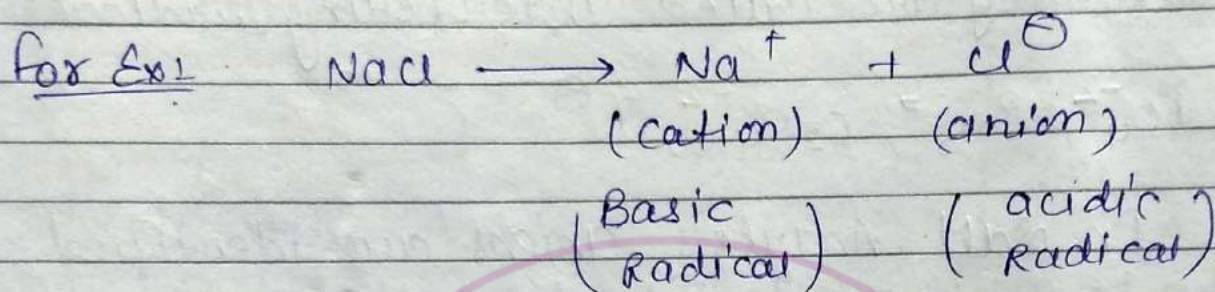




Handwritten Notes  
On  
Salt Analysis

# \* Salt Analysis \*

\* Identification of cation and anion in given salt is called salt analysis.



## Salt Analysis

↓  
Identification of Basic Radical or cation.

↓  
Identification of acidic Radical or anionic by wet test.

- 1] by wet test
- 2] dry test
- 3] flame test

\* What is test?

\* By different test method colour precipitate are formed specific gas is produced, colour complexes are formed and some other observed changes are obtained

\* Property based analysis is called Qualitative Analysis



## \* Interfering Radical :-

There are some anions which act as interfering radical during the test of cations. Because their presence in aq. solution does not give test of correct informations about cations.

So, that they are called interfering radical

for ex:  $\text{PO}_4^{-2}$ ,  $\text{BO}_3^{-2}$ ,  $\text{C}_2\text{O}_4^{-2}$ ,  $\text{F}^\ominus$

\*\*\*  
\* Note :- In salt analysis, anions are identified before the identification of cations because there are some anions which act as interfering radical. If any interfering radical is present, they are must be removed before the identification of cations.

## \* Classification of anions :-



# \* Classifications of Anions

Anion

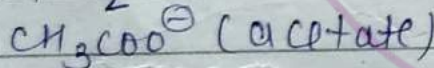
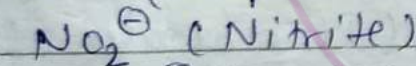
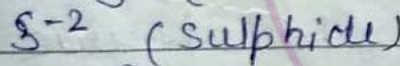
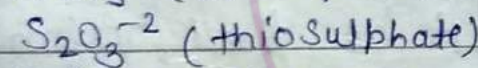
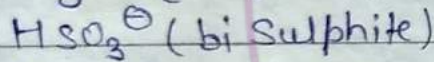
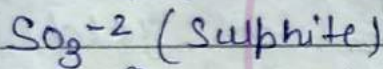
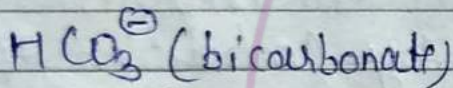
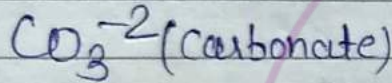
## Class - I

(which produce volatile product with  $H_2SO_4$ )

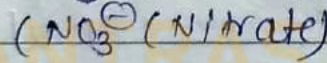
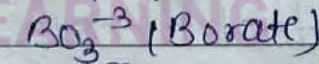
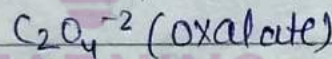
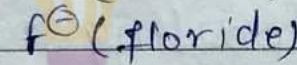
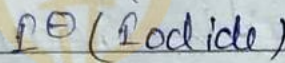
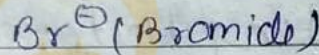
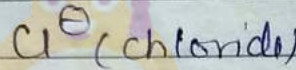
## Class - II

(which does not produce volatile product with  $H_2SO_4$ )

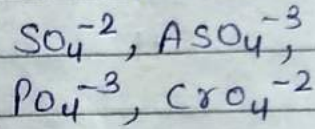
### Subgroup - I (dil. $H_2SO_4$ )



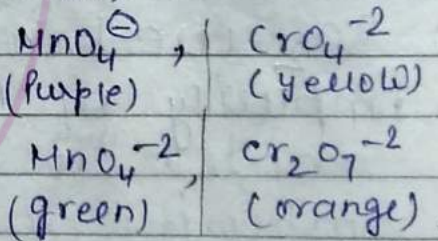
### Subgroup - II (conc. $H_2SO_4$ )



### Subgroup - I (Identification by PPT method)



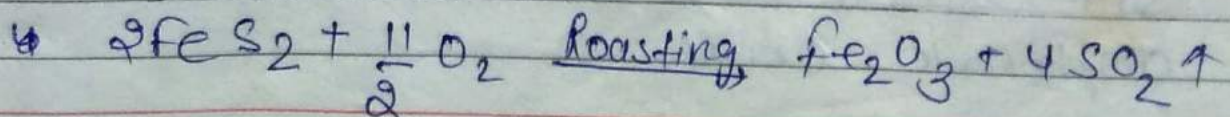
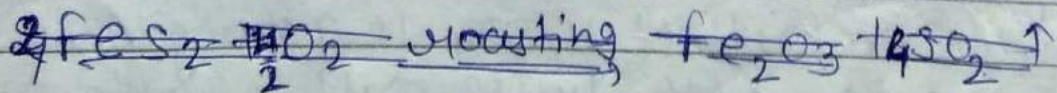
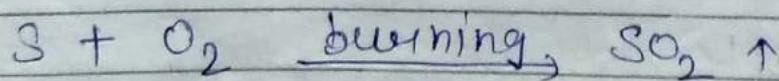
### Subgroup - II (Identified by Redox Rxn)



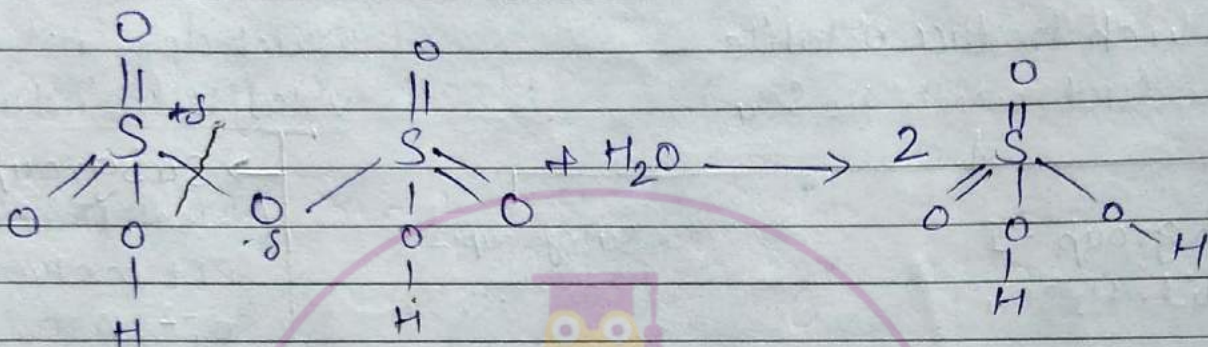
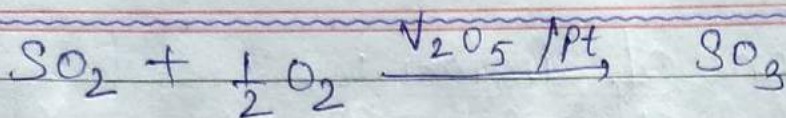
## \* Some Laboratory Reagents

### 1) Chemistry of $H_2SO_4$

#### Preparation of $H_2SO_4$ by Contact Process







\*  $\text{SO}_2$  is starting material for the preparation of  $\text{H}_2\text{SO}_4$  and is produced by combustion of Sulphur and roasting of  $\text{FeS}_2$  (fool's gold)

\*  $\text{SO}_2$  used in Contact Process must be free from impurity of Ar. So, that hydrated ferric oxide ( $\text{Fe}(\text{OH})_3$ ) is used for Purpose (It absorbs impurity of Ar)

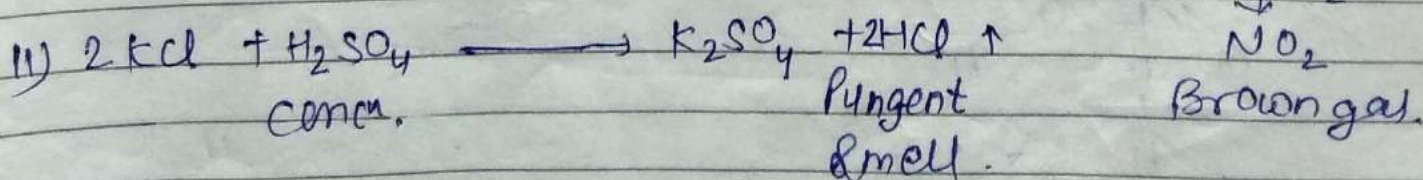
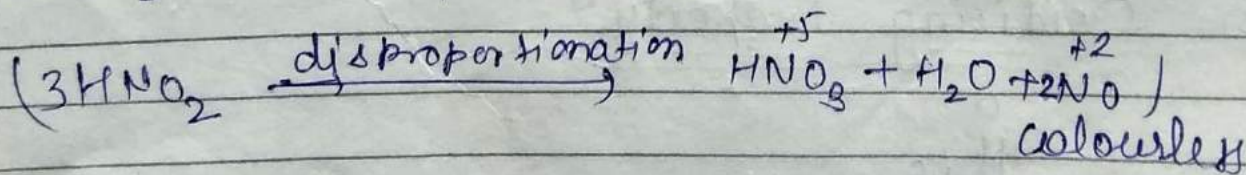
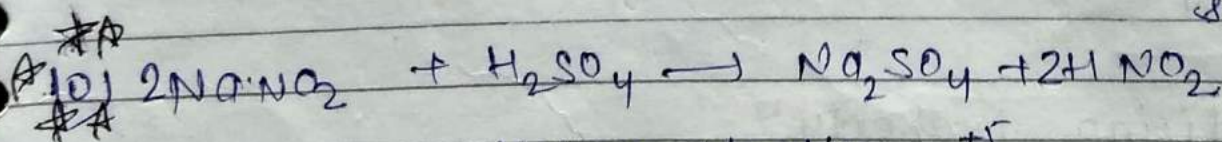
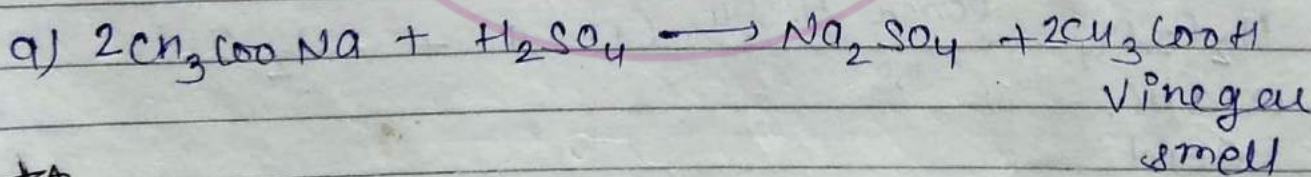
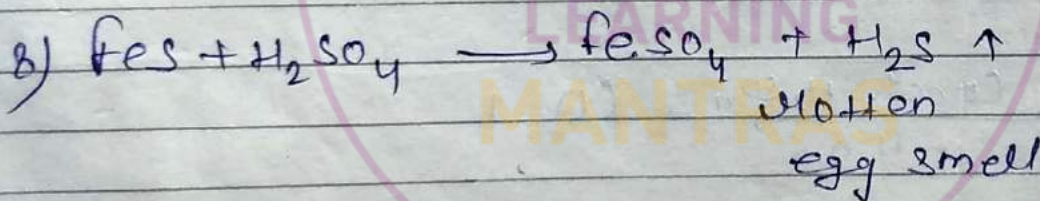
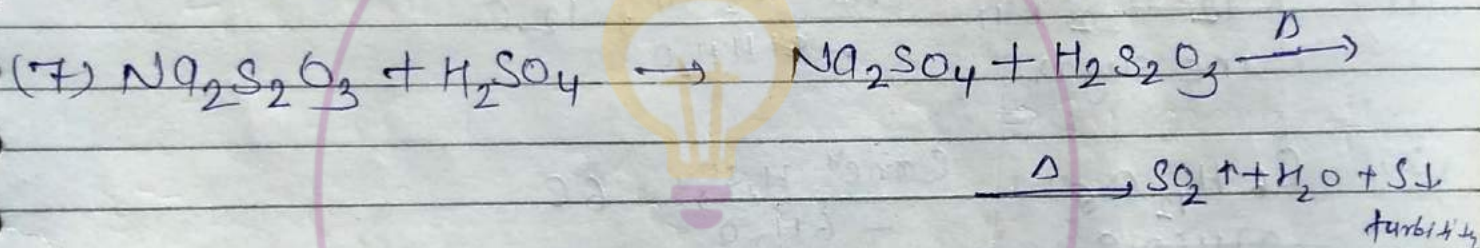
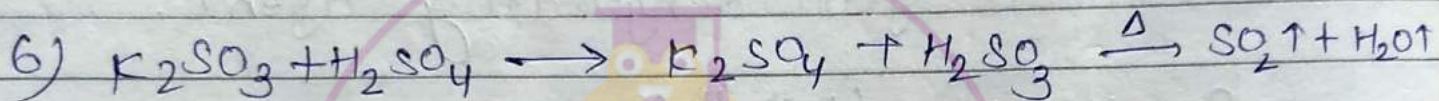
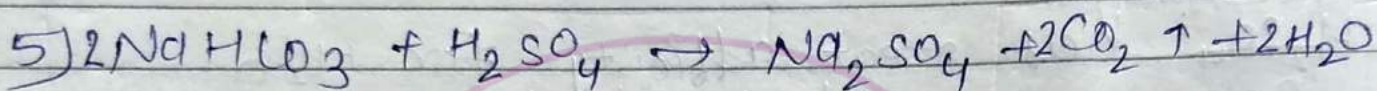
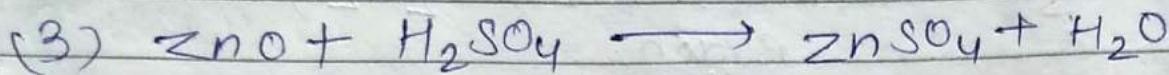
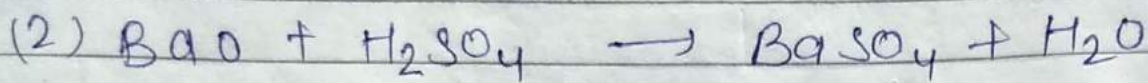
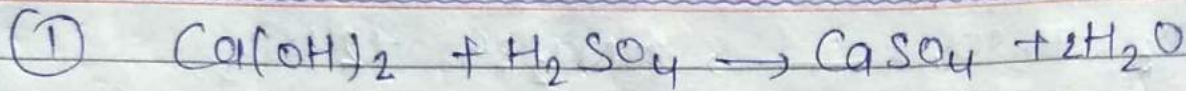
\*  $\text{SO}_3$  produce foggy over the surface of water. so that it does not dissolve in  $\text{H}_2\text{O}$

\*  $\text{SO}_3$  dissolve in  $\text{H}_2\text{SO}_4$  to produce oleum.

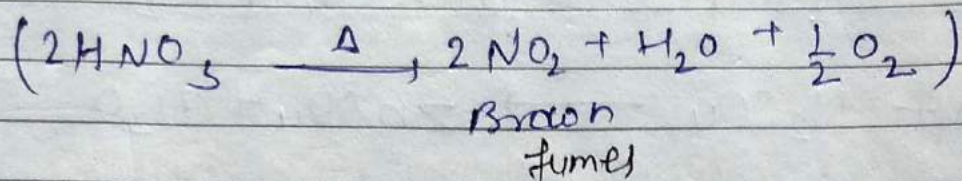
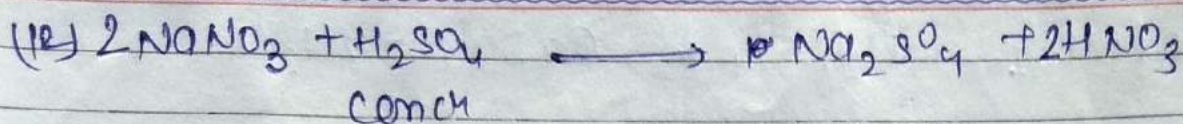
\* Properties:

1) Acidic Properties:  $\text{H}_2\text{SO}_4$  is a strong Acid. so that it react with basic salt, basic oxide, and amphoteric oxide



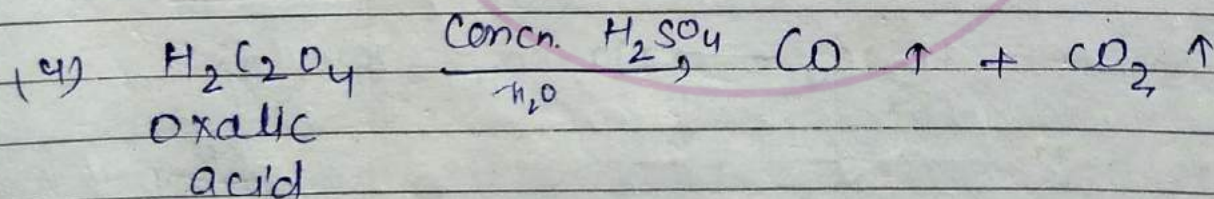
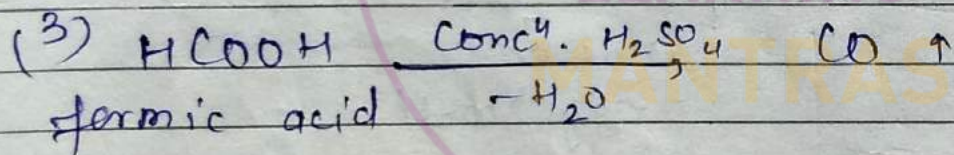
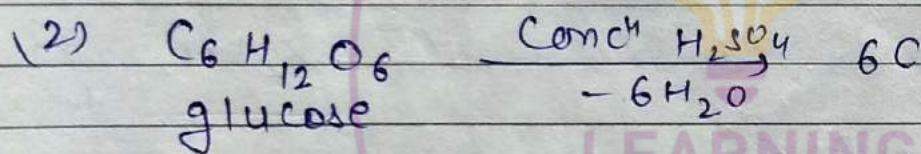
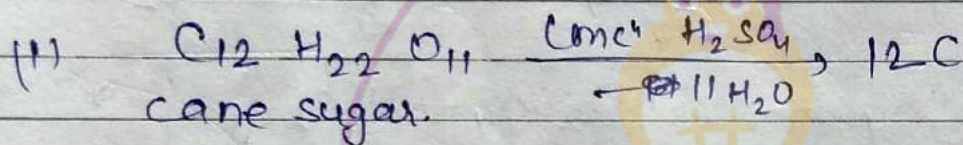




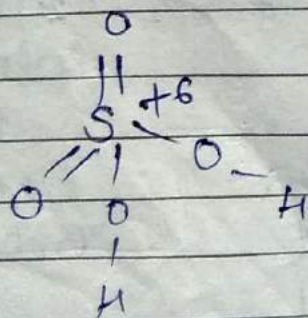


(2) Dehydrating property :

$\text{H}_2\text{SO}_4$  has great affinity for  $\text{H}_2\text{O}$ .  
So, it is good dehydrating agent.

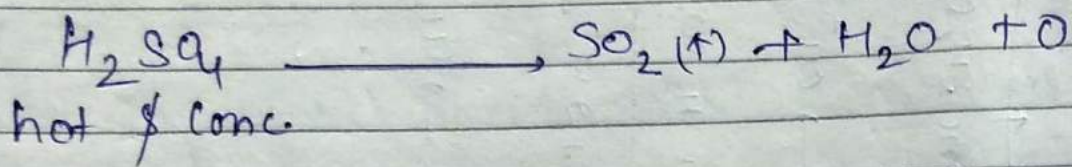


(3) Oxidising Property :

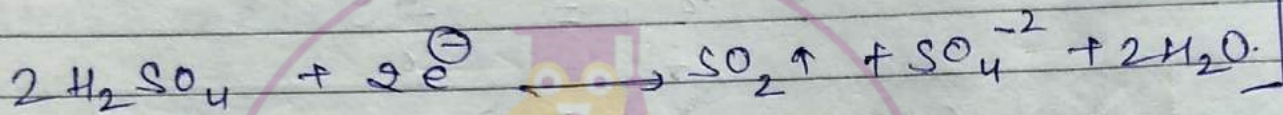




\*  $H_2SO_4$  does not act as oxidising agent in dil. solutions. But conc<sup>n</sup>  $H_2SO_4$  act as mild oxidising agent.



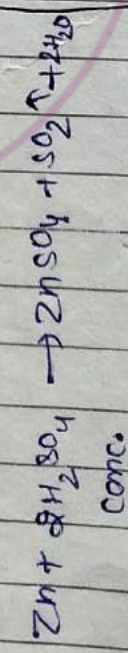
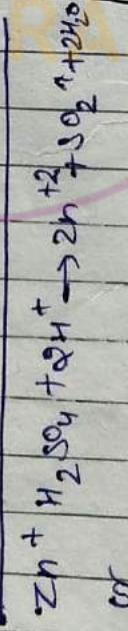
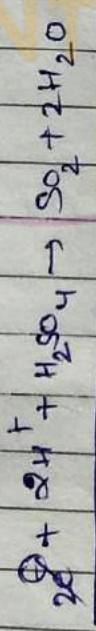
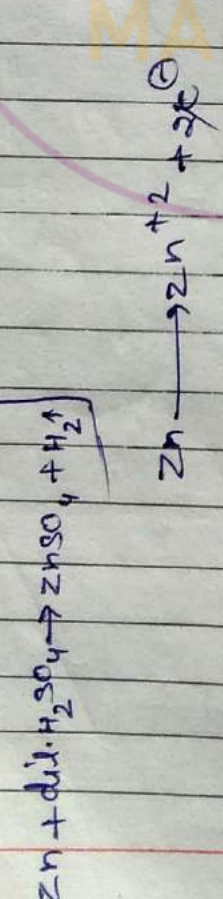
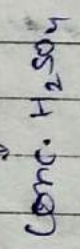
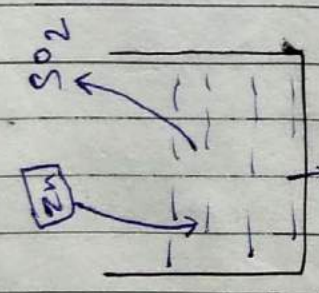
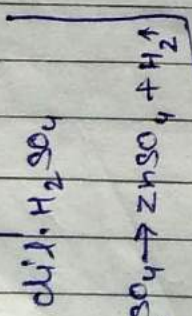
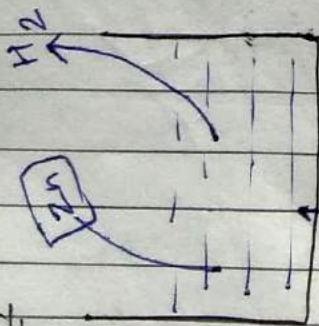
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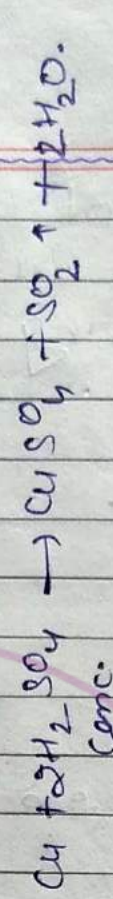
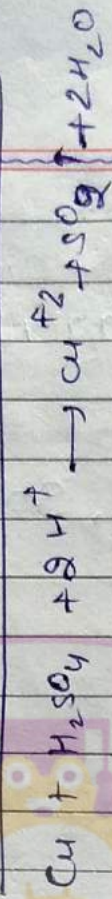
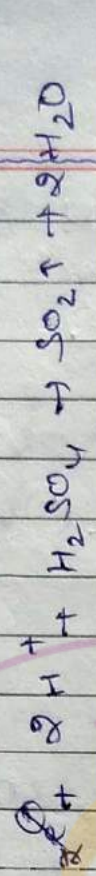
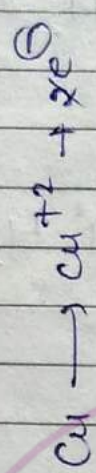
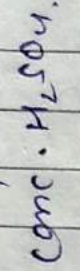
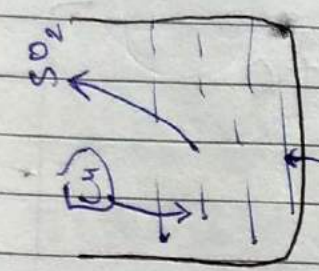
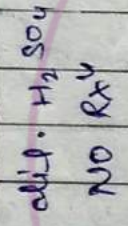
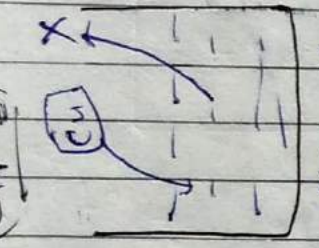
LEARNING  
MANTRAS



Exp. (1)



Exp. (2)





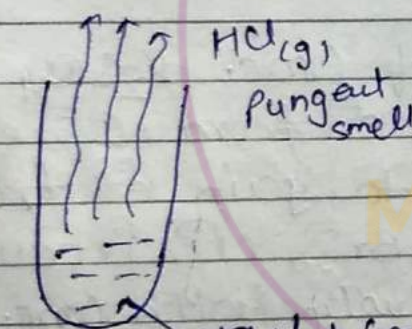
★ ★  
 ★ Note:  
 ★ ★

1) Metal above  $H^+$  in Reactivity Series, produce Hydrogen gas and metal sulphate with dil.  $H_2SO_4$

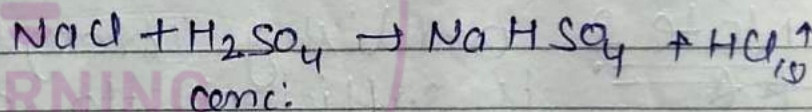
2) All the metal react with conc.  $H_2SO_4$ , they produce metal sulphate +  $SO_2$  except, Au, Pt.

3) Non-metals are oxidised by conc.  $H_2SO_4$  and produce 'ic' acid and  $SO_2$  ( $S \rightarrow SO_2$ )

★ ★ ★  
 ★ Write the Balance Rxn of NaCl, NaBr & NaI with conc.  $H_2SO_4$  respectively.

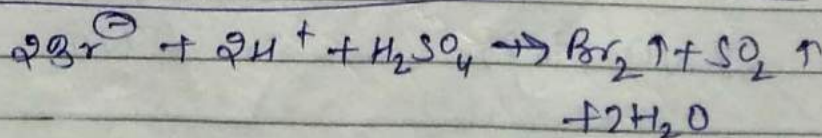
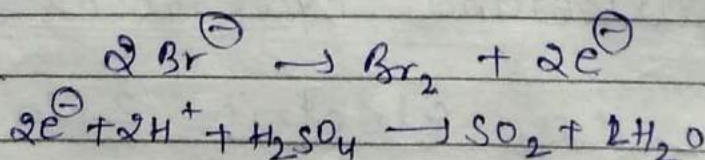


NaCl + conc.  $H_2SO_4$



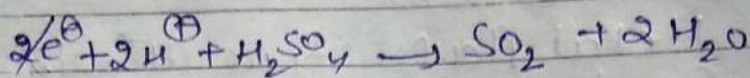
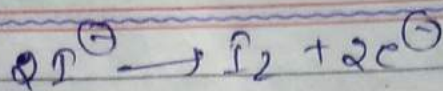
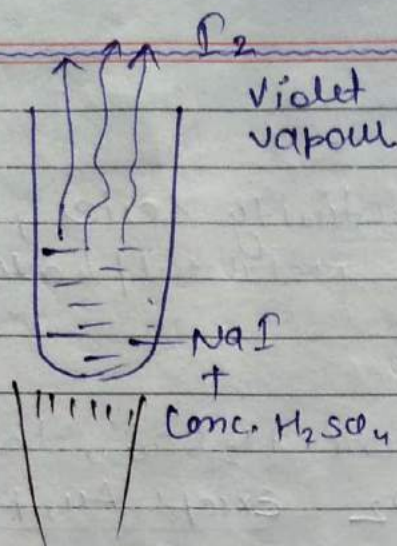
$Br_2$   
 brown gas

NaBr + conc.  $H_2SO_4$

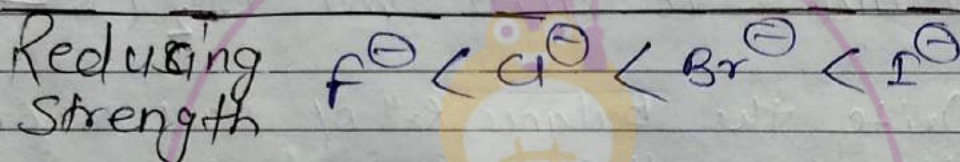
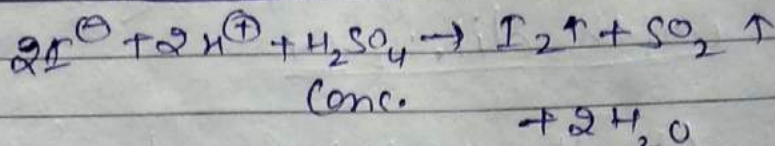




Metals in All cases  
Full shell



Conc.

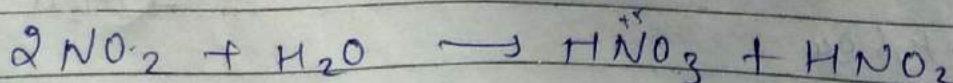
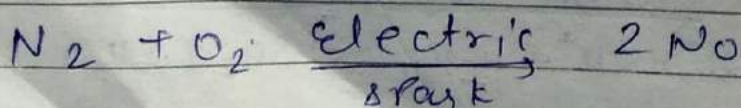


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Note: Oxidising strength of Conc. H<sub>2</sub>SO<sub>4</sub> is sufficient to gain e<sup>-</sup> from I<sup>-</sup> and Br<sup>-</sup> but not sufficient to gain e<sup>-</sup> from Cl<sup>-</sup>. So that salt of I<sup>-</sup>, Br<sup>-</sup>, Cl<sup>-</sup> produce I<sub>2</sub>, Br<sub>2</sub> and HCl respectively with Conc. H<sub>2</sub>SO<sub>4</sub> (F<sup>-</sup> → HF)

\* Chemistry of HNO<sub>3</sub> (Nitric acid):

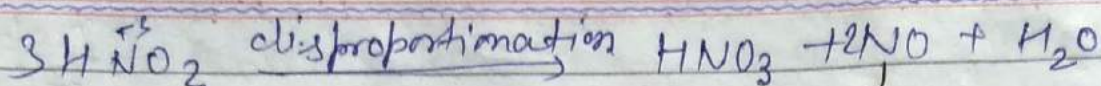
① Bankeland Eyle Process:



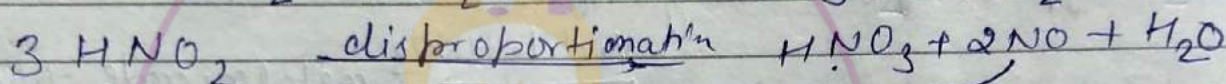
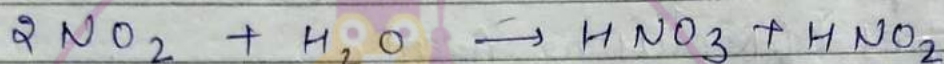
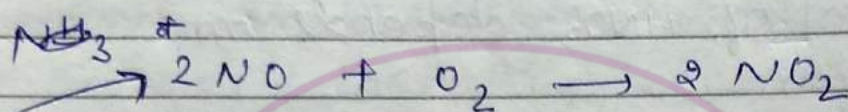
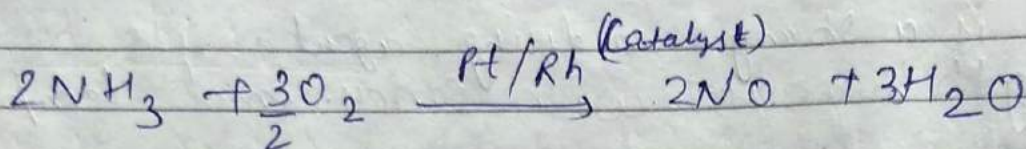


metal base

↓ +4 stable

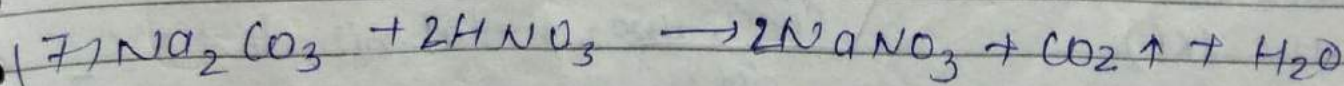
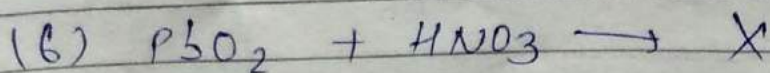
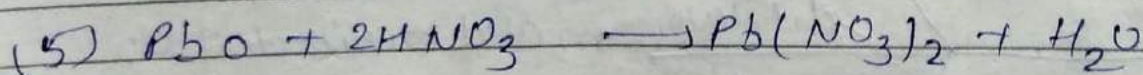
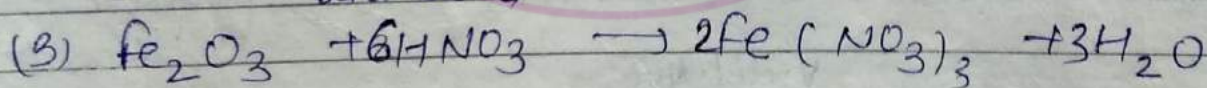
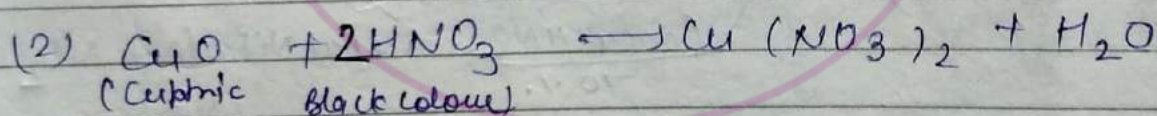
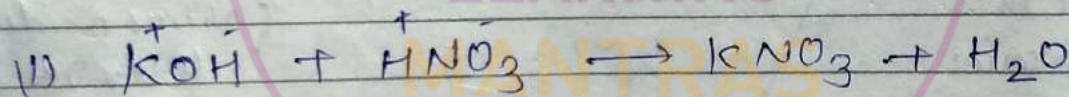


2) Ostward Ammmia Process:

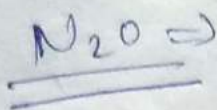


\* Properties of  $\text{HNO}_3$ :

(1) Acidic Property:





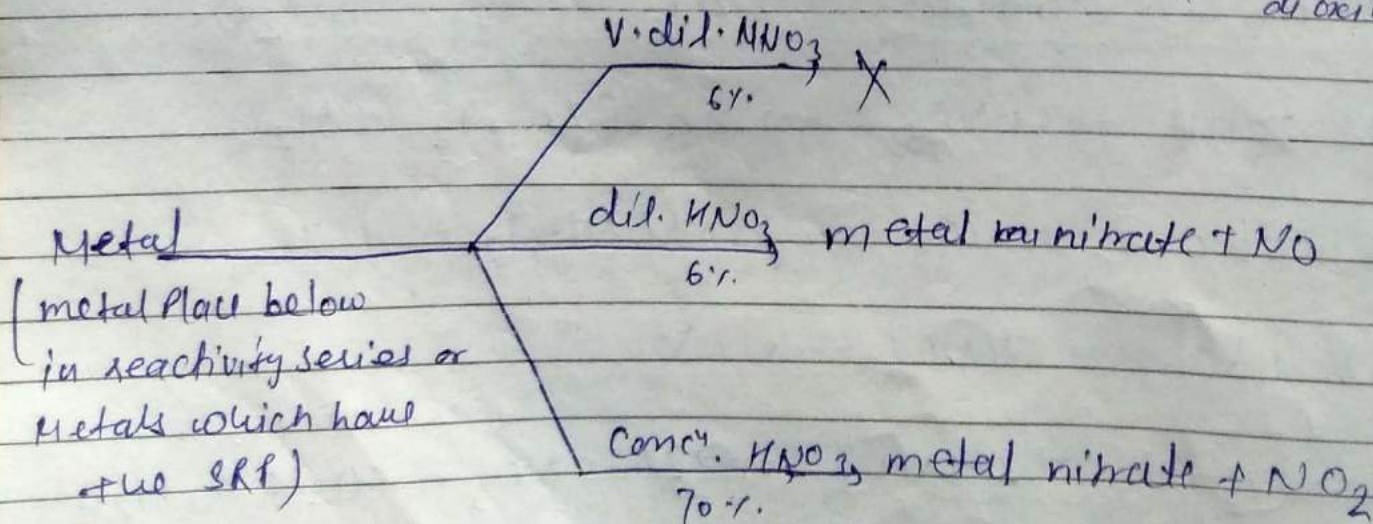
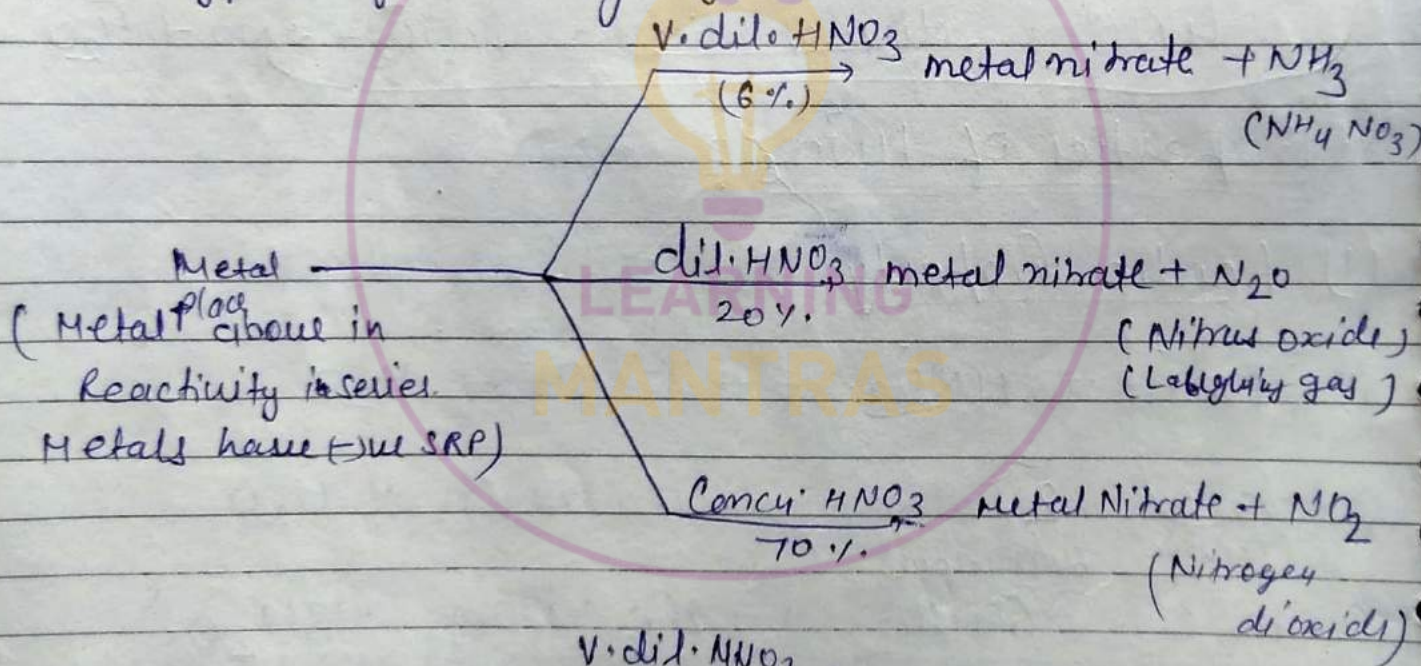


\* Oxidising Property:

\* HNO<sub>3</sub> is a strong oxidising agent. its oxidising strength increases with concn. and temp.

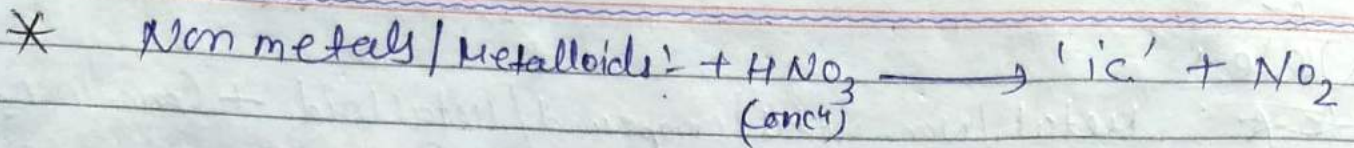
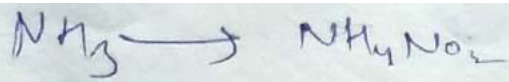
\* Redox Product of HNO<sub>3</sub> depends on

- i) Concentration
- ii) Temp.
- (iii) Types of Reducing Agent.



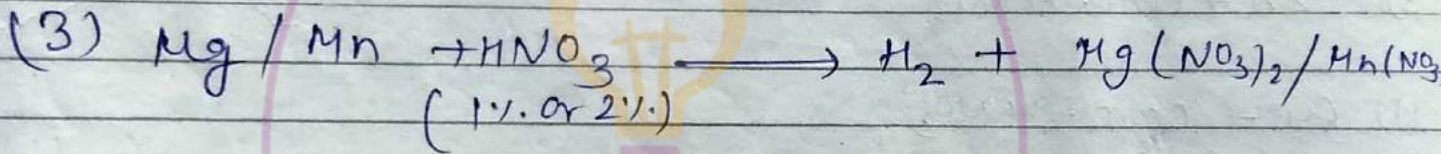
for Ex: Cu, Hg, Ag etc





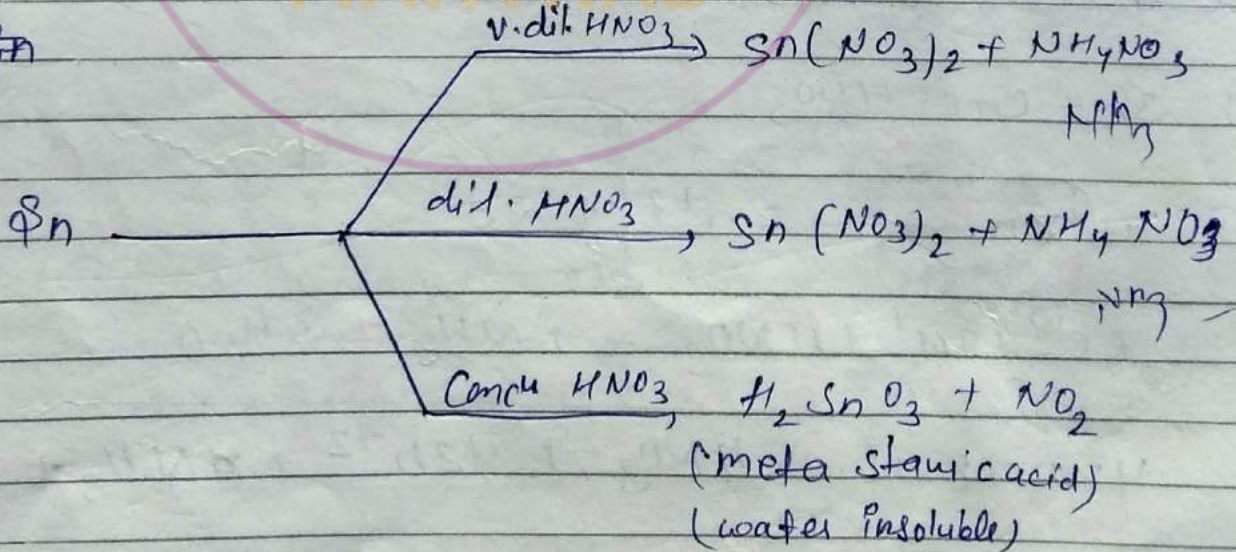
\* Exceptions!

- (1) Au / Pt does not react with  $\text{HNO}_3$
- (2) Al / Cr do not dissolved in conc<sup>n</sup>.  $\text{HNO}_3$  due to formation of Passé or Protected layer on surface (including  $\text{Fe} + \text{HNO}_3 \xrightarrow{80\%} \text{X}$  Protected layer of oxide  $\text{Fe}_2\text{O}_3$ )



4] Rx<sup>n</sup> of Pb with  $\text{HNO}_3$  are similar to Cu

5] Sn



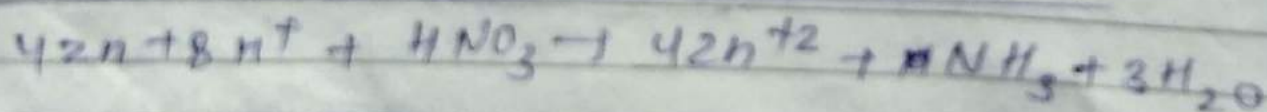
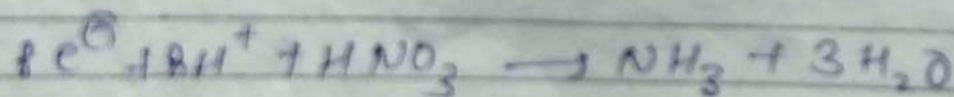
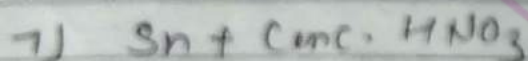
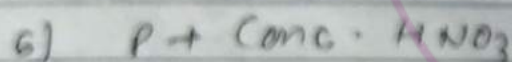
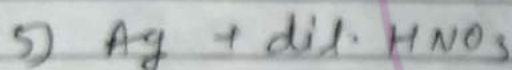
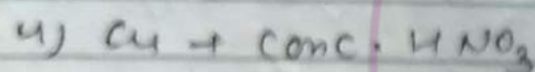
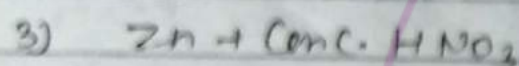
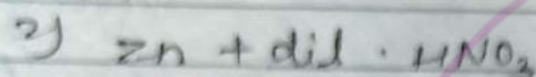
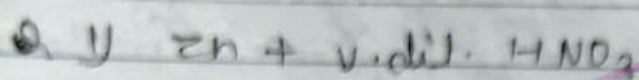


★ ★  
★ Note:

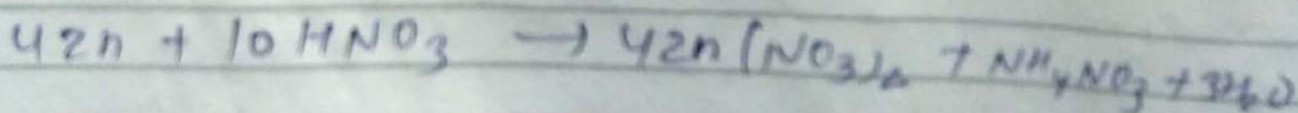
★ ★ ★ Metal / Non-metal / compound / Metalloids + Conc.  $\text{HNO}_3$  →

→  $\text{NO}_2 \uparrow$   
(always)

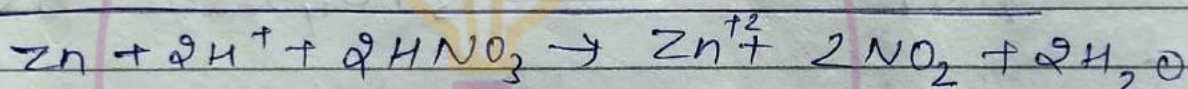
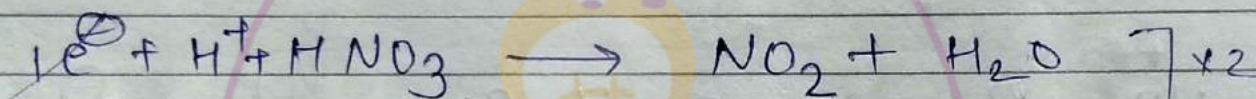
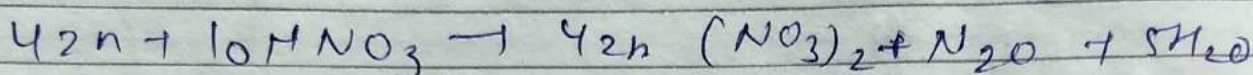
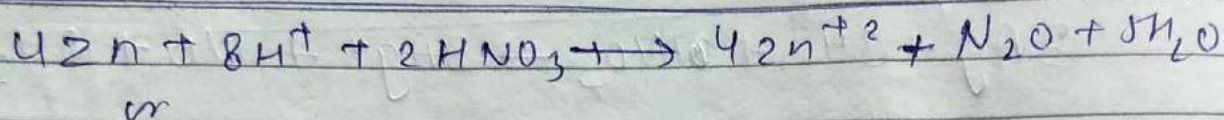
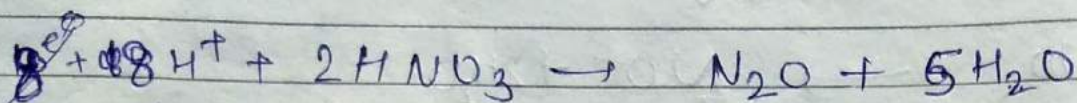
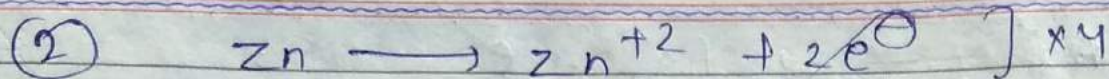
Ques: Write the Balance rx<sup>n</sup> of



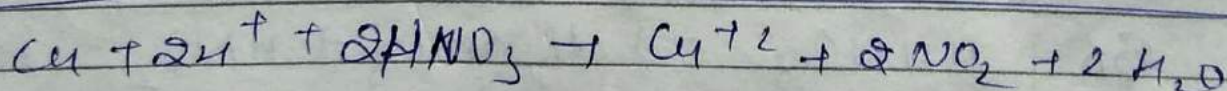
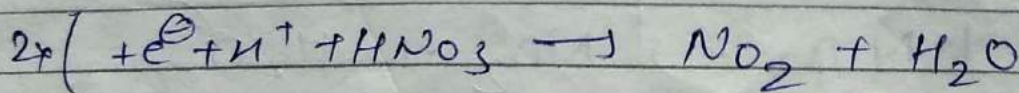
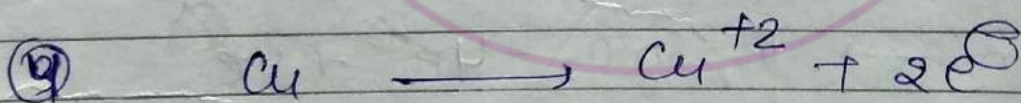
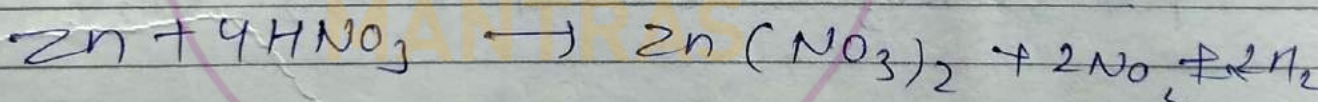
or



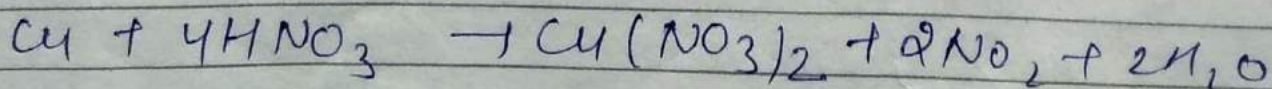




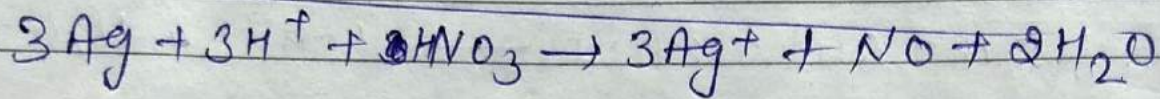
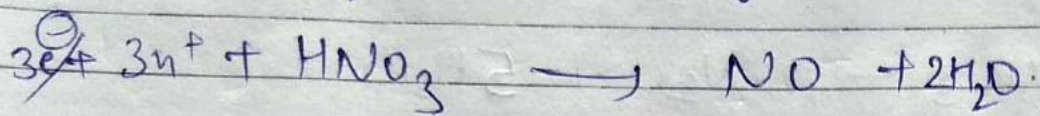
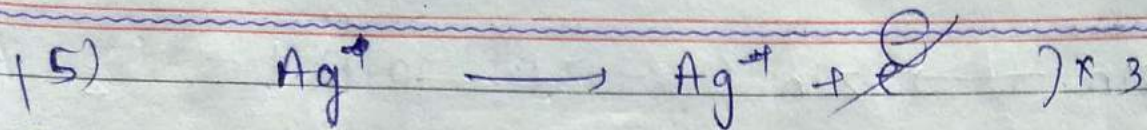
or



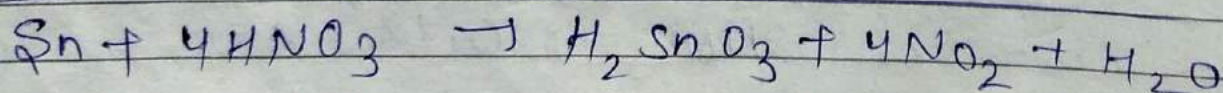
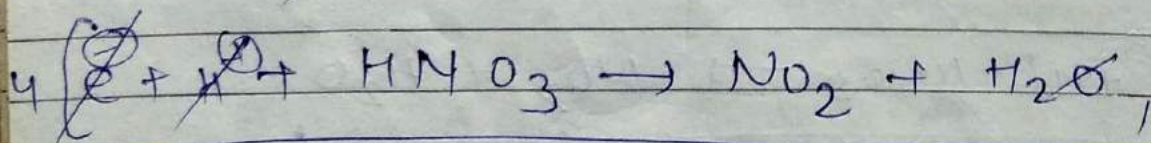
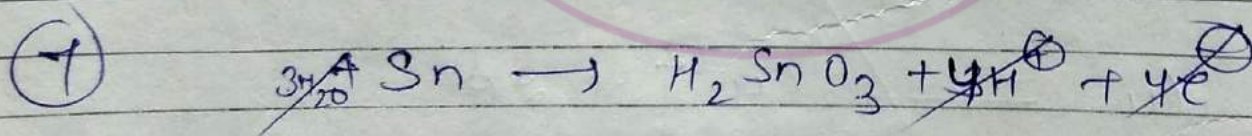
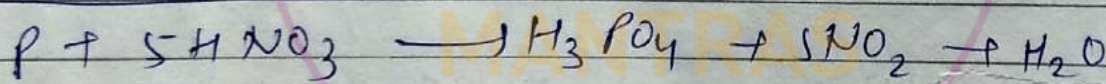
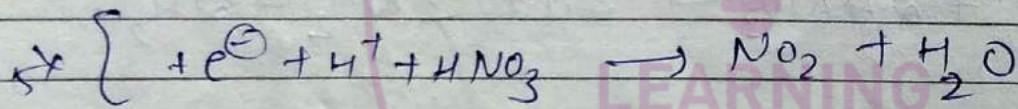
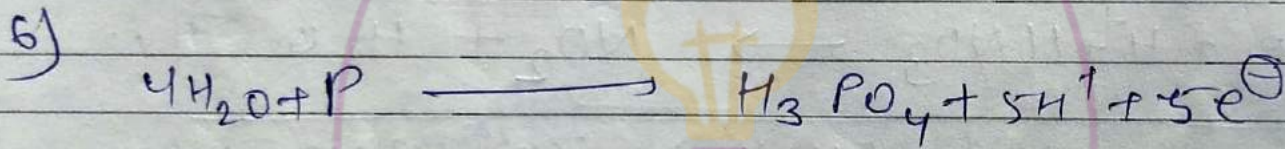
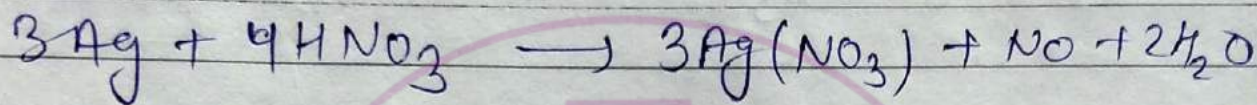
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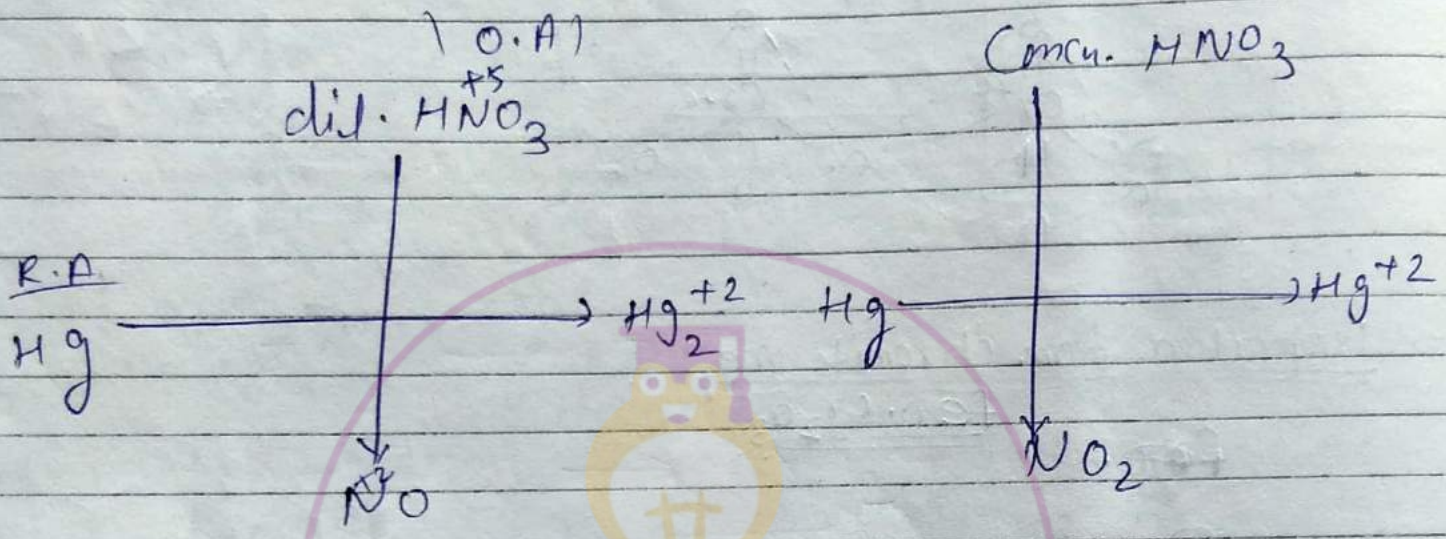
or





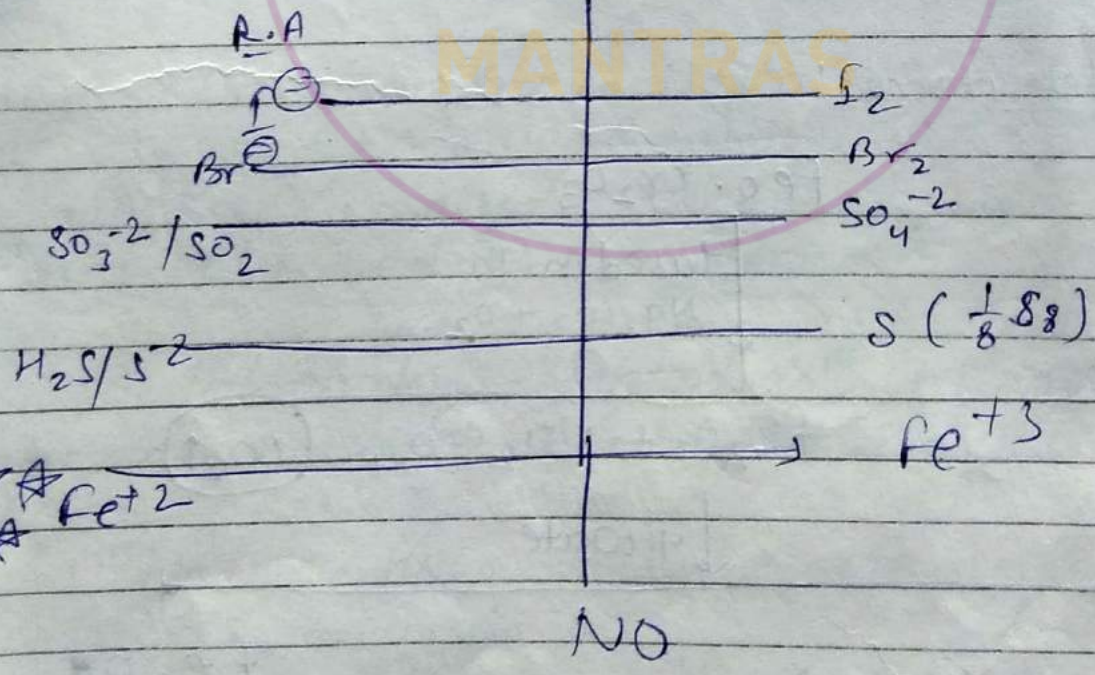
Ques - Write the Rx<sup>n</sup> of Hg with ~~HNO<sub>3</sub>~~

- (i) dil. HNO<sub>3</sub>
- (ii) Conc. HNO<sub>3</sub>



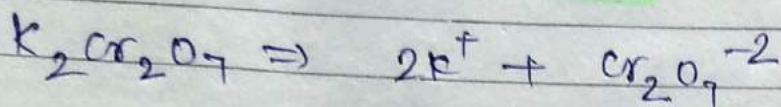
★★  
Note  
★★

(0.A)  
dil. HNO<sub>3</sub>

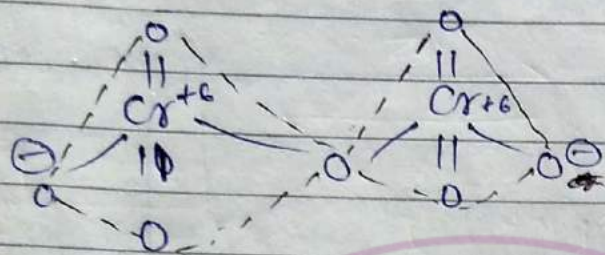




\* Chemistry of  $K_2Cr_2O_7$  (Potassium dichromate)

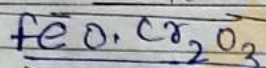


hyb  $\Rightarrow d^3s$



Preparation from chromite ore

~~FeO~~

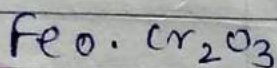


$CrO_2^- \Rightarrow$  chromite

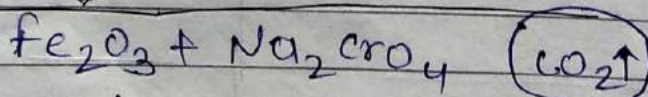
$CrO_4^- \Rightarrow$  chromate

$Cr_2O_7^{2-} \Rightarrow$  dichromate

\* Chromite process:



fused with  $Na_2CO_3 + O_2$



+ water

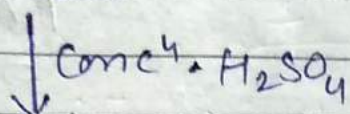
Sol<sup>n</sup> of  $Na_2CrO_4$  (Yellow)  
soluble

$Fe_2O_3$   
residue

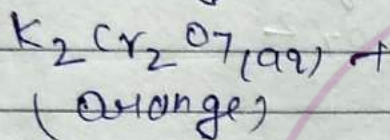
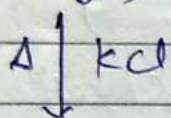
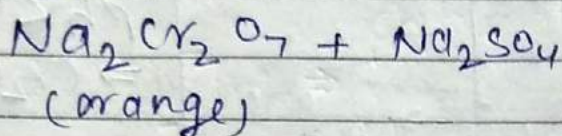


Sol<sup>n</sup> of  $\text{Na}_2\text{Cr}_2\text{O}_7$  (Yellow)  
Soluble

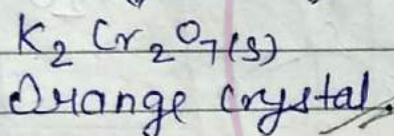
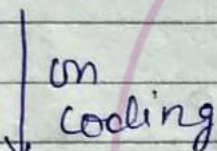
$\text{Fe}_2\text{O}_3$



~~Green~~



$\text{NaCl}$   
(P.P.T)  
filtrate off.



Note: In above process  $\text{Na}_2\text{CO}_3$  is used but not  $\text{K}_2\text{CO}_3$  because solubility of  $\text{K}_2\text{Cr}_2\text{O}_7$ , or  $\text{Na}_2\text{SO}_4$  is almost equal  $\text{K}_2\text{Cr}_2\text{O}_7$  does not obtained in pure form.

\* In laboratory standard sol<sup>n</sup> of  $\text{K}_2\text{Cr}_2\text{O}_7$  is used because  $\text{Na}_2\text{Cr}_2\text{O}_7$  absorb moisture

Important

\* Ques / JEE<sup>+</sup> If conc<sup>n</sup>  $\text{HNO}_3$  added in  $\text{K}_2\text{Cr}_2\text{O}_7$  sol<sup>n</sup> then

\* A) Cr is oxidised to  $\text{Cr}^{+7}$

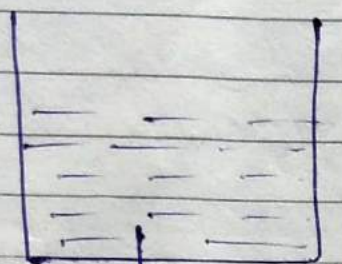
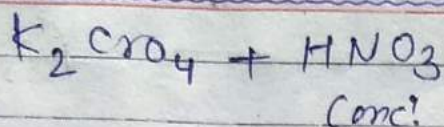
\* B) Cr is reduce to  $\text{Cr}^{+3}$

\* C)  $\text{Cr}_2\text{O}_7^{-2}$  and  $\text{H}_2\text{O}$  are produce

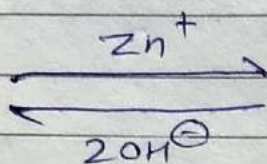
\* D)  $\text{Cr}_2\text{O}_7^{-2}$  and  $\text{Cr}^{+3}$  are produce



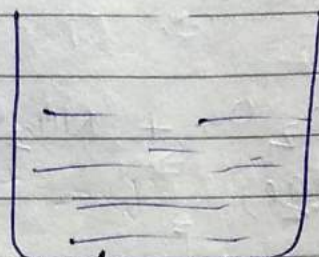
medium acid — dichromate



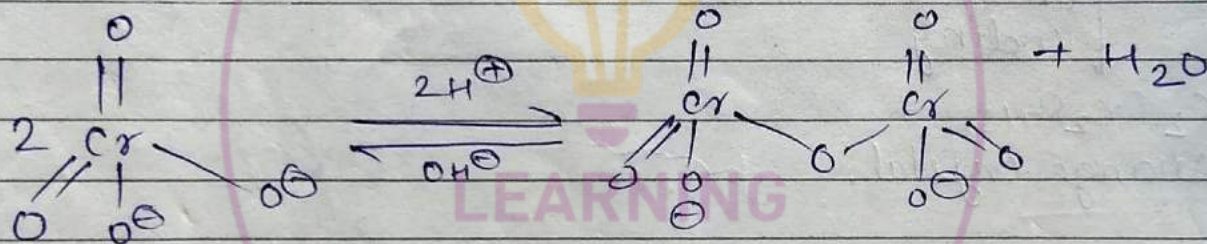
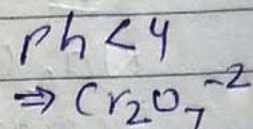
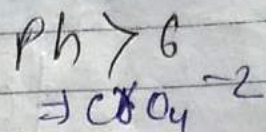
yellow sol<sup>n</sup>  
of  $CrO_4^{2-}$



acidic med<sup>ium</sup>



orange sol<sup>n</sup>  
of  $Cr_2O_7^{2-}$



$\Rightarrow$  at pH - 4 to 6 chromate and dichromate ions are exist in eq<sup>il</sup>. but in strongly acidic medium orange  $Cr_2O_7^{2-}$  ions exist in sol<sup>n</sup>.

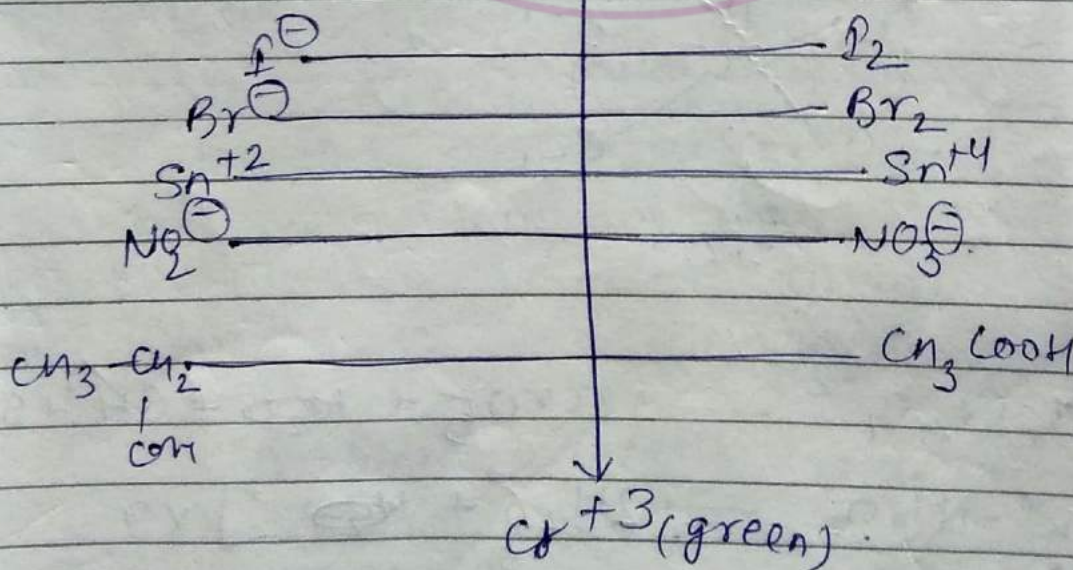
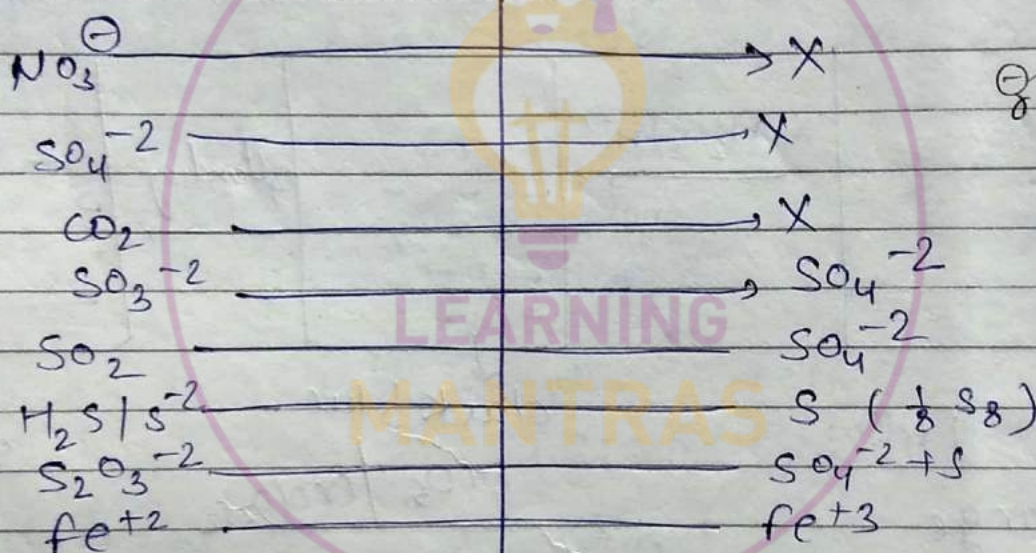
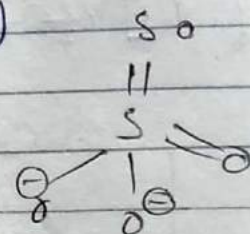
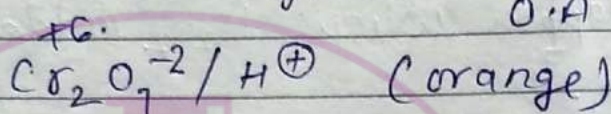
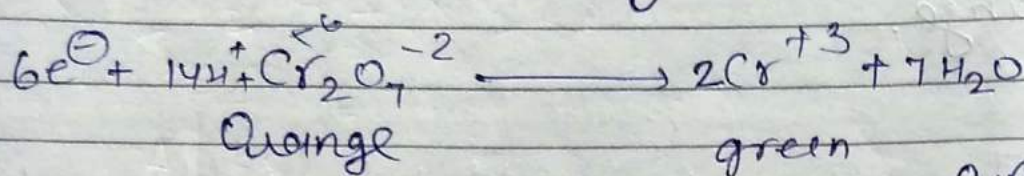
In alkylime median yellow  $CrO_4^{2-}$  ions exist in sol<sup>n</sup>. Yellow sol<sup>n</sup> of chromate can be converted into dichromate by the addition of non reducing acid like  $H_2SO_4$ ,  $HNO_3$ ,  $HClO_4$  and  $CH_3COOH$ .



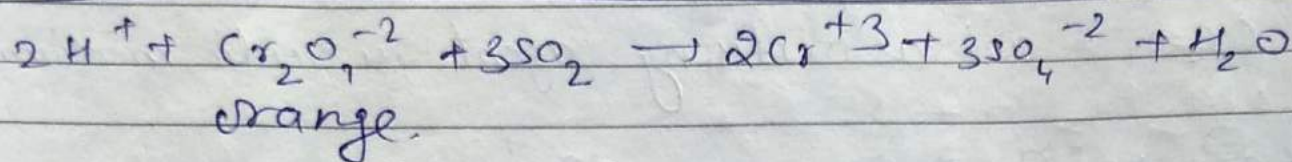
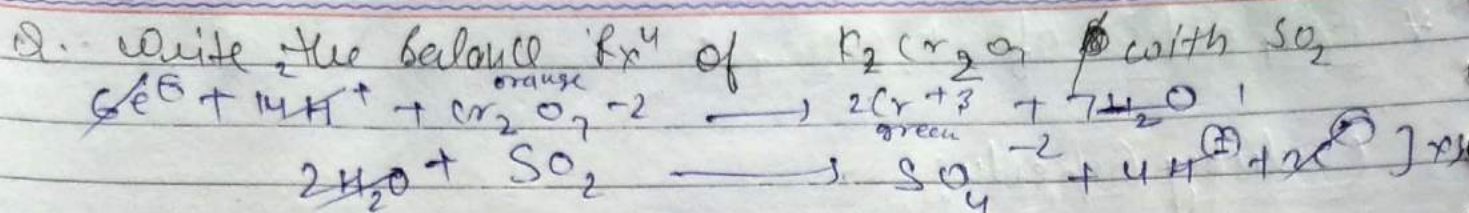
# \* Properties of $K_2Cr_2O_7$ :

## Oxidising Property:

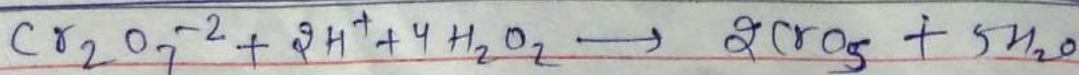
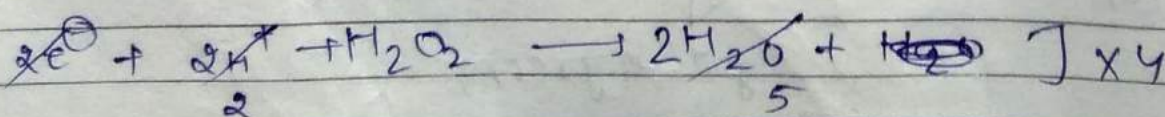
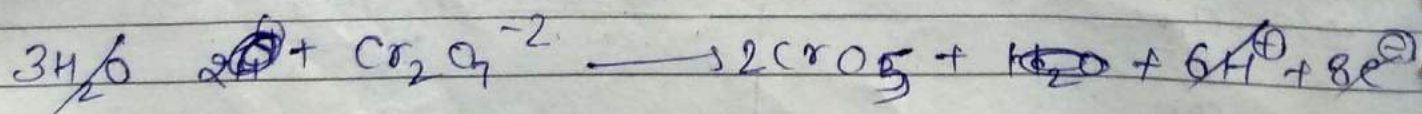
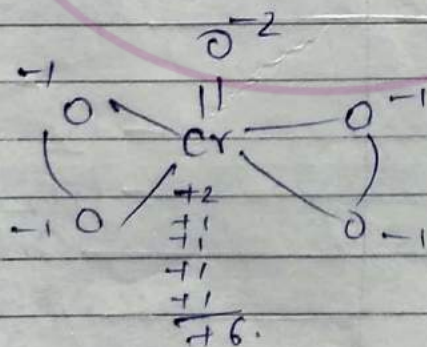
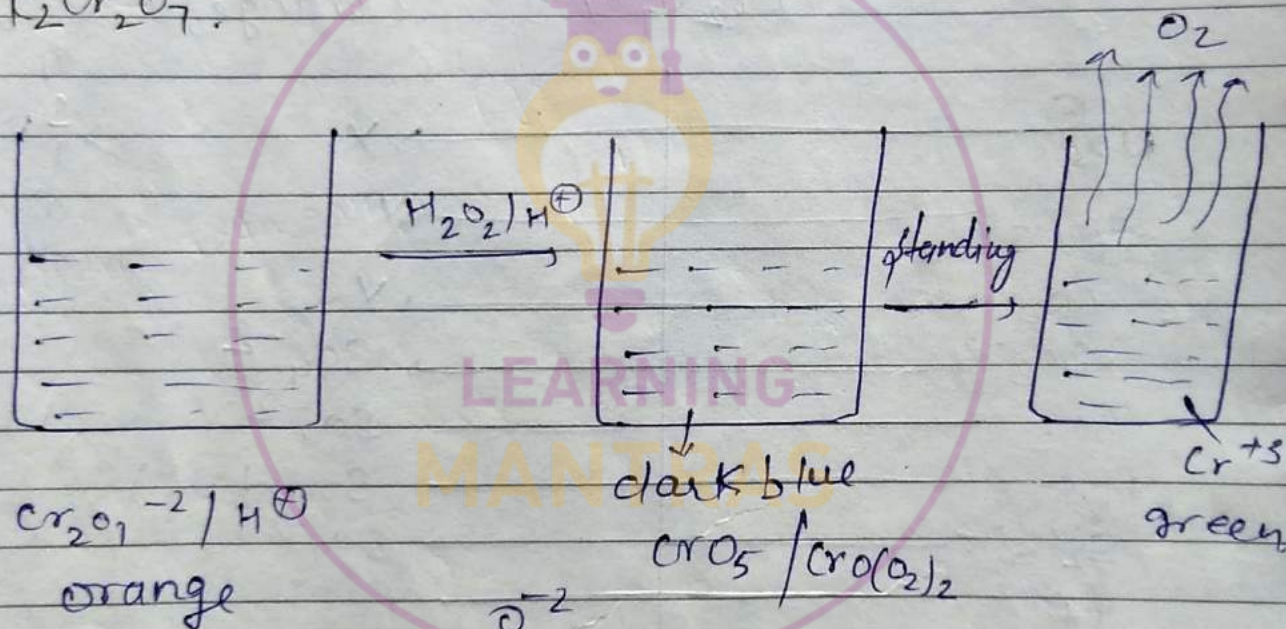
$Cr_2O_7^{2-}$  act as oxidising agent in acidic medium







Ques: what happen when  $H_2O_2$  added in Acidic medium of  $K_2Cr_2O_7$ .



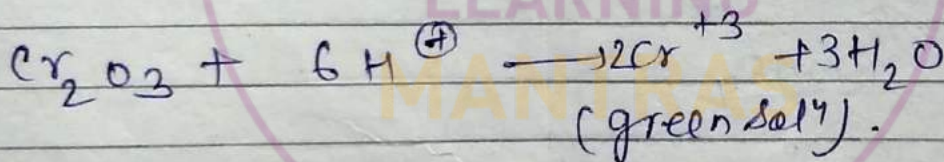
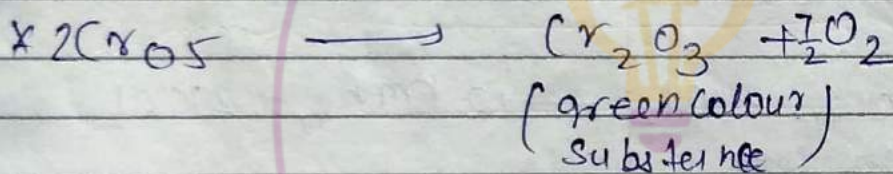


≠ mixed ester  
Bloeb.  
Ready

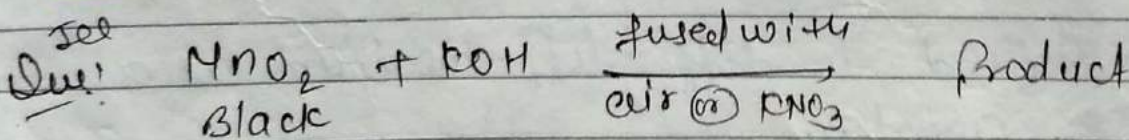
\* When orange sol<sup>n</sup> of  $K_2Cr_2O_7$  treated with  $H_2O_2$  in acidic medium it produce dark colour comp.  $CrO_5$

\*  $CrO_5$  is unstable so it decomposed on standing and it produce green sol<sup>n</sup> of  $Cr^{+3}$  and  $O_2$

\* On addition of pyridine, THF, amyl alcohol ( $CH_3-CH_2-CH_2-CH_2-CH_2$ ) stabilised the dark blue colour of green colour substance

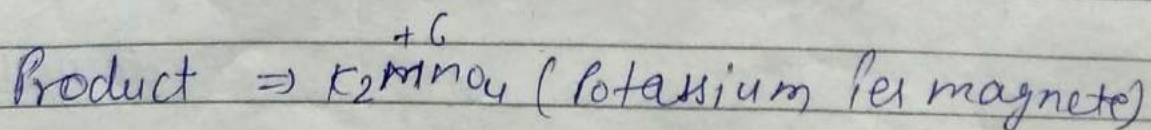


④  $KMnO_4$  (Potassium manganate):



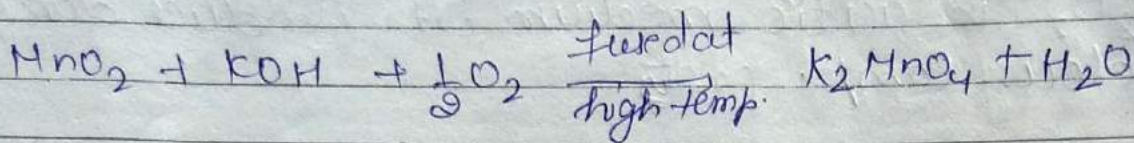
What is colour of product?

- (A) Black      (C) green  
(B) Brown      (D) violet



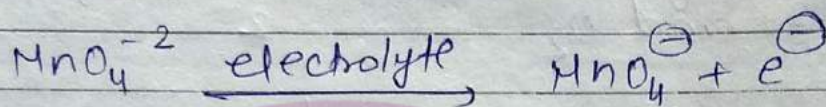


## Preparation (from pyrolusite):

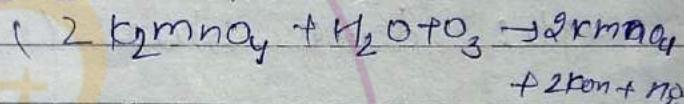
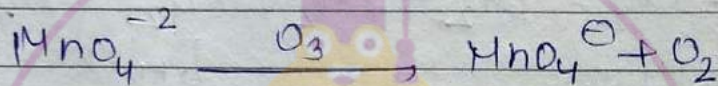


Conversion of  $\text{MnO}_4^{2-}$  to  $\text{MnO}_4^-$

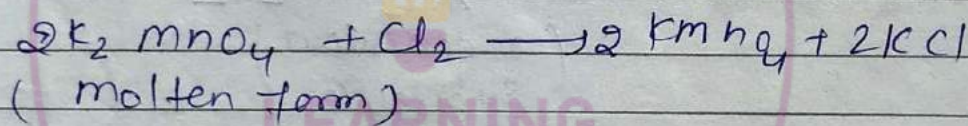
### (i) Electrolytic Method



### (ii) By Ozone



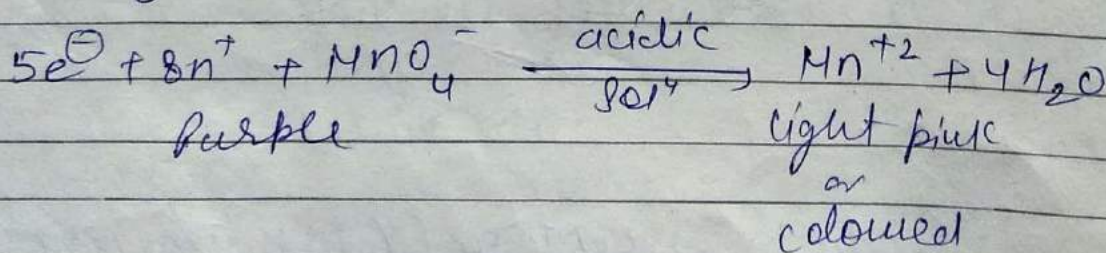
### (iii) By $\text{Cl}_2$



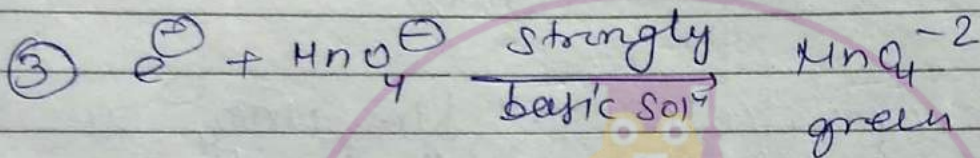
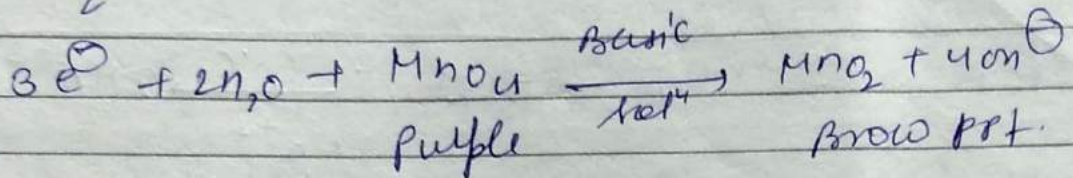
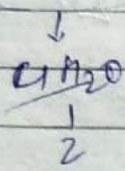
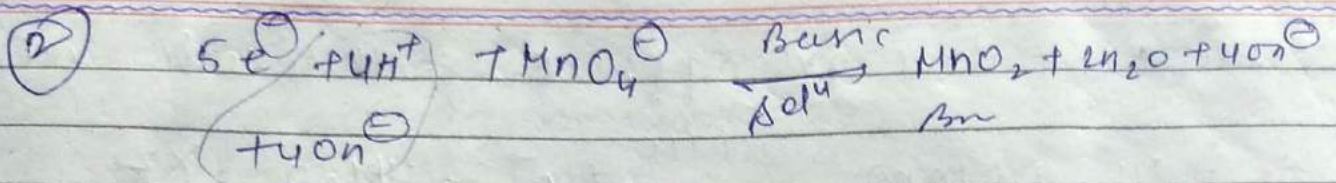
## Properties of $\text{KMnO}_4$ :

$\text{KMnO}_4$  is a strong oxidising agent in laboratory. It is used in many oxidation rxn.

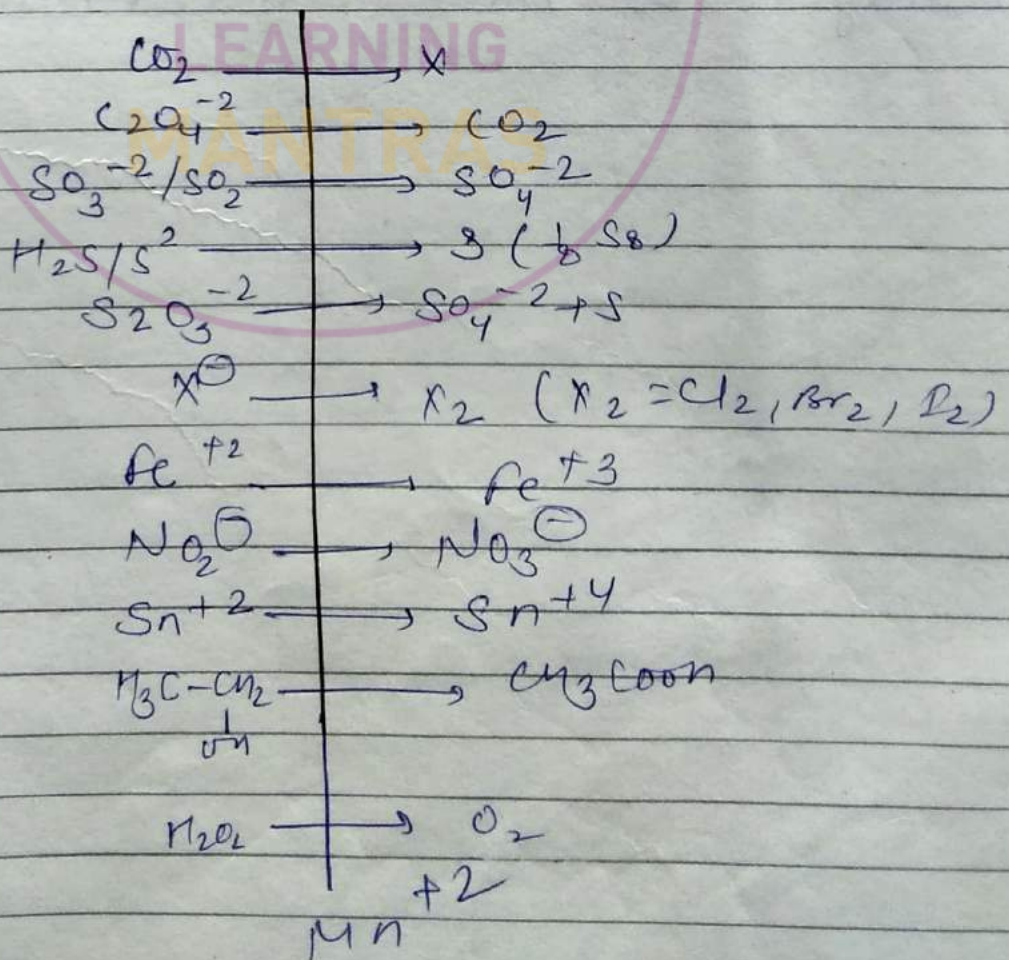
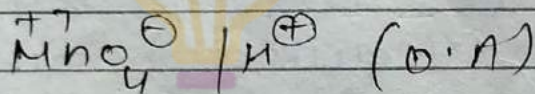
It is used in diff-diff. medium as an oxidising agent.







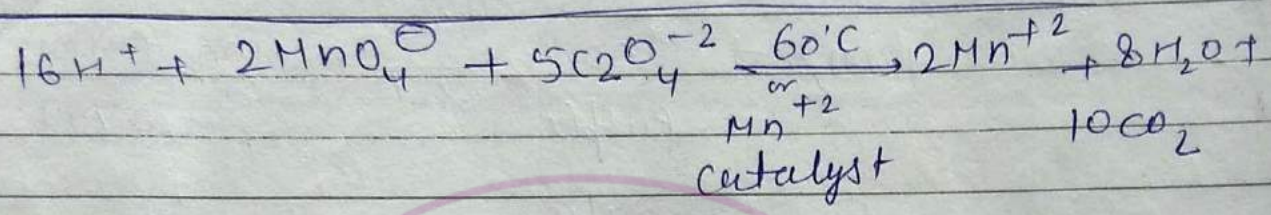
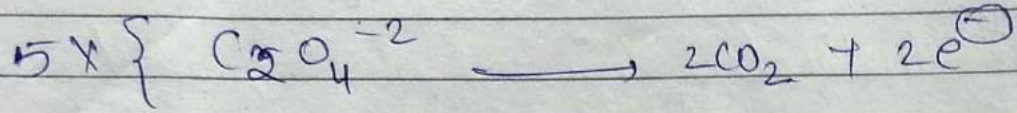
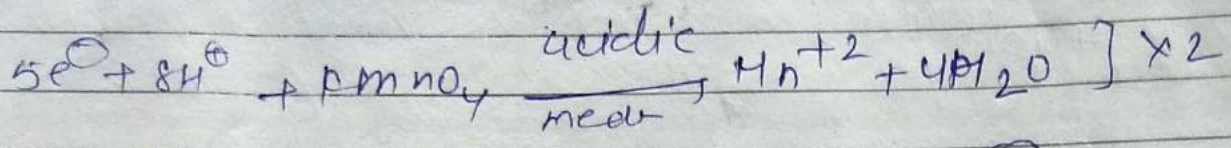
KMnO<sub>4</sub> is acidic sol<sup>n</sup> (oxidising property).





\*\*\*

Q write the balanced rxn of  $\text{KMnO}_4$  with oxalic acid



\*\*\* favorable temp. for the rxn b/w  $\text{MnO}_4^-$  vs  $\text{C}_2\text{O}_4^{-2}$  is  $60^\circ\text{C}$  so that initially heating is required for communitation of rxn. But once rxn is completed no further heating is required because rxn is catalysed by  $\text{Mn}^{+2}$  (self catalytic rxn).

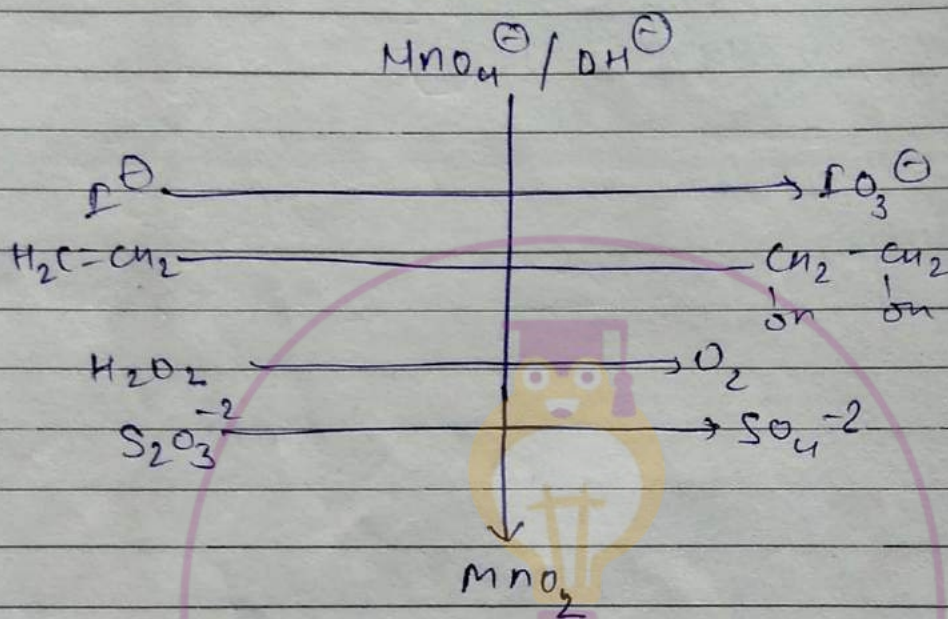


Learn

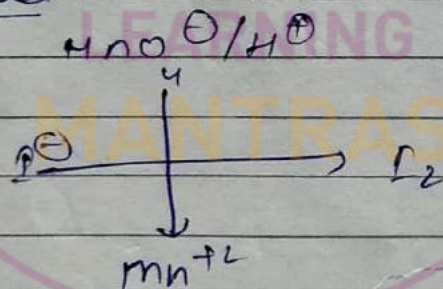
★ ~~pp~~ steps

Q. when ~~KMnO4~~ react with alkylne sol<sup>n</sup> of  $\text{KMnO}_4$  it produce  
~~(A)~~ (A)  $\text{IO}_3^-$  (B)  $\text{IO}_4^-$  (C)  $\text{I}_2$  (D)  $\text{IO}^-$

(ii)  $\text{KMnO}_4$  in basic medium

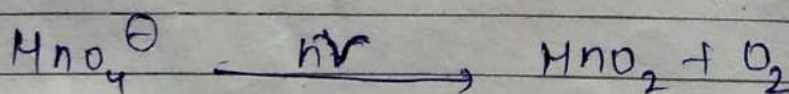


but in acidic sol<sup>n</sup>



Note!

99. sol<sup>n</sup> of  $\text{KMnO}_4$  is stored in dark coloured bottle to prevent sun light because  $\text{KMnO}_4$  sol<sup>n</sup> is decompose to  $\text{MnO}_2$  and  $\text{O}_2$  and Rx<sup>n</sup> is catalysed by sunlight

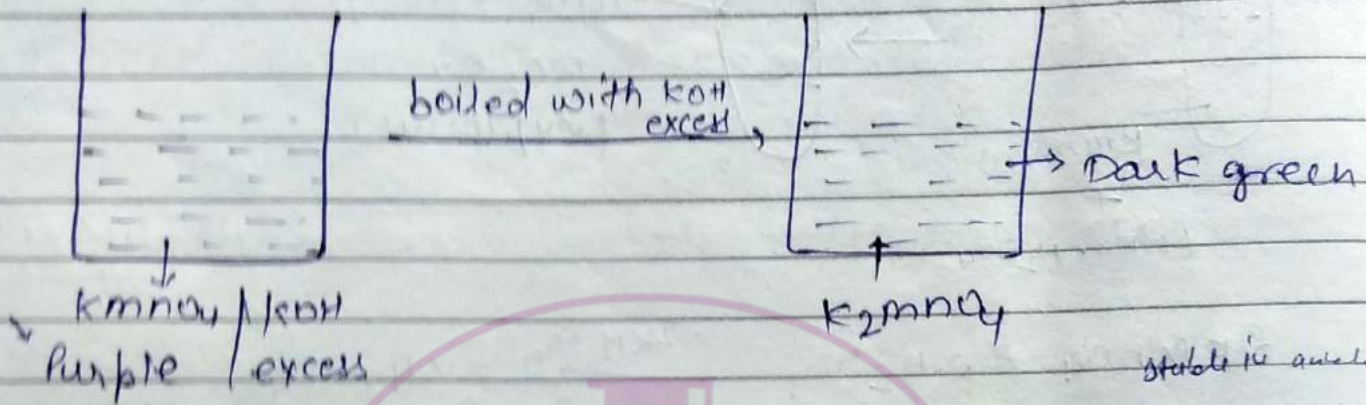
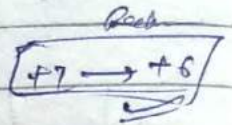


So that standard sol<sup>n</sup> of  $\text{KMnO}_4$  is used in laboratory in many Polymetric titration Rx<sup>n</sup>.



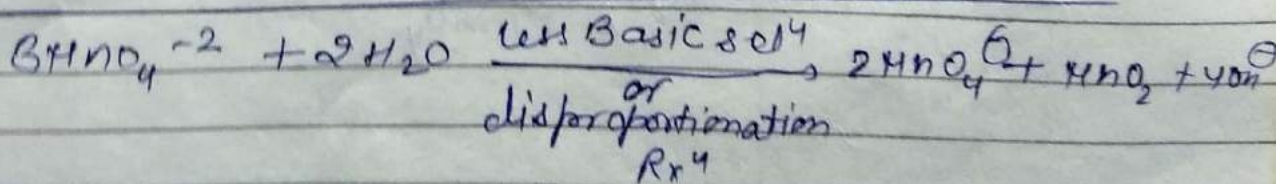
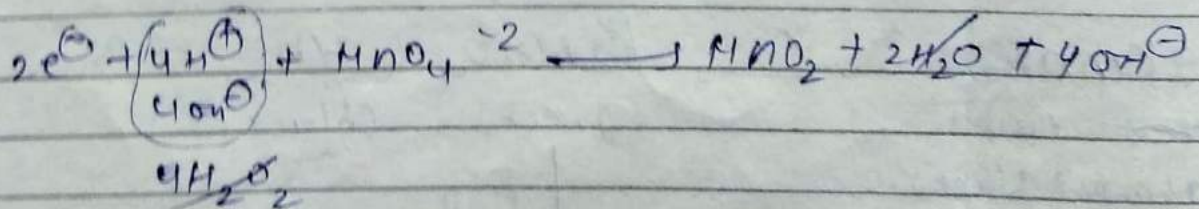
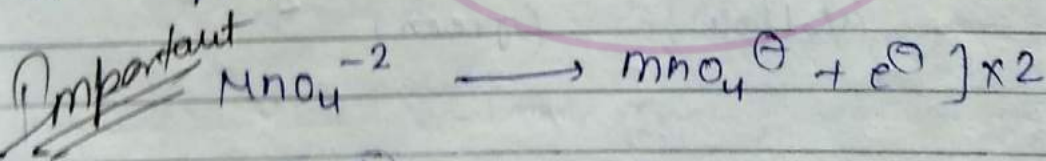
Q.2 What happens when  $\text{KMnO}_4$  sol<sup>n</sup> is boiling in excess amount of  $\text{KOH}$  or strongly alkali medium.

Ans:



When  $\text{KMnO}_4$  sol<sup>n</sup> is boiled in strongly alkali solution it produces dark green colour solution due to formation of  $\text{K}_2\text{MnO}_4$  and evolution of  $\text{O}_2$ .

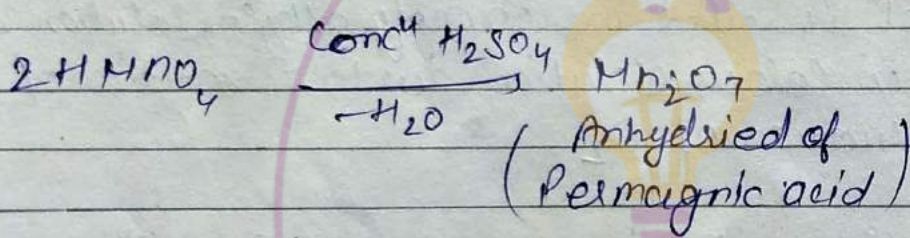
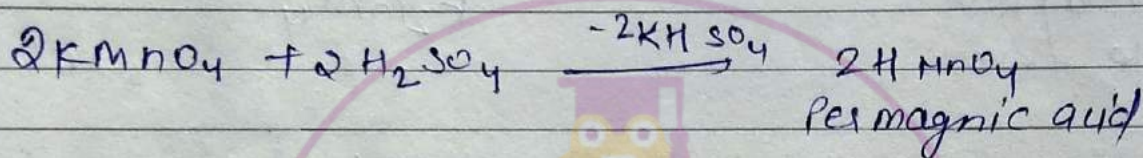
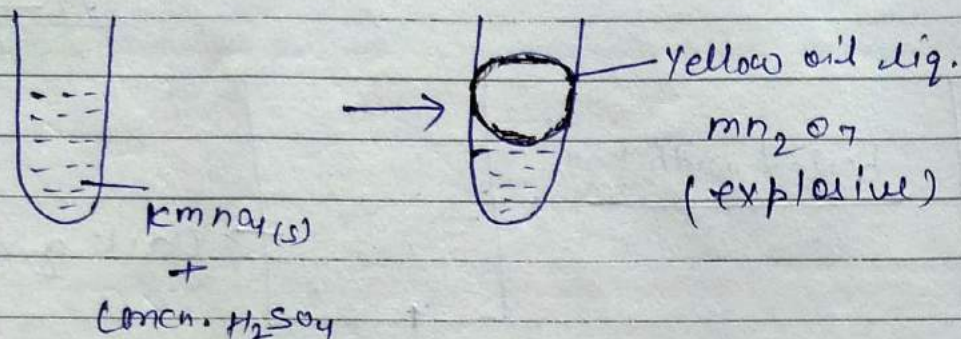
A<sup>n</sup> When  $\text{KMnO}_4$  sol<sup>n</sup> is boiled in strongly alkali sol<sup>n</sup> it produces dark green colour compound  $\text{K}_2\text{MnO}_4$ .  $\text{K}_2\text{MnO}_4$  is stable only in strongly alkali sol<sup>n</sup>. So that on addition of water or on addition of acid or less basic medium,  $\text{K}_2\text{MnO}_4$  is disproportionate to  $\text{KMnO}_4$  and  $\text{MnO}_2$ .





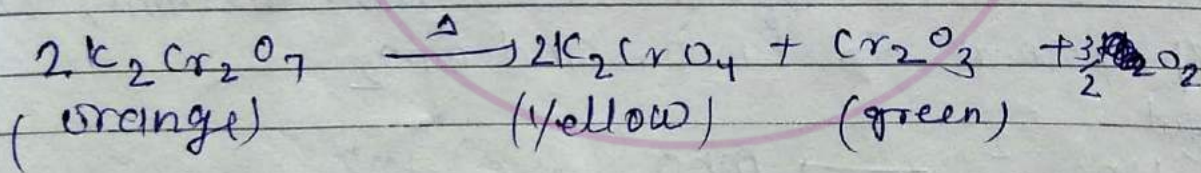
Ques: Why crystal of  $KMnO_4$  is not added in conc.  $H_2SO_4$

Ans:

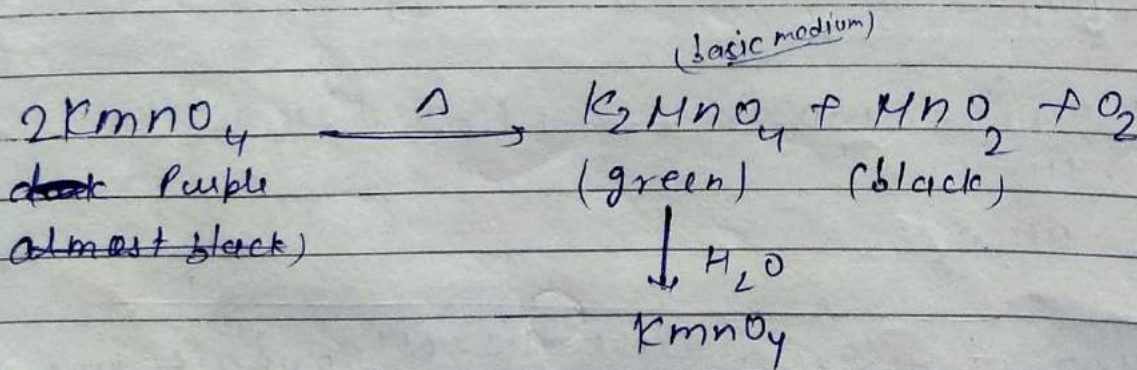


Q. Write the heating effect of

(1)  $K_2Cr_2O_7$

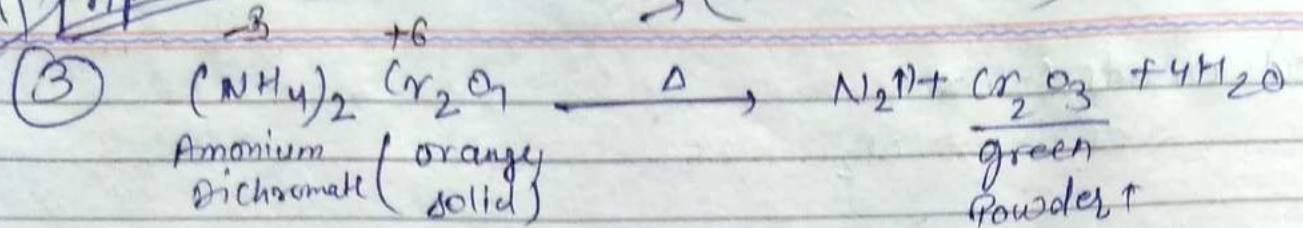


(2)



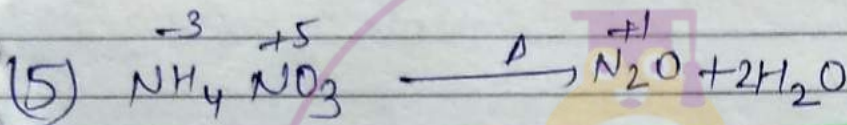
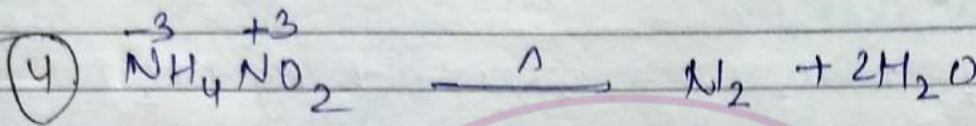


Important



(Exothermic Process)

This rxn is used for making artificial volcano

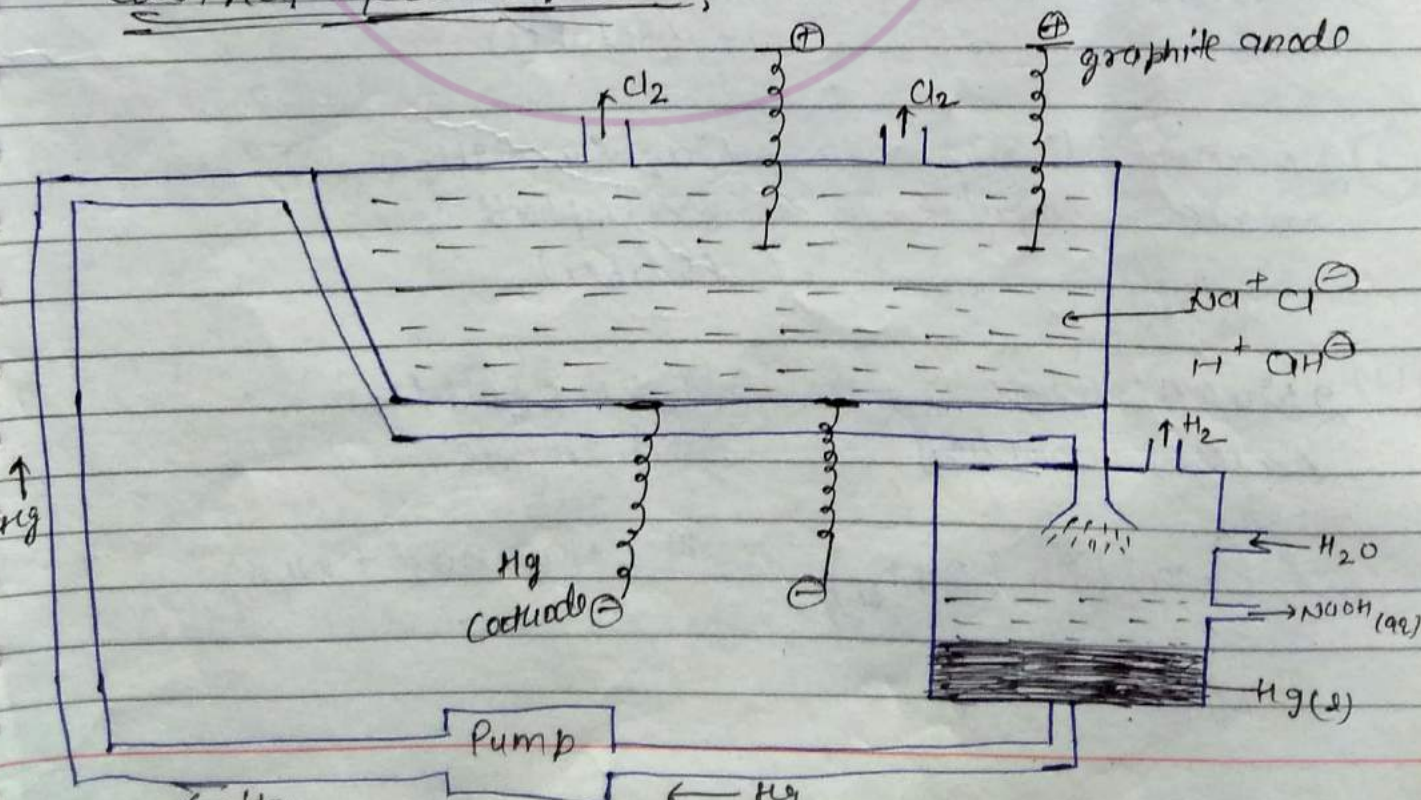


\* Chemistry of NaOH: (S-block) Caustic Soda

(Sodium hydroxide)

\* Preparation of NaOH:

Castner-Kellner Cell:

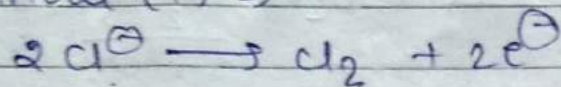




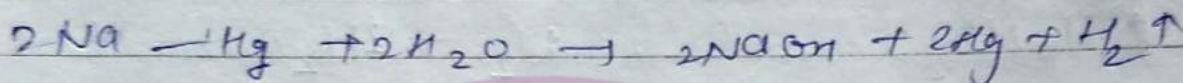
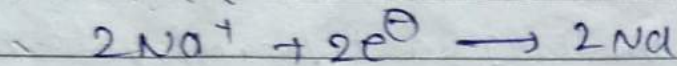
# Solubility of NaOH

non metal + H<sub>2</sub>O

at anode (+)  $\Rightarrow$

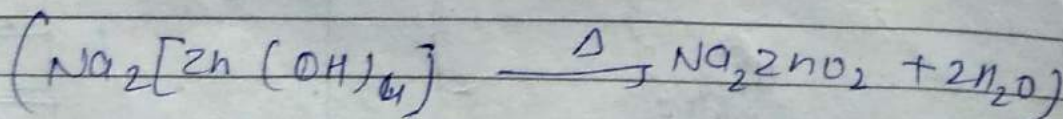
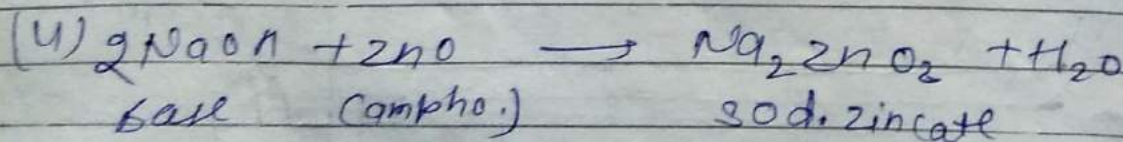
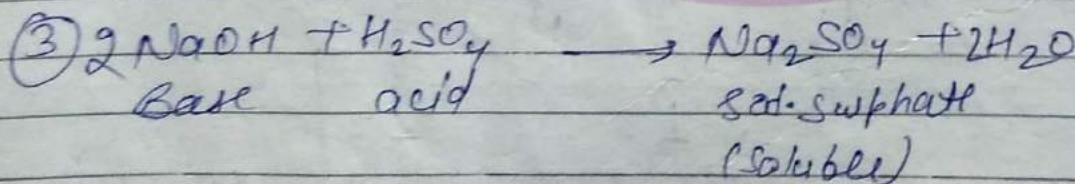
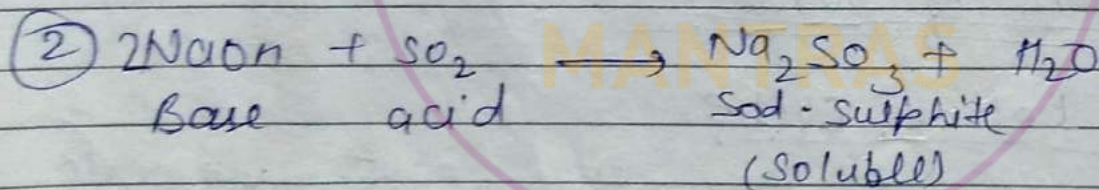
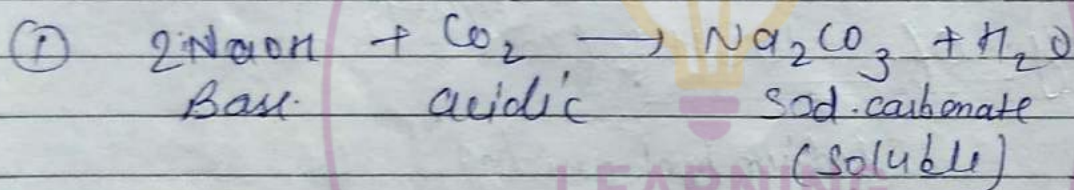


at Cathode (-)  $\Rightarrow$



## \* Properties of NaOH :-

### ① Basic Property :-





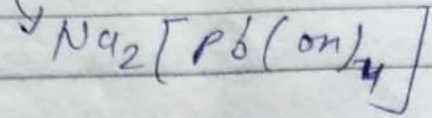
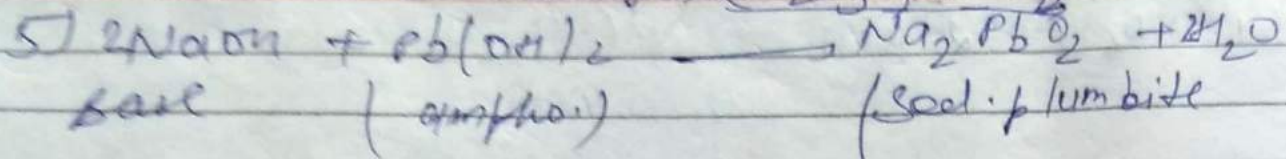
Amphoteric oxide!  $\text{BeO}$ ,  $\text{ZnO}$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{PbO}$ ,  $\text{PbO}_2$

oxide amphoteric and amphoteric

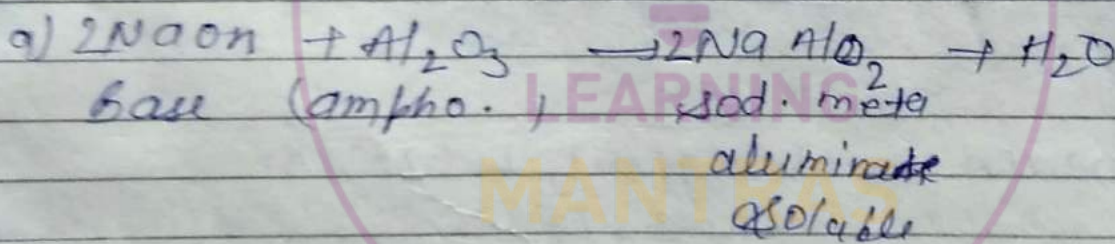
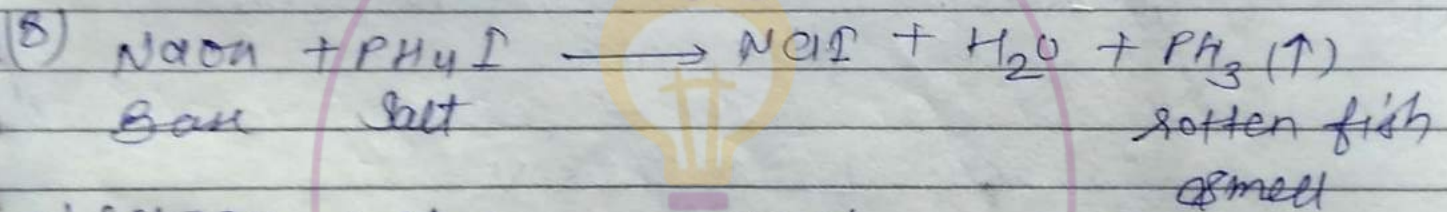
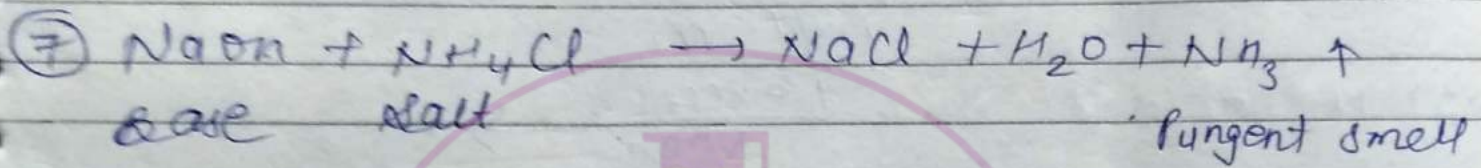
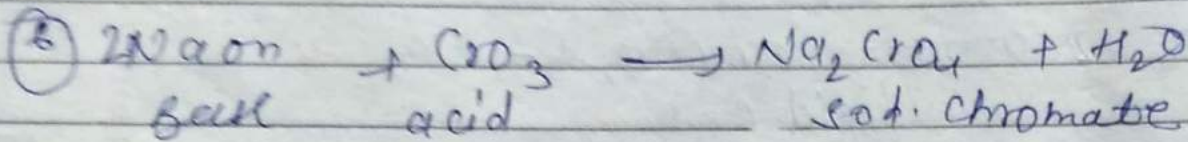
and some oxide of As and Antimony (Sb)

$\text{SnO}$ ,  $\text{SnO}_2$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_2$

$\text{Cr}_2\text{O}_3$ ,  $\text{MnO}_2$



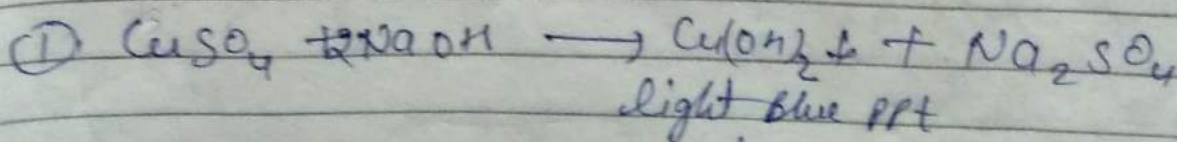
2



\* All Ammonium and Phosphonium salt produce ammonia and phosphine respectively with excess of NaOH and KOH strong base like NaOH & KOH

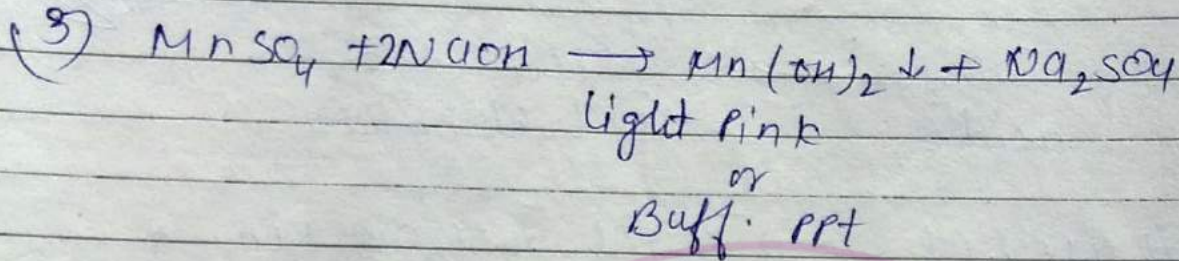
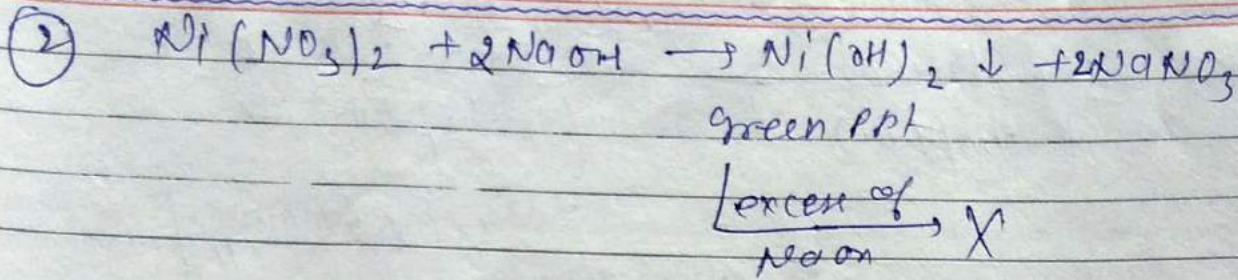
\*  $\text{R}^{2+}$  with salt:

1) Salt which produce ppt with excess of NaOH

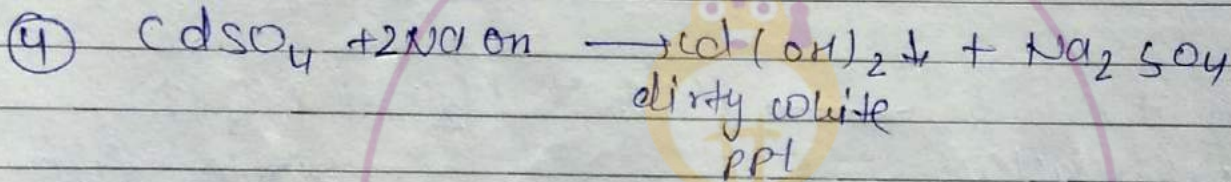


excess, ✓

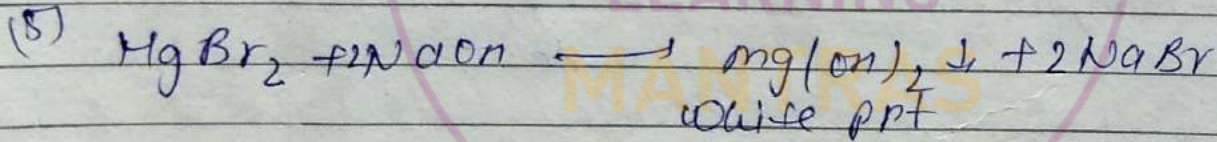




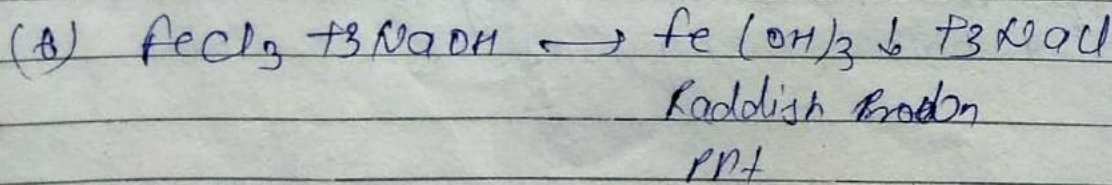
Excess of NaOH  $\rightarrow$  X



Excess of NaOH  $\rightarrow$  X



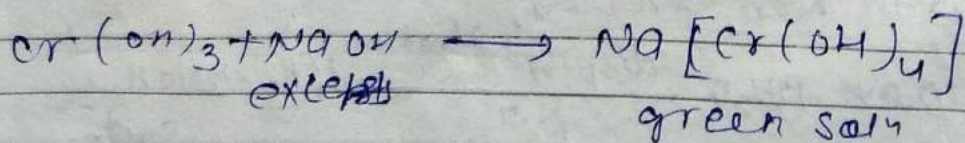
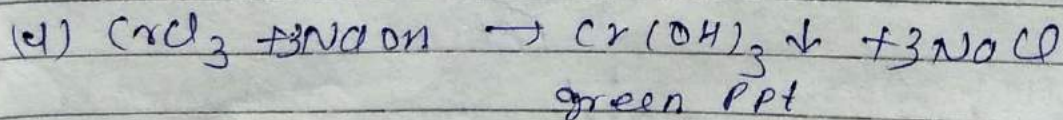
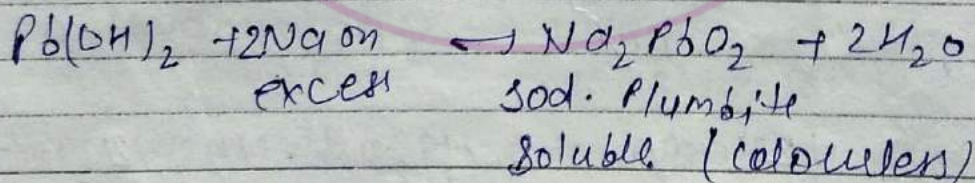
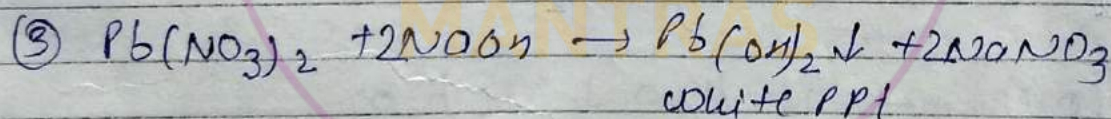
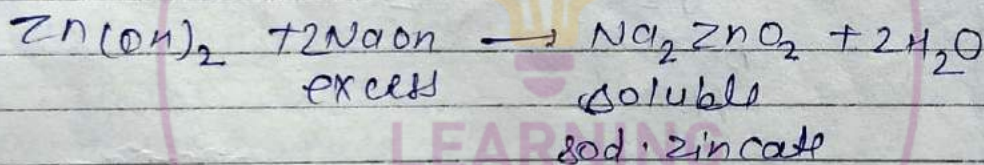
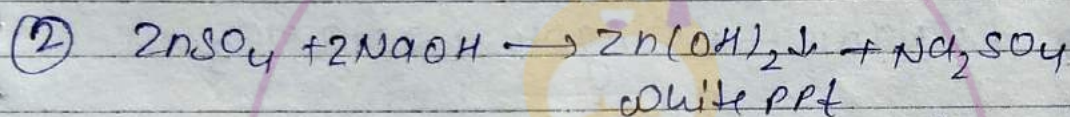
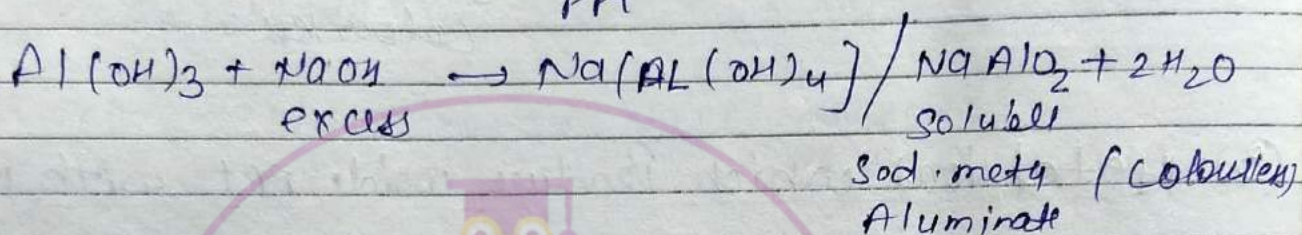
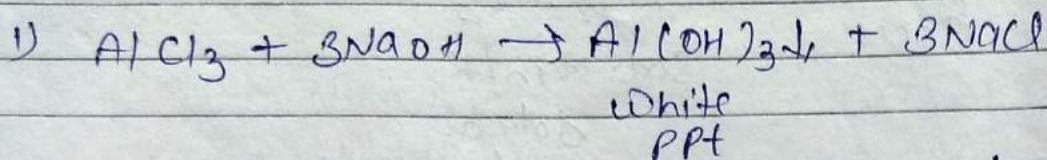
Excess of NaOH  $\rightarrow$  X



Excess of NaOH  $\rightarrow$  X.



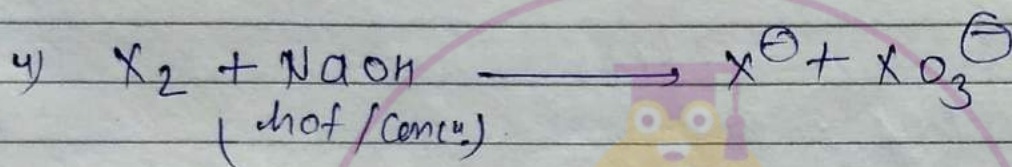
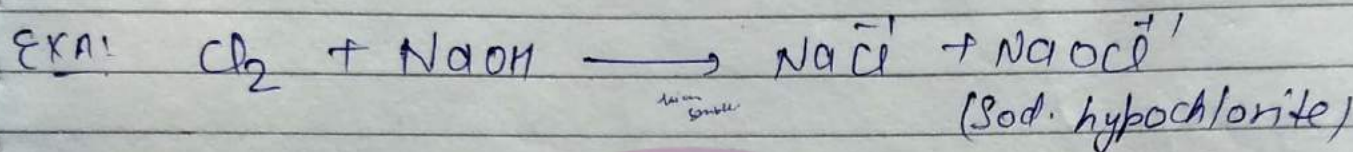
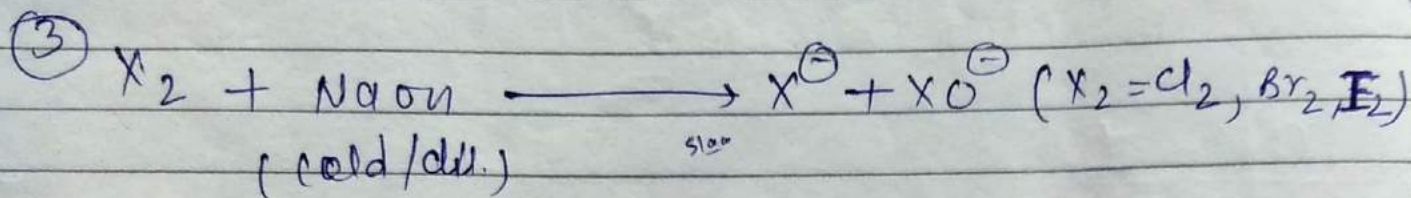
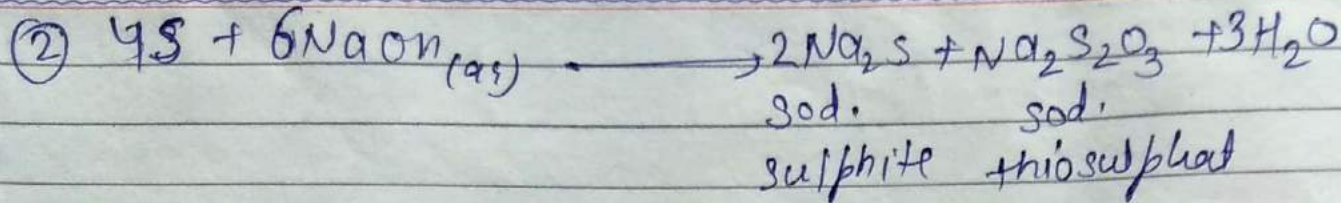
(ii) Salt do not produce ppt <sup>with</sup> excess of NaOH or salt which produce ppt with little amount of NaOH but soluble in excess of NaOH











5) Rxn with metals

Metal which form amphoteric oxide react with NaOH to produce  $H_2$  gas and soluble salt of metal.

