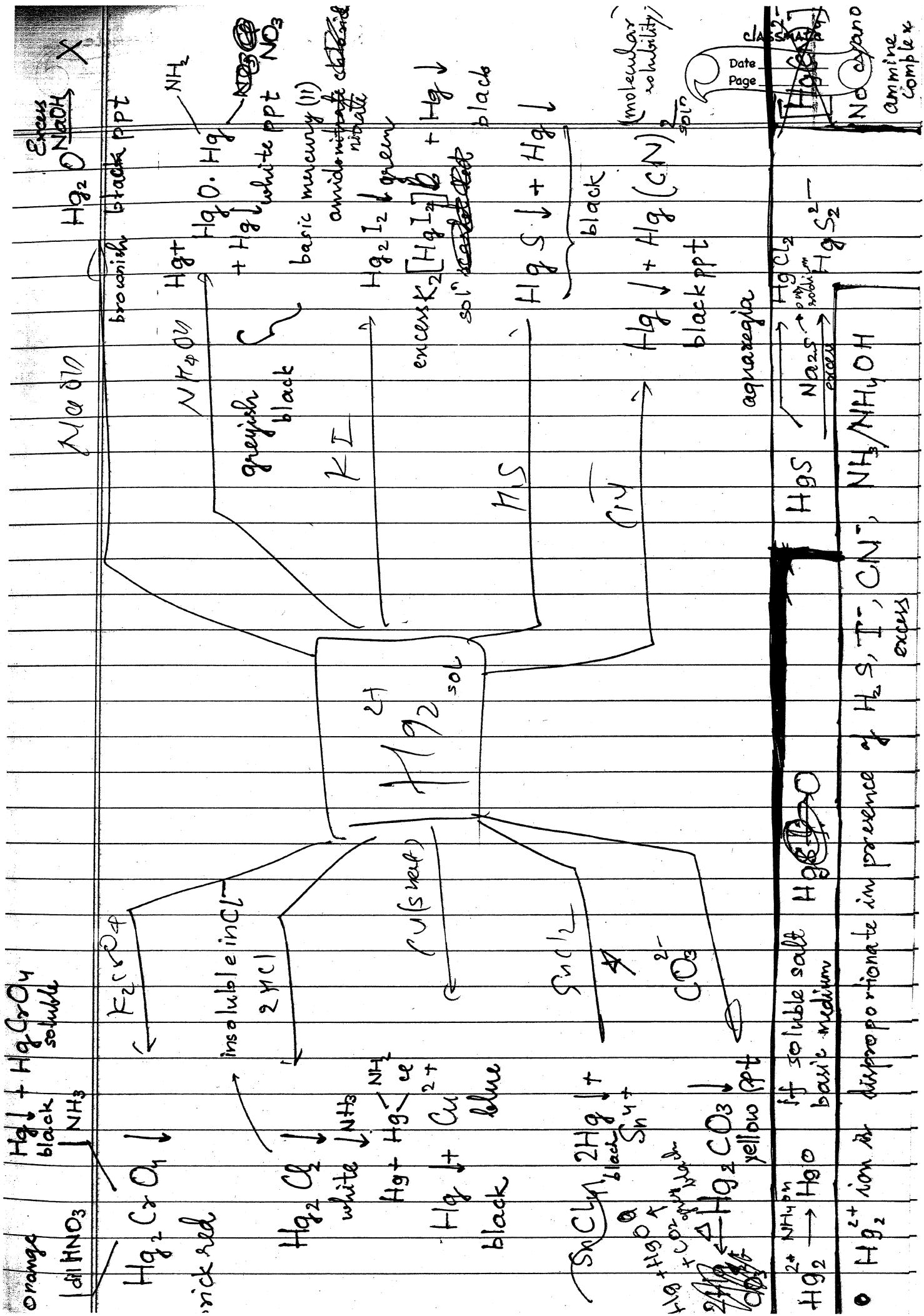
Page \_\_\_\_\_

(6) Test by  $\text{K}_2\text{CrO}_4$



(7) Test by  $\text{KCN}$





10 <sup>th</sup> group	Black	$(NH_4)_2S$	Ammonium sulphide white
	$HgS, PbS, CuS,$	$(NH_4)_2S$	$(NH_4)_2S$ : Am. polysulphide (fotates)
dil HCl	$Bi_2S_3, SnS$	$Bi_2S_3$	$nS = 2 - 5$
$H_2S$	Yellow	$YAS$ prepared	$[S(NH_4)_2]_2S$
	$CdS, As_2S_3,$ $As_2S_5, SnS_2$	$YAS$ (Yellow ammonium sulphide due to remaining amt. of sulphur in it)	$(Can be thought as sulphide donor & acceptor)$
filtrate of 1 <sup>st</sup> group	Orange	$YAS$ (Yellow ammonium sulphide)	
	$Sb_2S_3, Sb_2S_5$		
dil $HNO_3$	$Bi_2S_3$	$Not \ soluble$	$II - A$
	$PbS, CuS, Bi_2S_3, HgS, CdS$	$dil HNO_3$	$HgS$
$Ag^+$	$Cl^-$	$Ag^+ / Cu^{+2} /$ $Bi^{3+} / Cd^{+2}$	$AgCl_2 \text{ ag}$
			$\downarrow$ aqua regia
$As^{3+}$	$As_2S_3$	$As_2S_3 + S_2^{2-} \rightarrow AsS_3^{2-}$	$AsS_3$
		$As_2S_3 + S_2^{2-} \rightarrow Sb_2S_3^{2-}$ (antimonite) $(nH_4)_2S$ oxidising	$(thios antimonite)$
$Sn^{4+}$	$SnS$	$SnS + S_2^{2-} \rightarrow SnS_3^{2-}$	$SnS_3$
		$SnS + S_2^{2-} \rightarrow SnS_3^{2-}$ (thios tannate)	$(thios tannate)$
$As^{3+}$	$As_2S_3$	$As_2S_3 + S_2^{2-} \rightarrow AsS_3^{2-}$	$AsS_3$
		$As_2S_3 + S_2^{2-} \rightarrow AsS_3^{2-}$ (all others dissolve in normal)	$(Sb_2S_3 + S_2^{2-} \rightarrow SbS_3^{2-})$

- Subdivision of 2<sup>nd</sup> group is based on solubility of sulphide ppt in YAS
- II A sulphides are not soluble in YAS but II B sulphides are soluble in YAS due to formation of soluble ~~this~~ salt.
- II B sulphides are also soluble in ordinary sulphides (except Sns)
- None of II<sup>nd</sup> group sulphides is decomposed by dil HCl (they are formed in presence of HCl) but some of them can be decomposed by conc HCl (e.g. CdS, SnS etc.)
- None of black sulphides are decomposed by dil HCl except FeS (in common salt)
- Metal oxide and hydroxide ppt are soluble in excess NH<sub>3</sub> when metal ion belong to d-block except  $\text{Fe}^{+2}$ ,  $\text{Fe}^{+3}$ ,  $\text{Mn}^{+3}$ ,  $\text{Hg}^{+2}$ ,  $\text{Hg}_2^{2+}$  no ammine under any condition. These cations cannot form ammine complexes under laboratory conditions

$\text{HgCl}_2$ : many dissolve in mol. form.

$\text{HgCl}_2$  (yellow ppt) volatile

HCl dil

$3\text{HgO} \cdot \text{HgCO}_3 \cdot \text{CO}_3^{2-}$

red brown ppt

$\text{HgS} \cdot 2\text{HgO}$   
(yellow ppt)

$\text{SnCl}_2$  excess

$\text{Sn}^{+4} + \text{Hg}^{2+} \xrightarrow{(1-2) \text{ drop}} \text{Hg}_{2\text{Cl}_2}$

lack  $\text{Sn}^{+4}$

$\text{Cu}^{+2} + \text{Hg}^{2+} \xrightarrow{\text{Cu sheet}}$

$\text{CO}_2 + \text{Hg}^{2+} \xrightarrow{\text{reducing agent}}$   
reacts with Tollens

$\text{HCOO}^{-} \downarrow$

$\text{CO}_2 + \text{Hg}^{2+} \xrightarrow{\text{both}}$

$\text{Co}[\text{Hg}(\text{SCN})_4]/\text{Hg}[\text{Co}(\text{SCN})_4]$   
(dark soluble ppt)  
(crystalline)

(both)

$\text{H}_2\text{S} \rightarrow \text{HgS} \downarrow$  black

ammonia

$\text{HgO} \downarrow$  excess

(yellow)

$\text{NH}_4\text{OH}$

$\text{HgO} \cdot \text{Hg}^{2+} \xrightarrow{\text{excess}}$

white/yellow  
ppt

$\text{KI} \rightarrow \text{HgI}_2$

scarlet red  
(crystaline)

$\text{K}_2[\text{HgI}_4]$

colourless  
(crystaline)

$\text{HgSO}_4 \cdot 2\text{HgO}$

basic  
yellow  
mercuric  
sulphate

$\text{HgSO}_4 \cdot 2\text{HgO}$   
(substituted  
coloured  
in  $\text{H}_2\text{SO}_4$ )

$\text{Vas} \rightarrow \text{dil HNO}_3$

aqua regia

IMP PT

$\text{Fe}^{+2}, \text{Fe}^{+3},$   
 $\text{Mn}^{+2}, \text{Hg}^{2+},$   
 $\text{Hg}^{2+}$

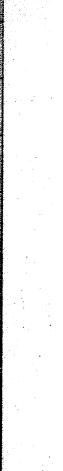
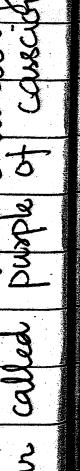
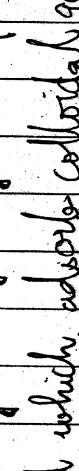
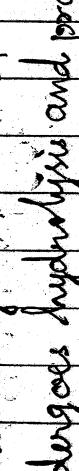
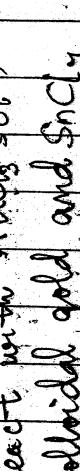
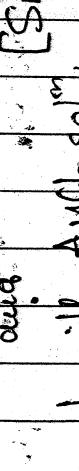
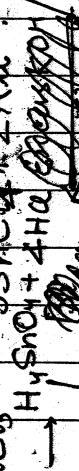
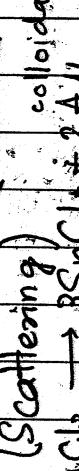
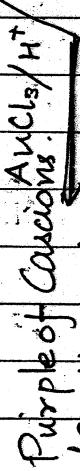
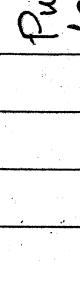
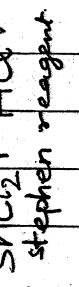
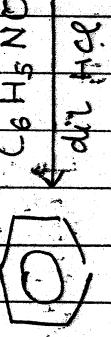
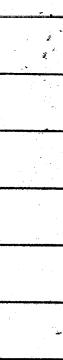
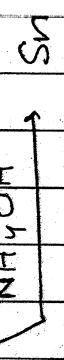
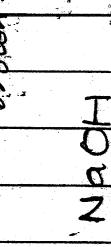
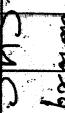
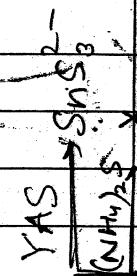
No ammine  
complex

Quiz 3  
Date \_\_\_\_\_  
Page \_\_\_\_\_

On rubbing  
of am seed

$\text{HgSO}_4 \cdot 2\text{HgO}$

yellow  
red



$Sn^{+4}$  (Not much important)

$Sn^{+4}$  conc HCl excess,  $[Sn(OH)_2]$

$Na_2SnO_2 \cdot 2H_2O$   
sodium stannite  
(although meta)

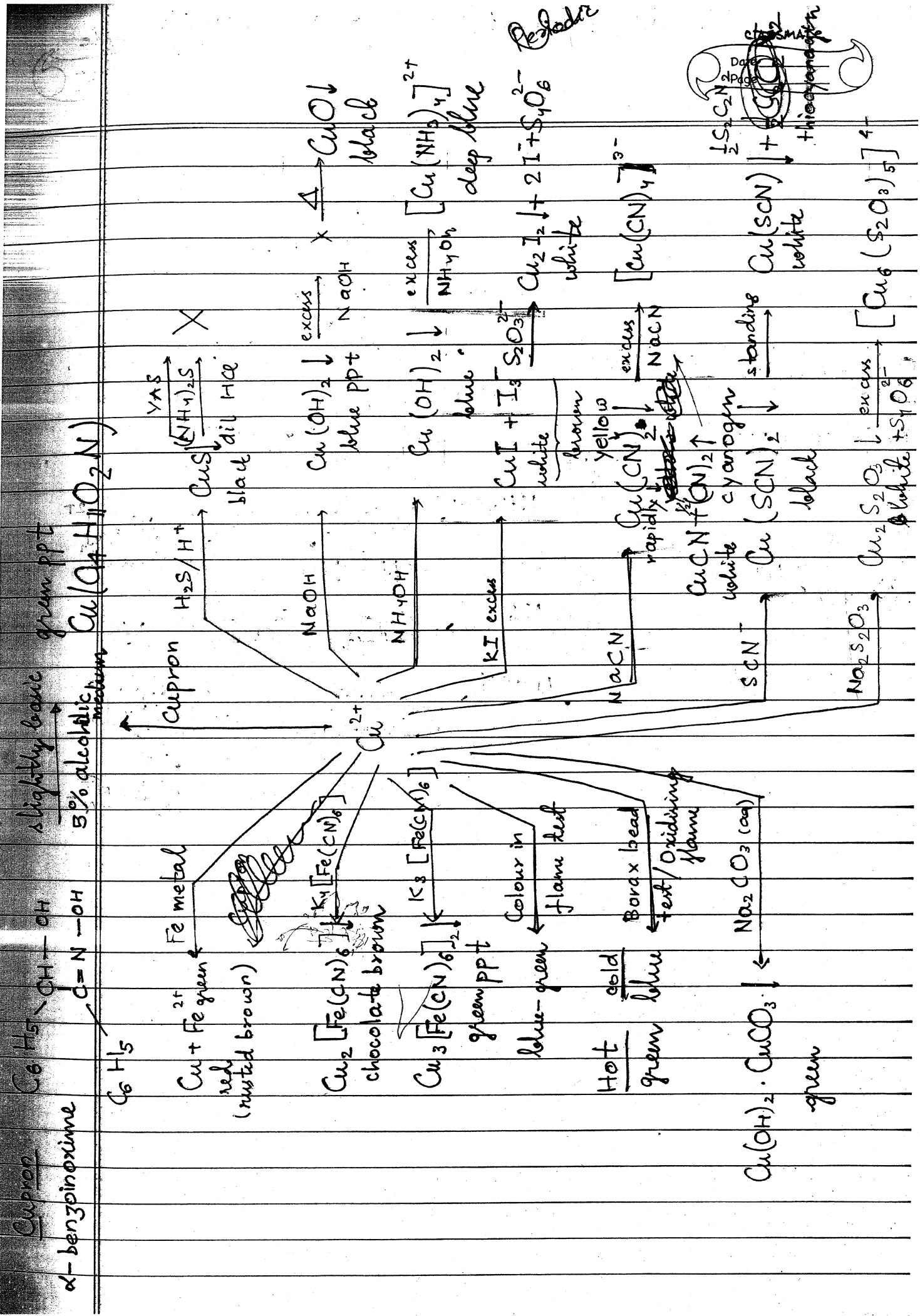
$Sn(OH)_2$  excess  $NH_4OH$

white

classmate  
Date \_\_\_\_\_  
Page \_\_\_\_\_

No disproportionation

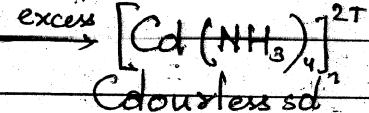
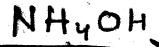
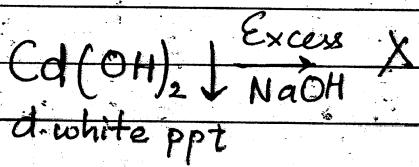
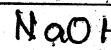
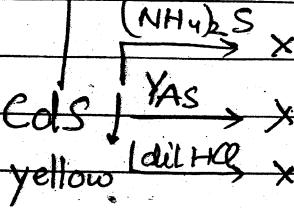
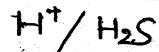
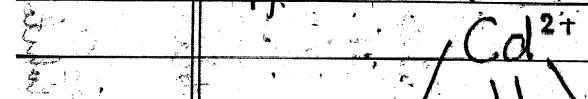
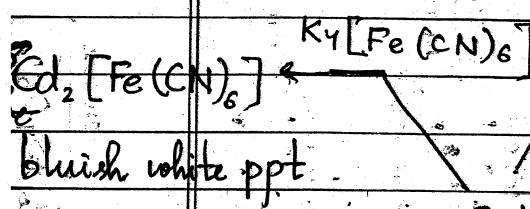
$Sn^{+2}$   $\downarrow$  ppt



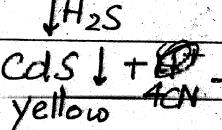
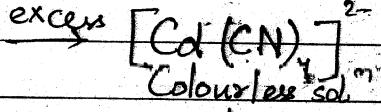
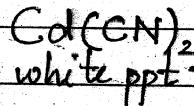
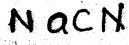
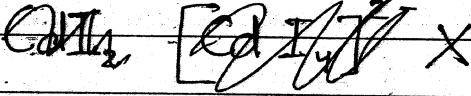
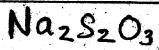
$Zn, Cd \rightarrow$  tetraamine

Cd: silvery white classmate

Date \_\_\_\_\_  
Page \_\_\_\_\_



No rxn

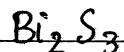


Bismuth  
chloride

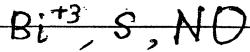
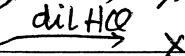
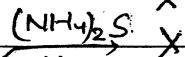
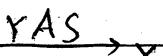
$\text{Bi}^{+3}$  amphoteric  
classmate  
Date \_\_\_\_\_  
Page \_\_\_\_\_

### Test of $\text{Bi}^{+3}$

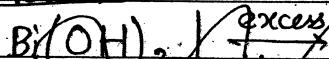
#### 1) Test by $\text{H}_2\text{S}$



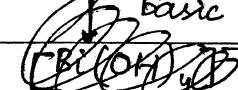
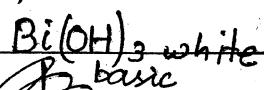
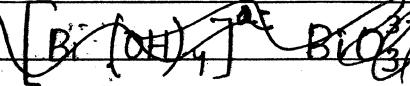
brownish-black \ dil  $\text{HNO}_3$



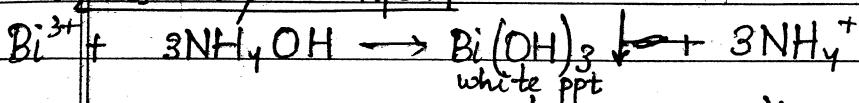
#### 2) Test by $\text{NaOH}$



Does not dissolve in excess  $\text{NaOH}$

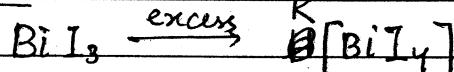


#### 3) Test by $\text{NH}_4\text{OH}$



white ppt

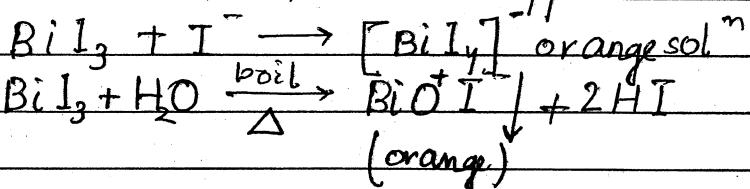
#### 4) Test by $\text{KI}$



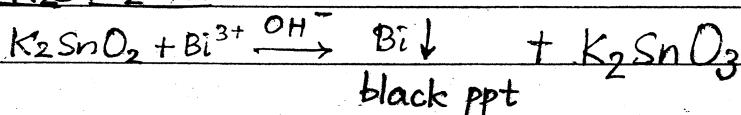
brown

orange

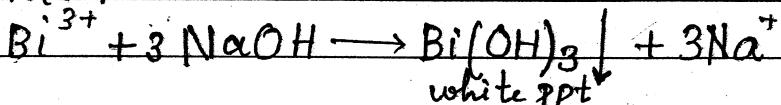
#### 5) Test by $\text{K}_2\text{SnO}_2$ sol<sup>n</sup>



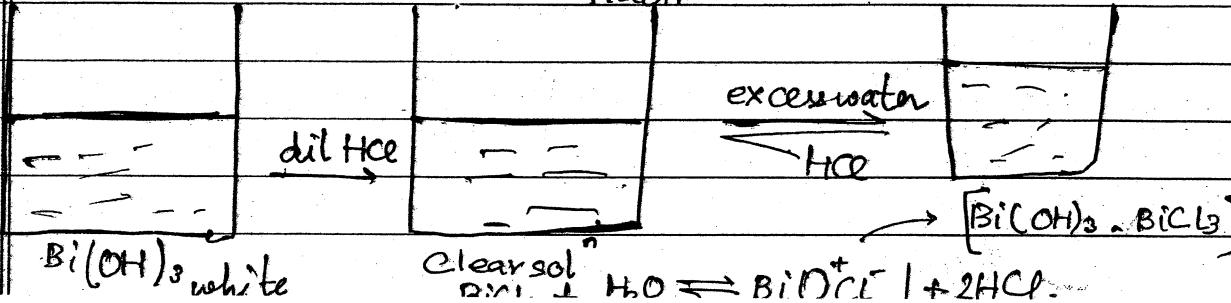
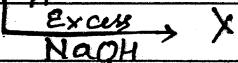
#### (5) Test by $\text{K}_2\text{SnO}_2$ sol<sup>n</sup>



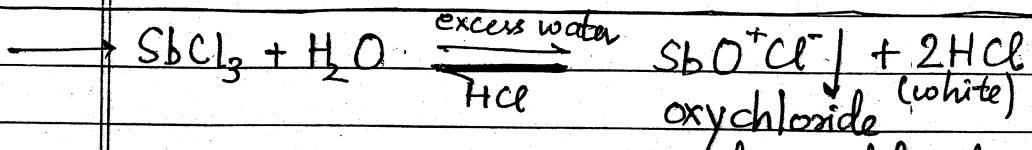
$\rightarrow \text{NaOH}$



white ppt



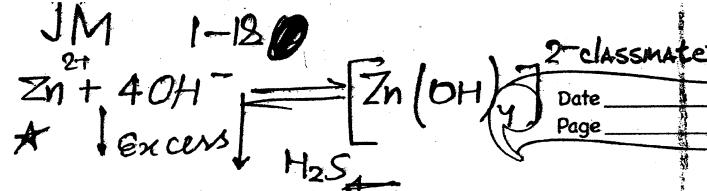
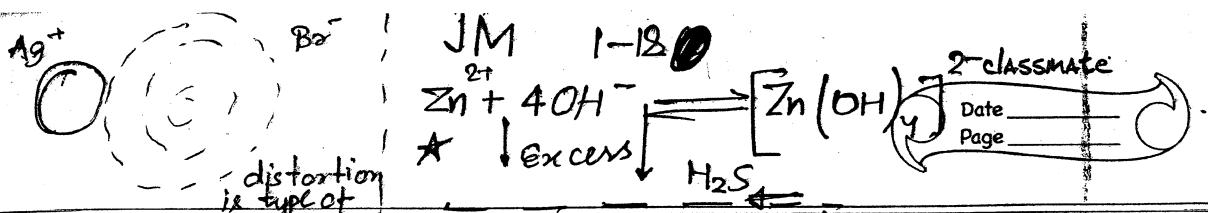
• partially hydrolysis  $\text{BiO}^+\text{Cl}^-$  white turbidity  
(Not hypochlorite)



or basic chloride

(Soluble in tartaric acid)

(but  $\text{BiOCl}$  is not soluble in)  
tartaric acid



Date \_\_\_\_\_

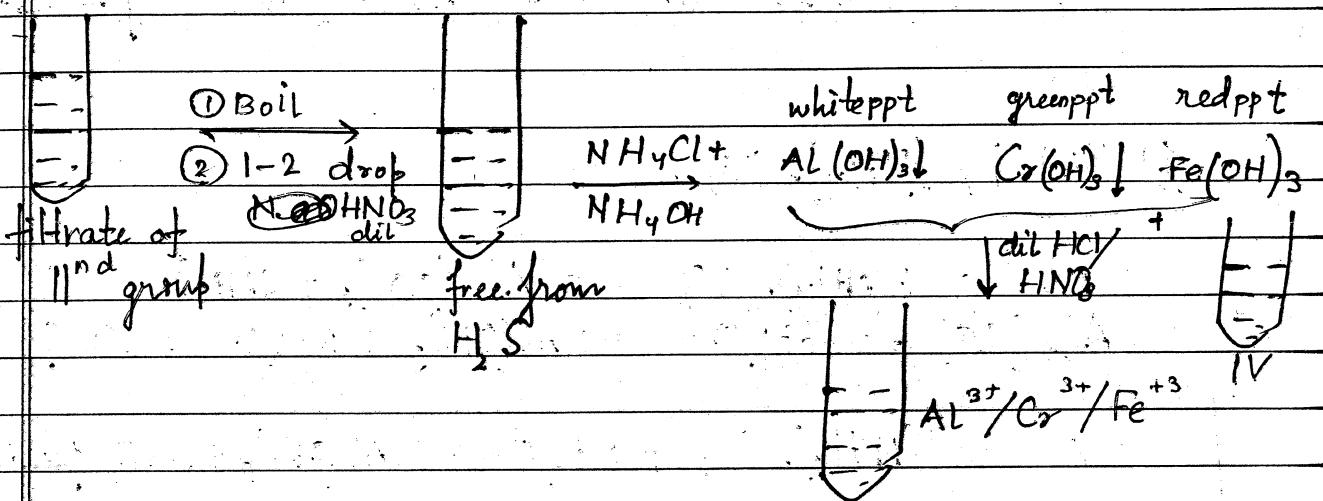
Page \_\_\_\_\_

$\text{Fe}^{+2}$  IV<sup>th</sup> group

$\text{FeS}$ : black

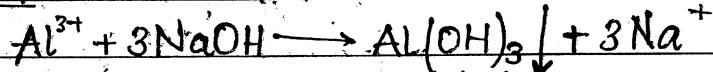
$\text{KI}_3$ : tincture iodine

### III<sup>rd</sup> group cations

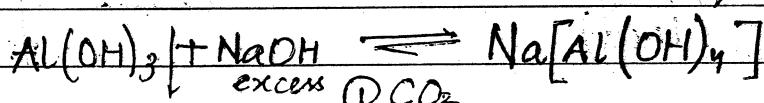


### Test of $\text{Al}^{3+}$

#### Test by $\text{NaOH}$



white  
(lighter than water)

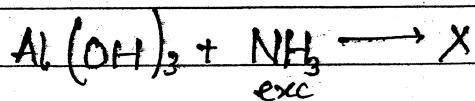
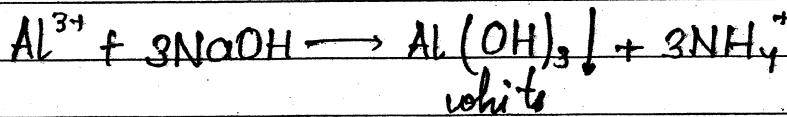


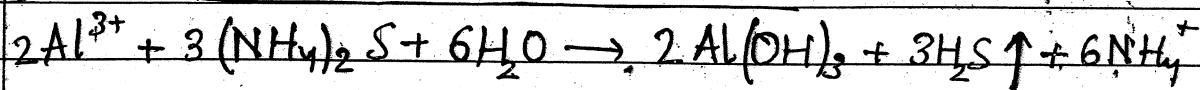
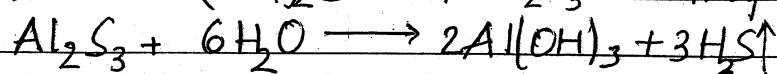
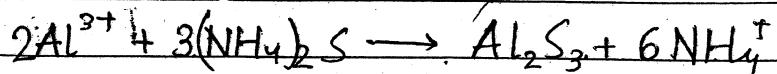
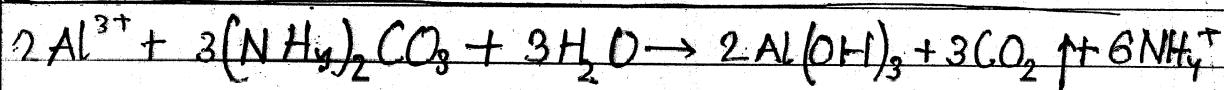
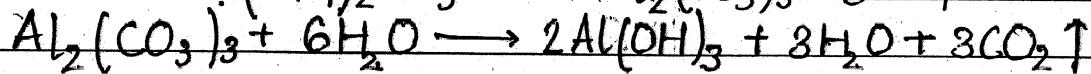
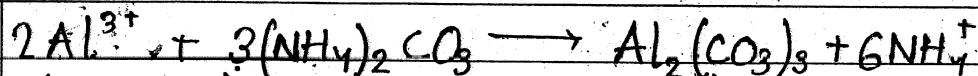
② Excess water

③  $\text{Al}(\text{OH})_3$  (precipitate)

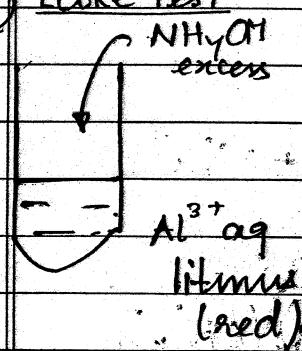
④  $\text{NH}_4\text{Cl}$  (acidic salt)

#### Test by $\text{NH}_4\text{OH}$



(3) Test by  $(\text{NH}_4)_2\text{S}$ (4) Test by  $(\text{NH}_4)_2\text{CO}_3$ 

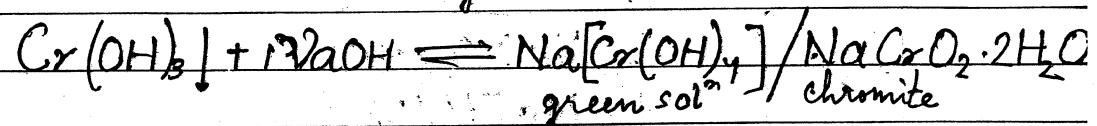
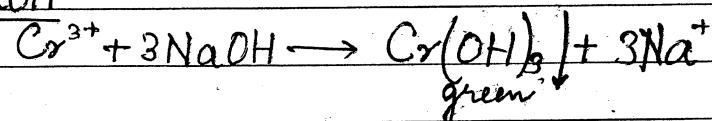
## (5) Lake test



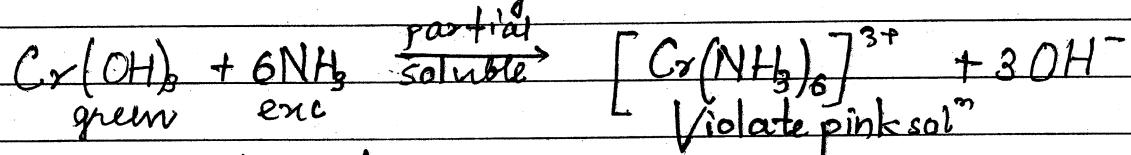
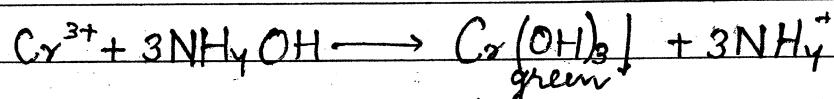
blue  
Lake of lithium due to  
chemiadsorption of  
lithium on  $\text{Al}(\text{OH})_3$   
fresh

## Test Of Cr<sup>3+</sup>

### ① Test by NaOH



### ② Test by NH<sub>4</sub>OH

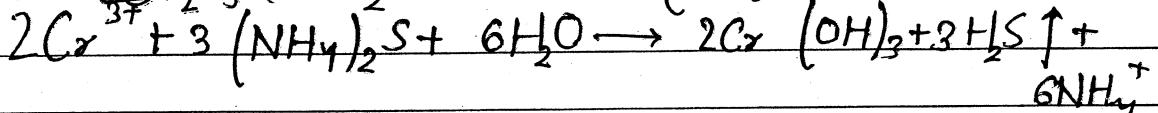
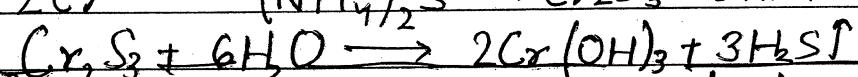
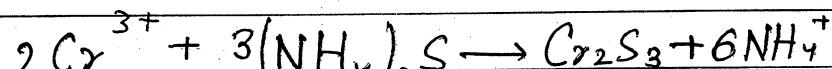


[green ppt obtained]

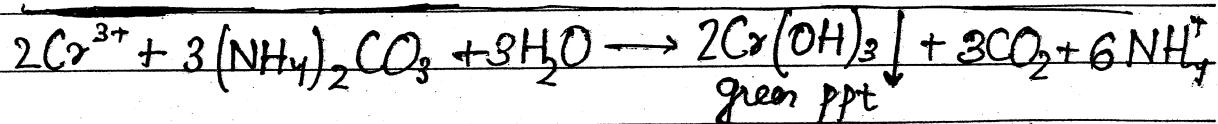
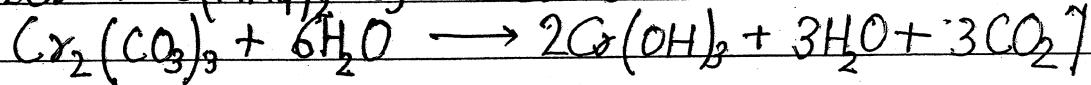
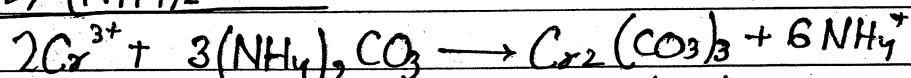
Note: it is soluble in both

### ③ Test by (NH<sub>4</sub>)<sub>2</sub>S

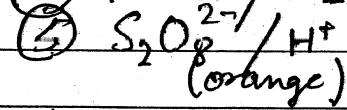
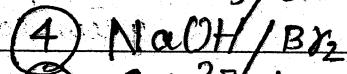
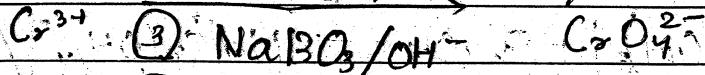
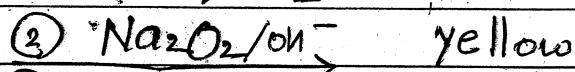
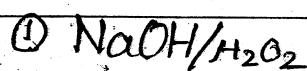
(S<sup>2-</sup> CO<sub>3</sub><sup>2-</sup>)  
prepared  
don't exist in  
(aq soln)  
just written)



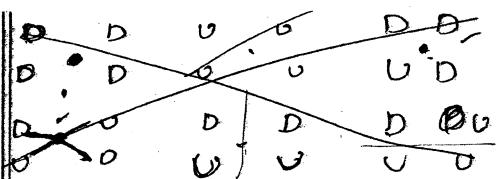
### ④ Test by (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>



## Q5) Test of $\text{Cr}^{3+}$ based on its oxidation to $\text{CrO}_4^{2-}$



(Note absence of  $\text{Cl}_2, \text{KMnO}_4$ )



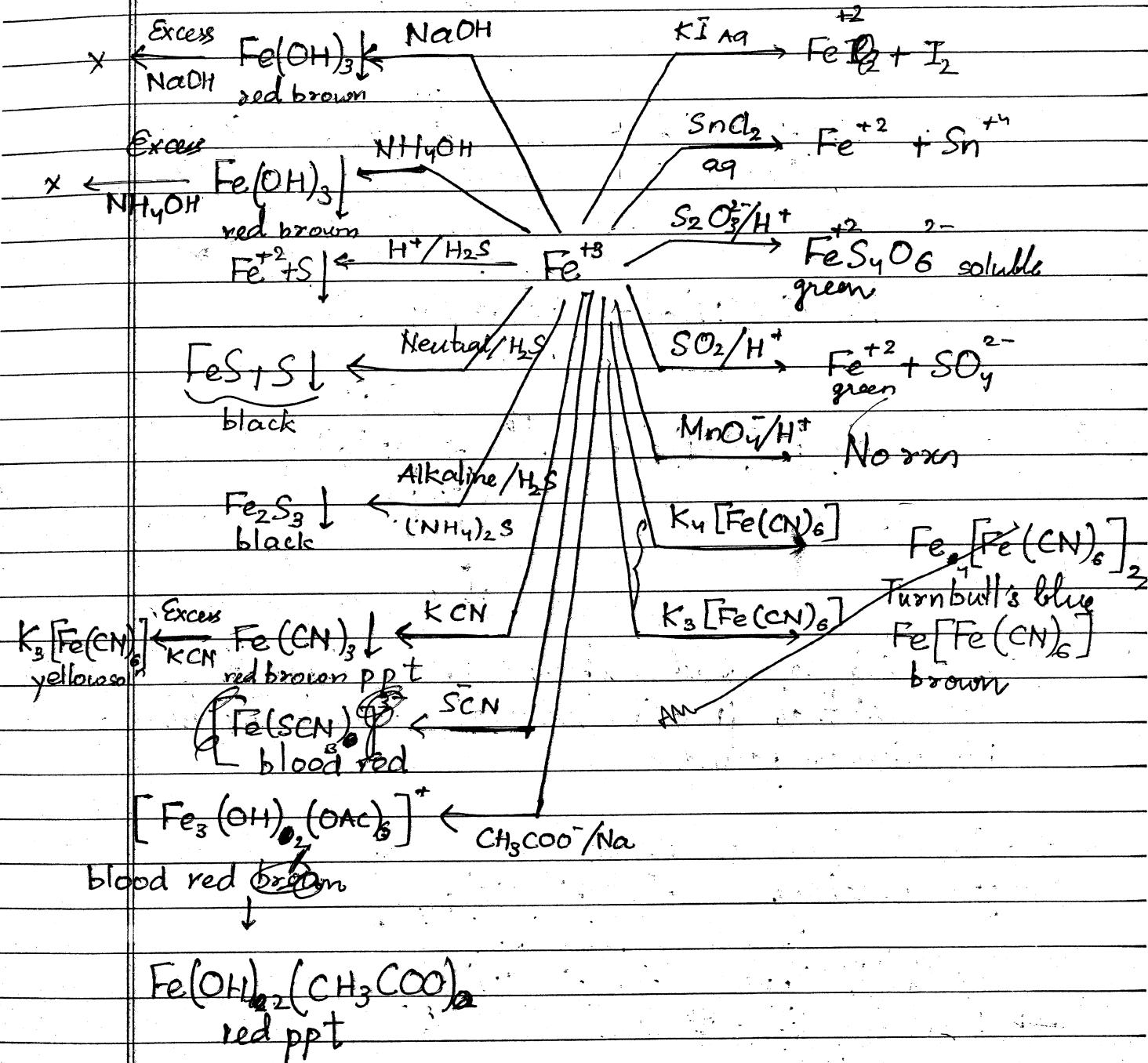
TLI<sub>3</sub>X

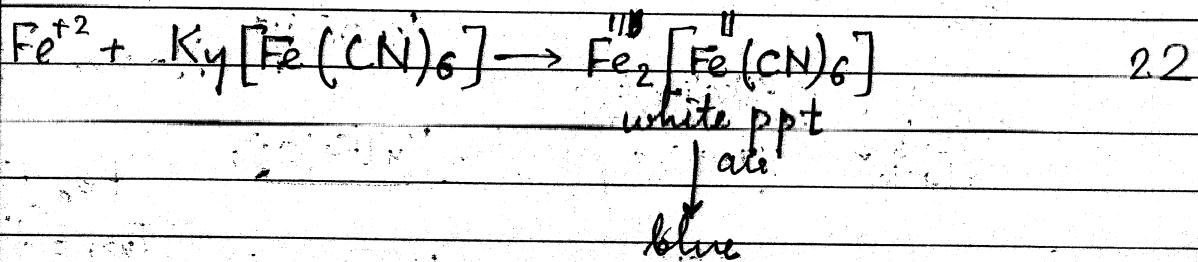
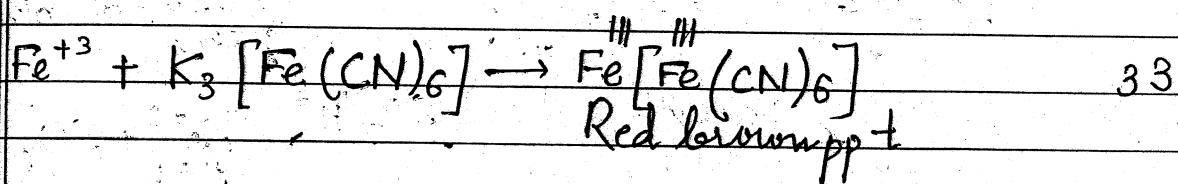
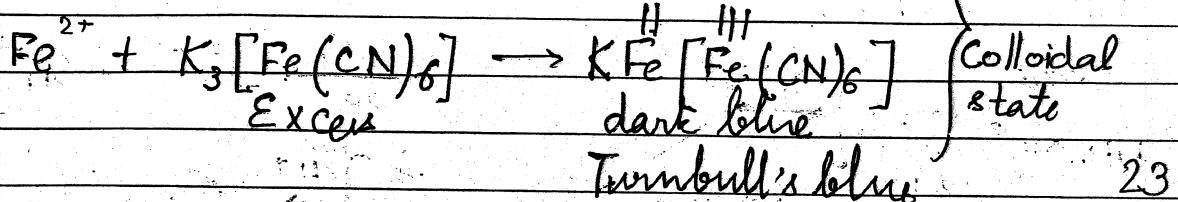
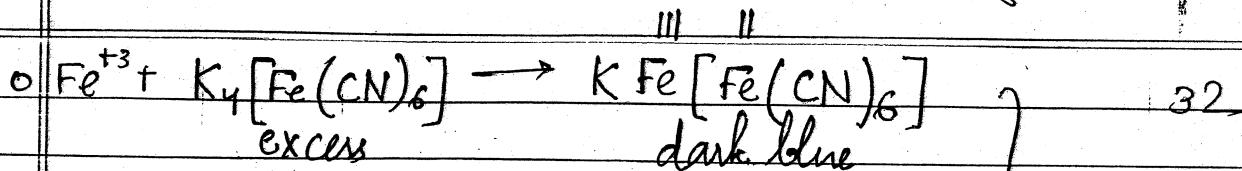
CTW JM

classmate

Date \_\_\_\_\_

Page \_\_\_\_\_





o According to modern spectroscopic methods it is observed that prussian blue and Turnbull's blue are identical compounds

→ In 32, 23 Fe excess ppt obtained  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$  ↓  
 prussian blue ppt

Turnbull ppt  $\text{Fe}_3[\text{Fe}(\text{CN})_6]_2$

→ Prussian Fe bath is dat

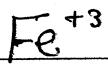
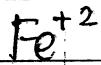
③ PB 32

List of blue colour compound classmate  
 (Thru)



Date \_\_\_\_\_

Page \_\_\_\_\_



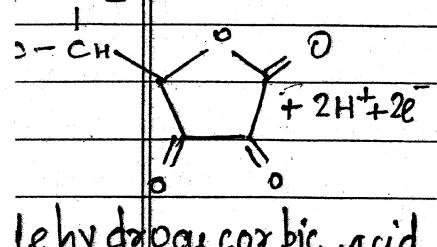
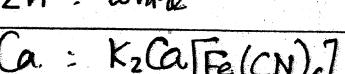
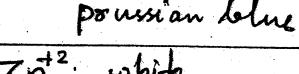
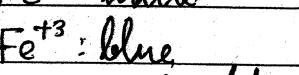
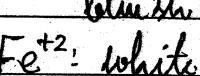
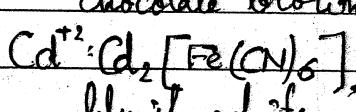
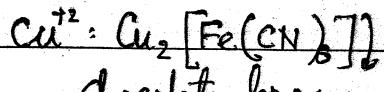
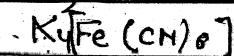
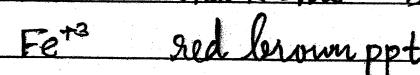
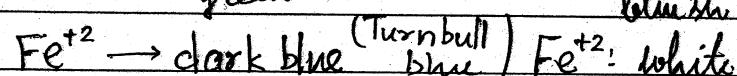
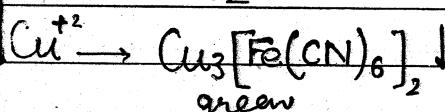
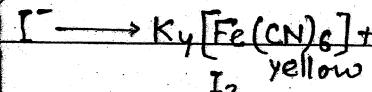
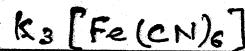
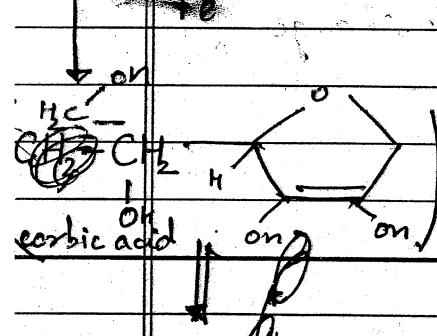
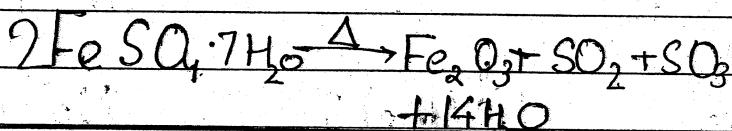
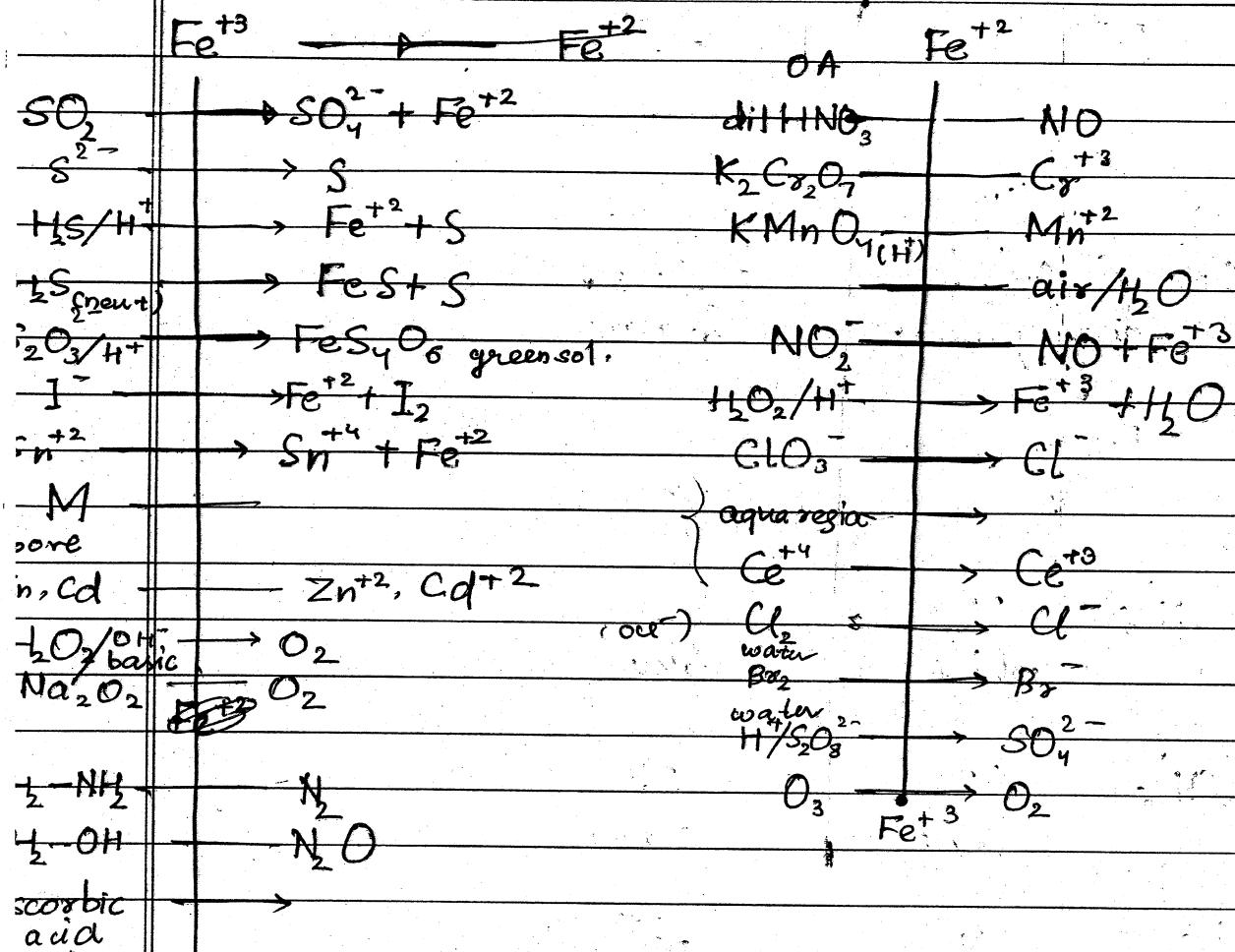
- MnO <sub>4</sub> <sup>-</sup> /H <sup>+</sup>	✓	
- SCN	x (No observable change)	blood red
- NaOH	Fe(OH) <sub>2</sub> ↓ dirty green ppt ↓ air	Fe(OH) <sub>3</sub> ↓ brown
	Brown	
- I <sup>-</sup>	x	✓
	excess	
- K <sub>4</sub> [Fe(CN) <sub>6</sub> ]	22 white	32 blue
- K <sub>3</sub> [Fe(CN) <sub>6</sub> ]	23 blue	33 red brown
- H <sub>2</sub> S/H <sup>+</sup>	x	Fe <sup>+2</sup> + S
dmg	[Fe(dmg) <sub>2</sub> ] red ppt	No observable change

$\{ +3 \text{ OS}$  most stable in  
 lanthanide

classmate

Date \_\_\_\_\_

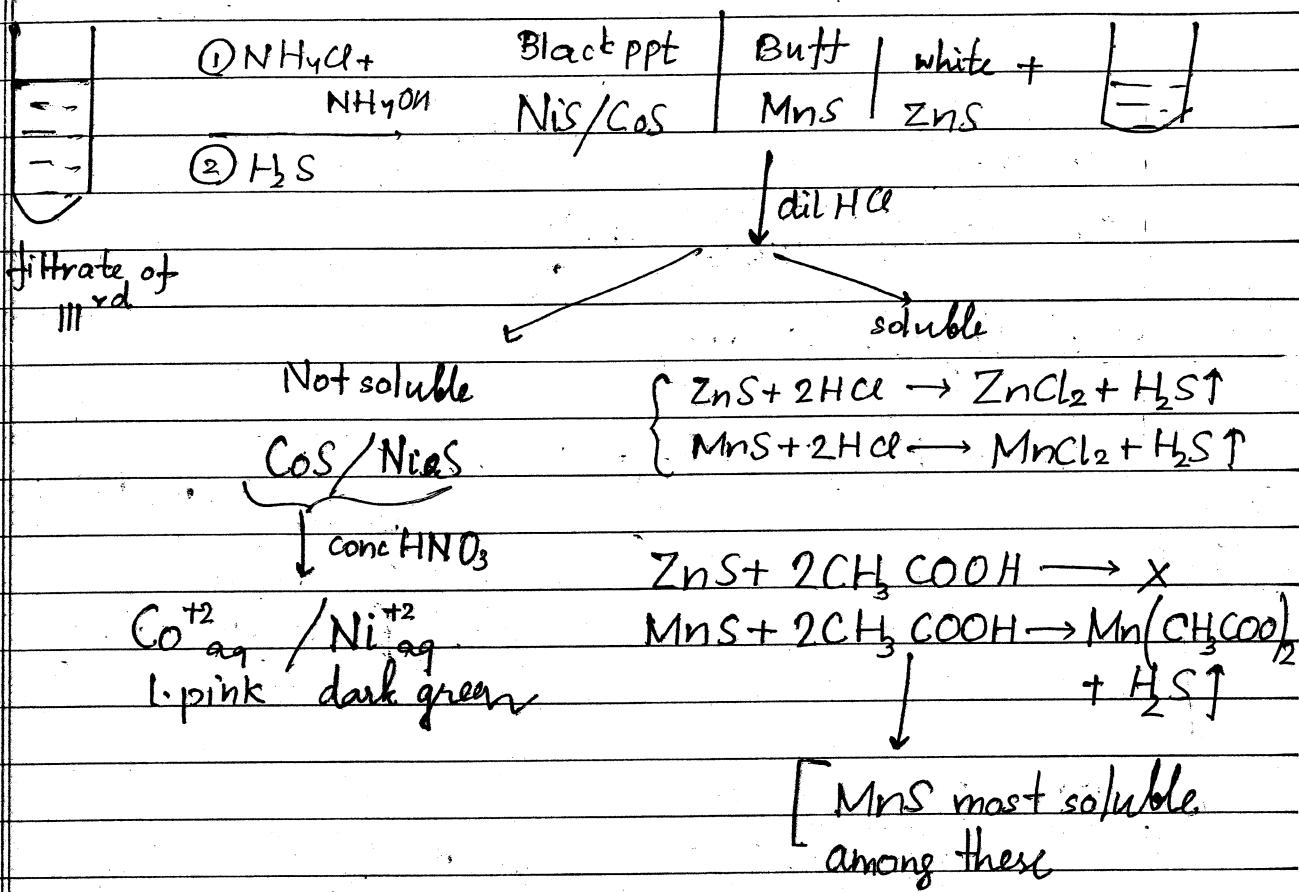
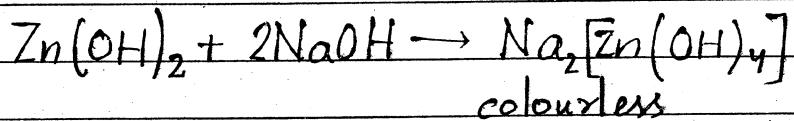
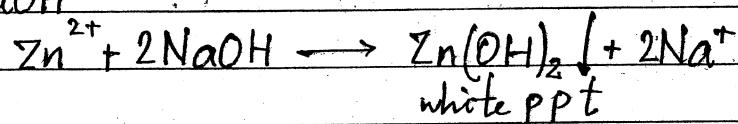
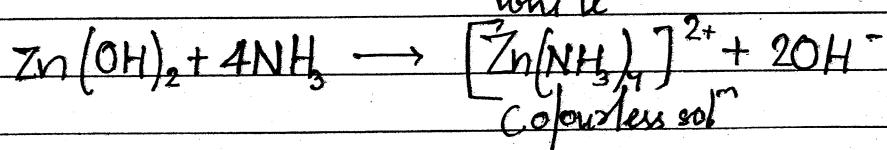
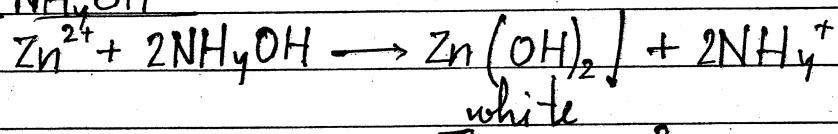
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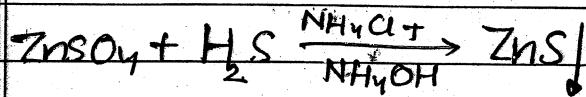
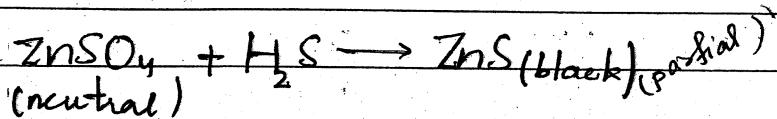
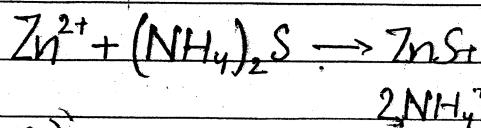
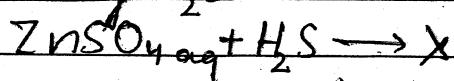
## List Of Blue Compounds

- $\text{CuSO}_4 \cdot \text{cag}$  (blue)
- $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$  (blue)
- $\text{CrO}_5$  dark blue
- $\text{Cu}(\text{OH})_2$  (blue)
- $\text{I}_2$  starch paper blue black
- Methylene blue.
 

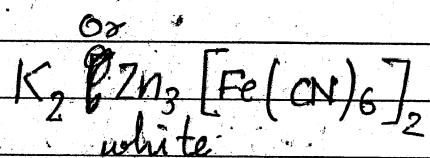
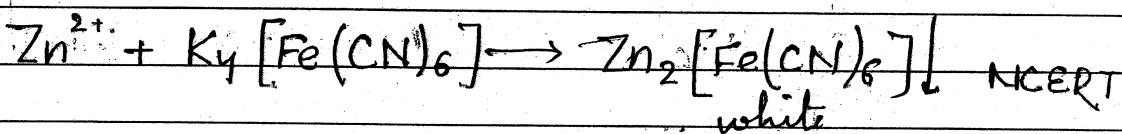
$\text{H}_2\text{N}-\text{C}=\text{N}-\text{S}-\text{C}_6\text{H}_4-\text{C}_6\text{H}_4-\text{N}^+(\text{Me})_2$
- $\text{NO} + \text{NO}_2 \xrightarrow[\text{(-30°C)}]{\text{Cold}} \text{N}_2\text{O}_3 \text{ (s)}$  dark blue
- $(\text{NH}_4)_2 \text{MoO}_4 + \text{conc. H}_2\text{SO}_4 + \text{Na}_2\text{S}_2\text{O}_3$   
blue ring
- flame of  $\text{CO}, \text{H}_2, \text{Cs}, \text{Pb}, \text{Cu}$
- $\text{Na}_2 [\text{Cu}(\text{BO}_2)_4]$   $\text{Co}(\text{BO}_2)_2$
- $\text{CoO} \cdot \text{Al}_2\text{O}_3$  (Thinnard blue)
- $\text{CoO} \cdot \text{SnO}$  (blue)
- $[\text{Ni}(\text{NH}_3)_6]^{2+}$
- IA metals + liq  $\text{NH}_3$
- $\text{Hg} [\text{Co}(\text{SCN})_4]$
- $\text{Cu}(\text{OH})_2 \cdot 2\text{CuCO}_3$
- $\text{S}_2$
- $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- $\text{Cd}_2 [\text{Fe}(\text{CN})_6]$  bluish white
- adsorption of litmus on  $\text{Al}(\text{OH})_3$
- $\text{KFe} [\text{Fe}(\text{CN})_6]$   
Turnbull's and prussian blue
- $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  b. blue
- $\text{CoX OH}$
- $\text{Co}(\text{OH})_2$
- $[\text{Co}(\text{H}_2\text{O})_4]^{2+}$  d. blue

GROUP IVTest of  $\text{Zn}^{+2}$ 1. Test by  $\text{NaOH}$ 2. Test by  $\text{NH}_4\text{OH}$ 

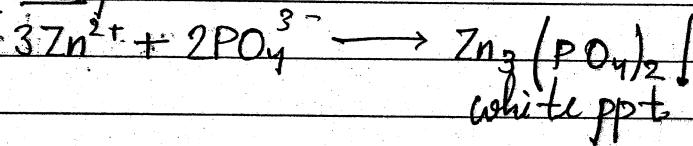
③ Test by  $H_2S$



④ Test by  $K_4[Fe(CN)_6]$



⑤  $\text{Na}_2HPO_4$



- phosphate ppt colour same as  $M^{n+}$   
except  $Ag^+$  (yellow)

$\xrightarrow{\text{H}_2\text{O}_2}$

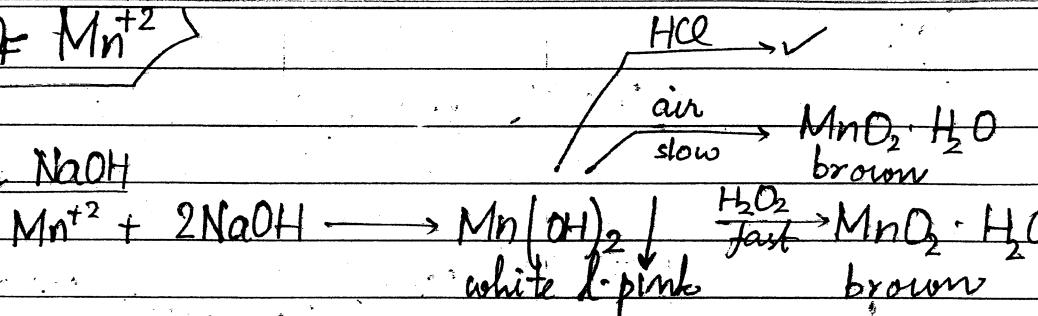
classmate

Date \_\_\_\_\_

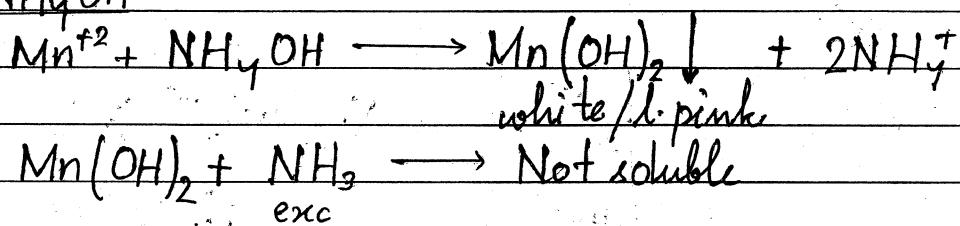
Page \_\_\_\_\_

## Test of $\text{Mn}^{+2}$

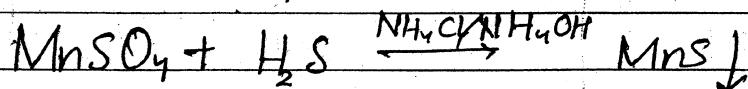
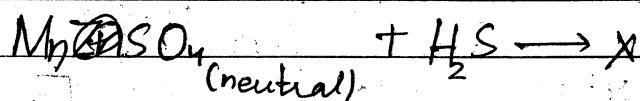
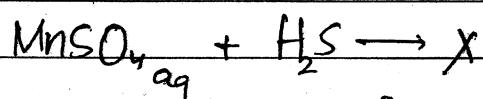
### (1) Test by $\text{NaOH}$



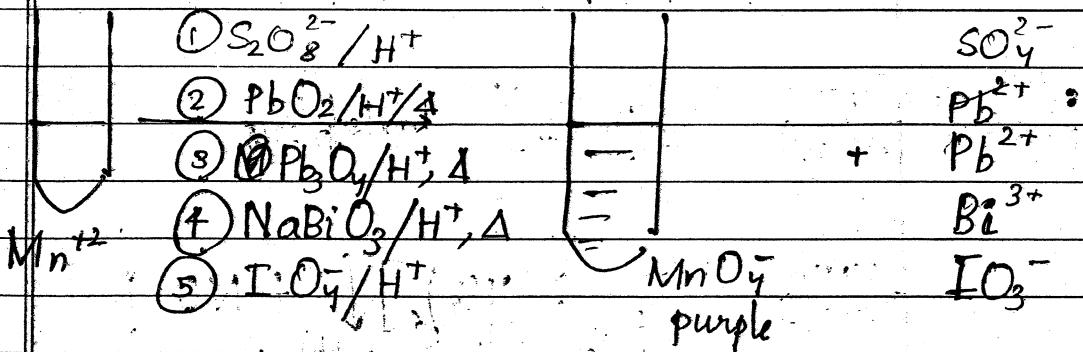
### (2) Test by $\text{NH}_4\text{OH}$



### (3) Test by $\text{H}_2\text{S}$



### (4) Test of $\text{Mn}^{+2}$ based on its oxidation of $\text{MnO}_4^-$



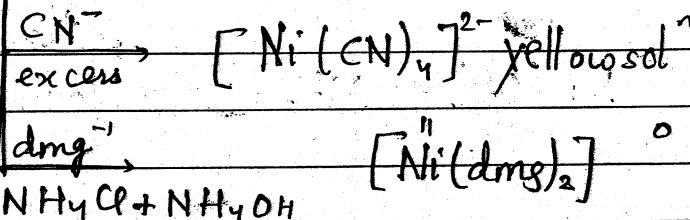
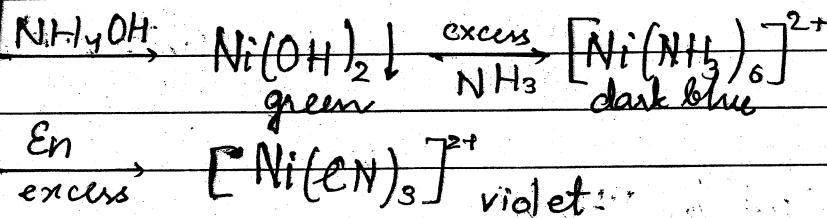
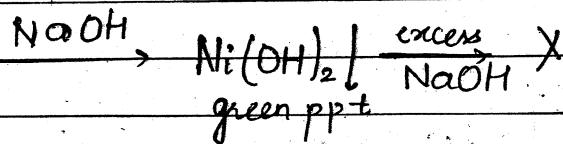
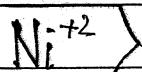
$\xrightarrow{\text{A}}$  Non spontaneous in acidic medium

air  $\rightarrow$  red brown

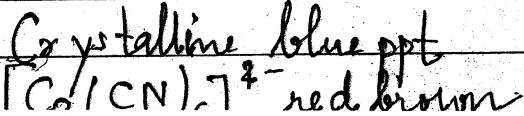
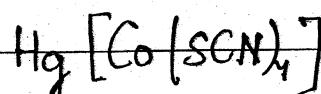
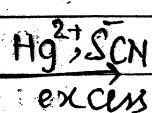
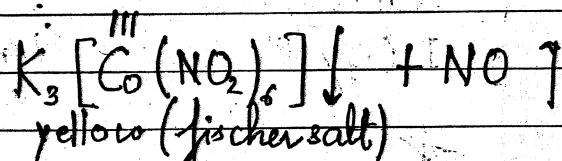
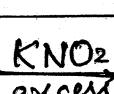
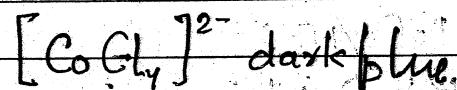
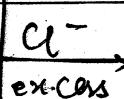
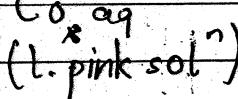
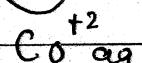
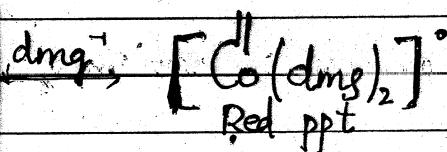
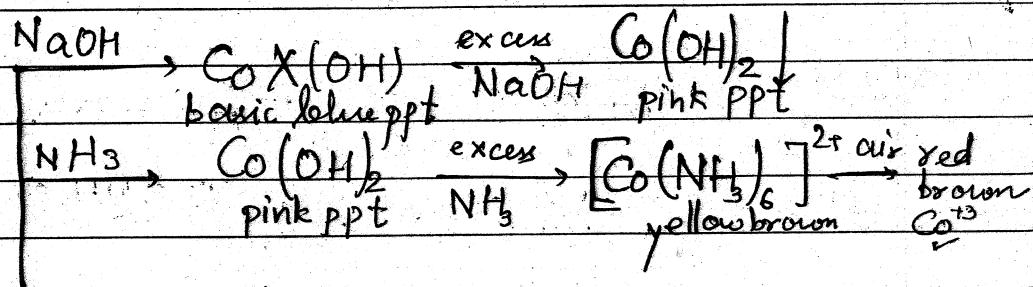
classmate

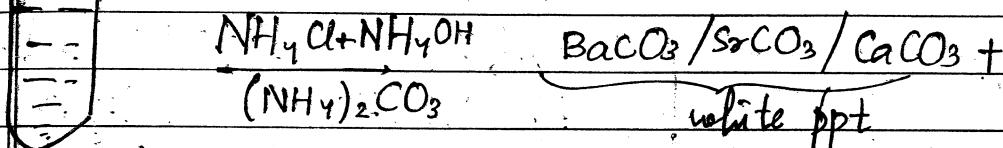
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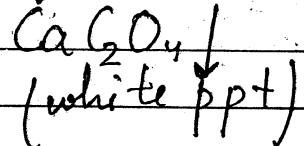
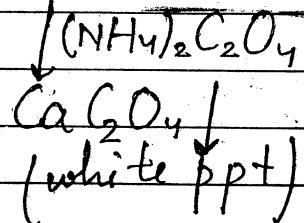
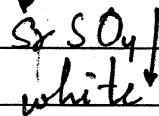
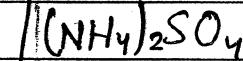
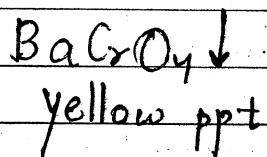
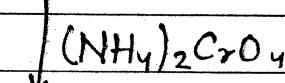
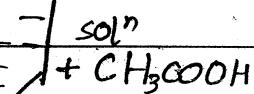
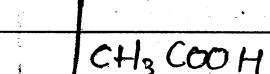


(Rosy red ppt)



V<sup>th</sup> GROUP

filtrate of  
IV



$\text{Ag}_2\text{SO}_4$   
 $\text{SO}_4^{2-}$  excess

classmate

Date \_\_\_\_\_

Page \_\_\_\_\_

$\text{Ba}^{+2}$

$\text{Sr}^{+2}$

$\text{Ca}^{+2}$

$\text{CrO}_4^{2-}$

$\text{BaCrO}_4 \downarrow$   
yellow

$\text{SrCrO}_4 \downarrow$   
yellow ppt

$\text{CaCrO}_4 \downarrow$   
yellow

\* Soluble in  $\text{HCl}, \text{HNO}_3$

\* Not soluble in  $\text{CH}_3\text{COOH}$

\* Soluble in  $\text{CH}_3\text{COOH}, \text{HCl}, \text{HNO}_3$

\* Soluble in  $\text{CH}_3\text{COOH}, \text{HCl}, \text{HNO}_3$

$\text{SO}_4^{2-}$

$\text{BaSO}_4 \downarrow$  (white)

$\text{SrSO}_4 \downarrow$  (white)

$\text{CaSO}_4 \downarrow$  (o.s.) (white)

Not soluble in  
 $\text{HCl}/\text{HNO}_3/\text{CH}_3\text{COOH}$

\* Not soluble in  
excess  $\text{SO}_4^{2-}$

Not soluble in  
 $\text{HCl}, \text{HNO}_3, \text{CH}_3\text{COOH}$

Not soluble in  
excess  $\text{SO}_4^{2-}$

Not soluble in  
 $\text{HCl}, \text{HNO}_3, \text{CH}_3\text{COOH}$

Soluble in  
excess  $\text{SO}_4^{2-}$

$\text{C}_2\text{O}_4^{2-}$

$\text{BaC}_2\text{O}_4 \downarrow$   
(white)

$\text{SrC}_2\text{O}_4 \downarrow$   
(white)

$\text{CaC}_2\text{O}_4 \downarrow$   
(white)

\* Soluble in  $\text{HCl}, \text{HNO}_3$

Soluble in  $\text{HCl}, \text{HNO}_3$

Soluble in  
 $\text{HCl}, \text{HNO}_3$

\* Soluble in  $\text{CH}_3\text{COOH}$

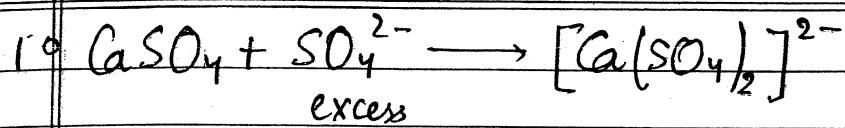
Not in  
 $\text{CH}_3\text{COOH}$

Not in  
 $\text{CH}_3\text{COOH}$

9/12/21 2/25 2/25  
 2/1 2/1 3/1

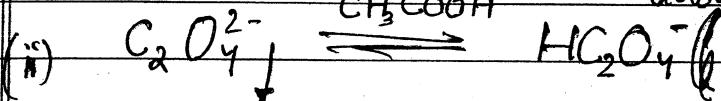
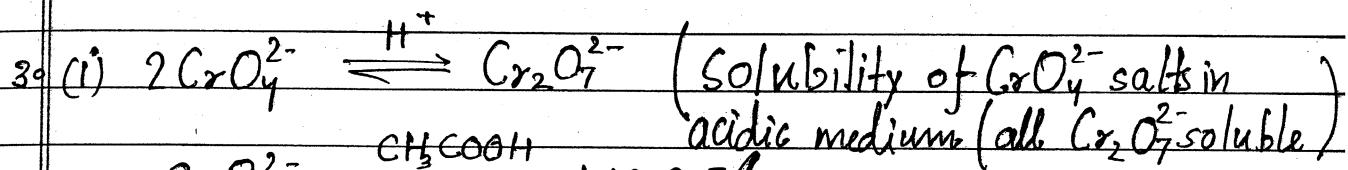
classmate

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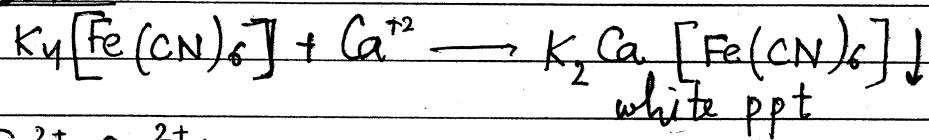
2. Solubility trends

- $\text{BaCrO}_4 < \text{SrCrO}_4 < \text{CaCrO}_4$
- $\text{BaSO}_4 < \text{SrSO}_4 < \text{CaSO}_4$
- $\text{BaC}_2\text{O}_4 > \text{SrC}_2\text{O}_4 > \text{CaC}_2\text{O}_4$



all  $\text{HC}_2\text{O}_4^-$  salts water soluble

Test of Ca ion



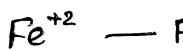
$\text{Sr}^{2+}, \text{Ba}^{2+} \times$

(The solubility trends only for simple salts)

~~Ca PO<sub>4</sub><sup>3-</sup> interfering~~

Race 39

s-blocks



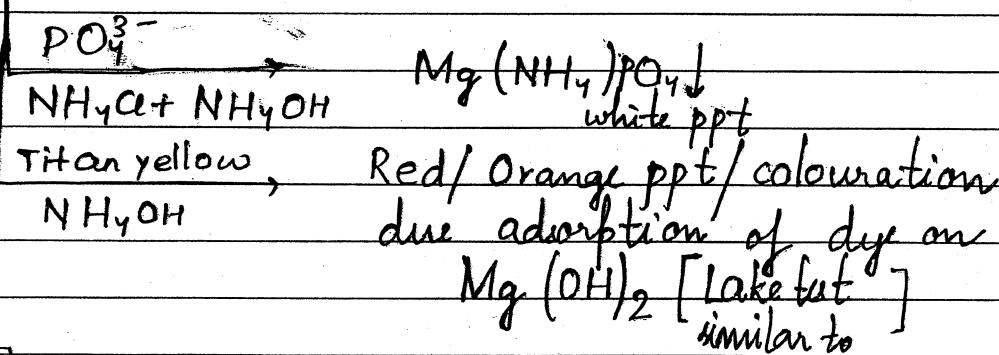
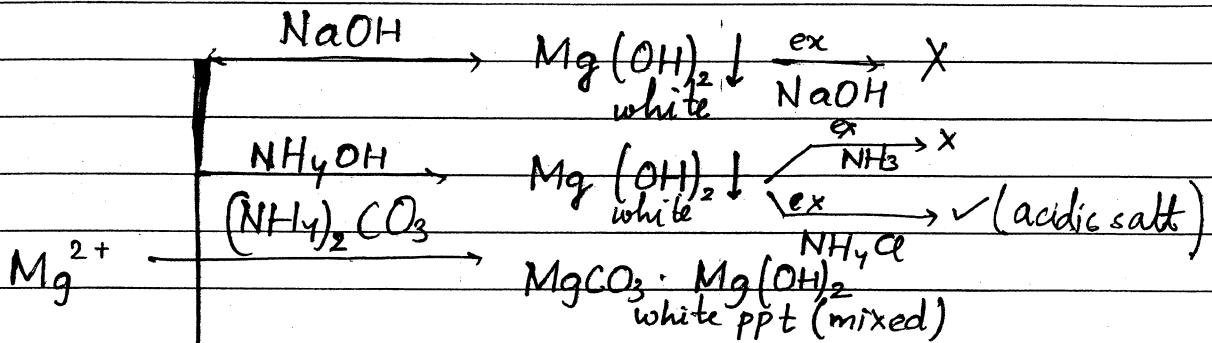
classmate

Date \_\_\_\_\_

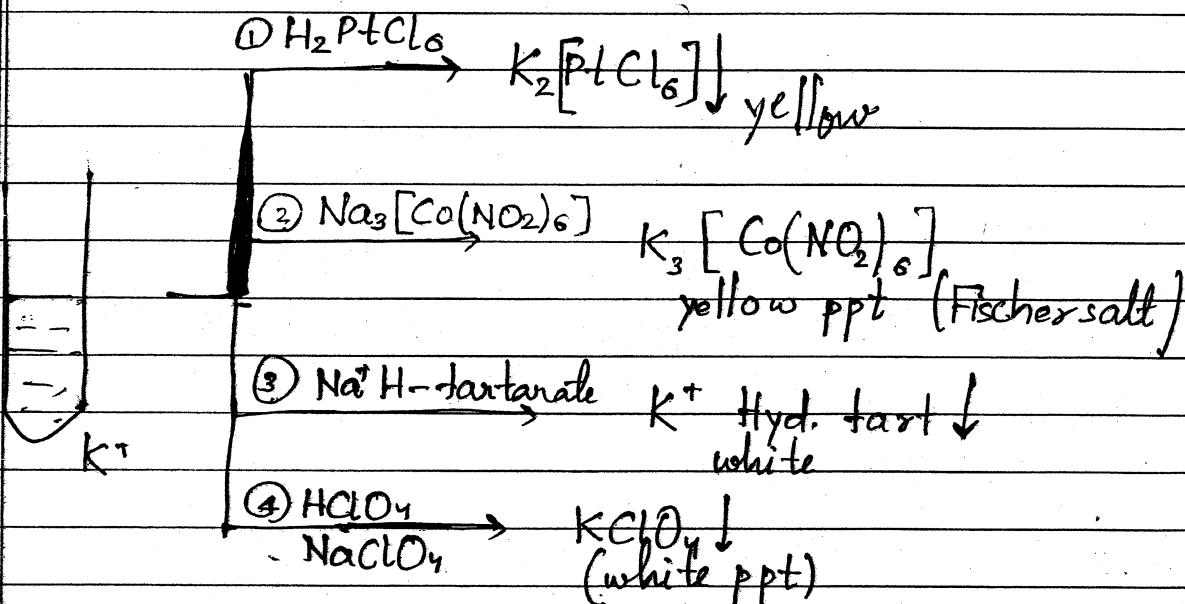
Page \_\_\_\_\_

## GROUP VI

### Test of Mg<sup>2+</sup>



### Test of K<sup>+</sup>

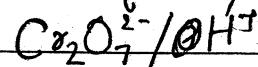
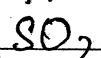
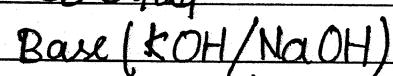
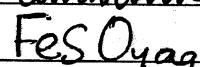
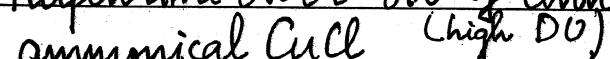
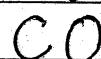
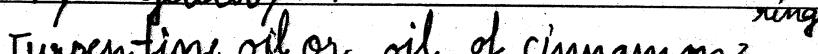
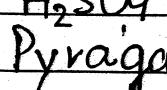
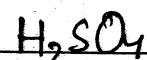


(1, 2, 3 are also given by NH<sub>4</sub><sup>+</sup>)

## Absorption of gases

gas

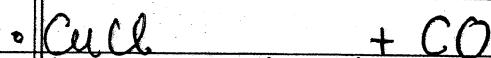
absorber



(oxidation)

activated

ring

(ammonical sol<sup>n</sup>)

stable

