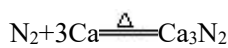
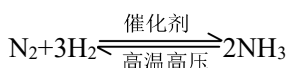
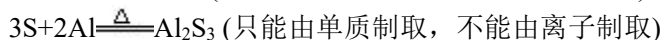
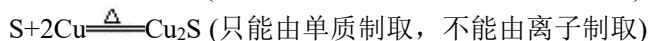
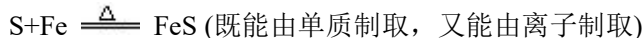
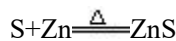
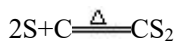
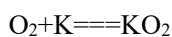
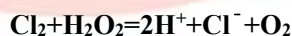
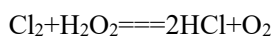
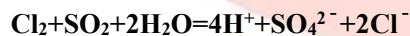
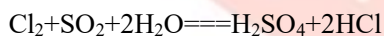
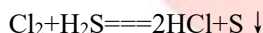
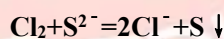
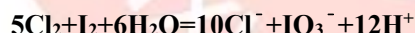
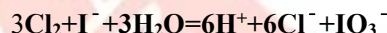
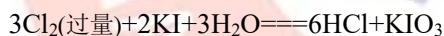
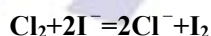
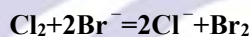
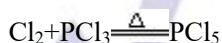
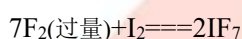
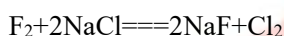
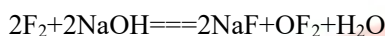
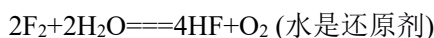
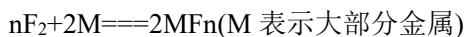
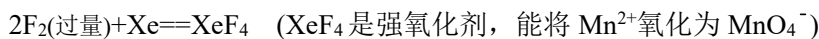
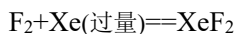
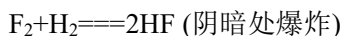
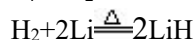
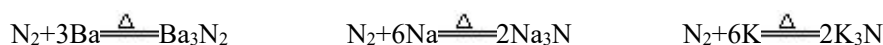


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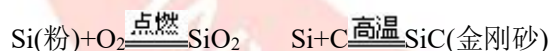
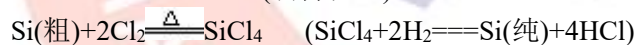
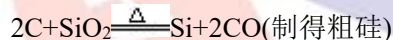
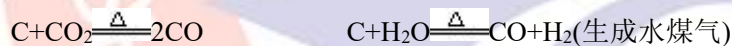
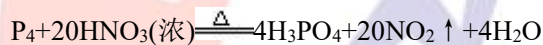
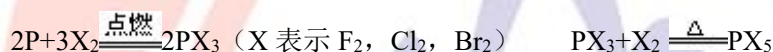
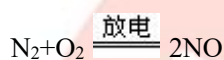
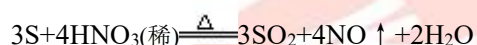
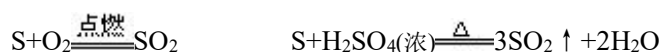
一、非金属单质 (F₂, Cl₂, O₂, S, N₂, P, C, Si, H)

1、氧化性:

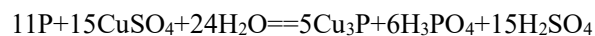
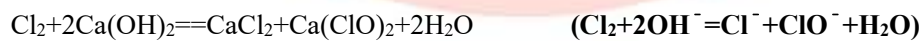




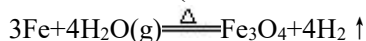
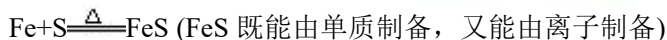
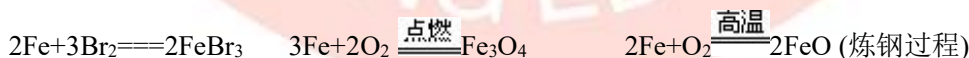
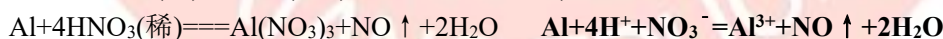
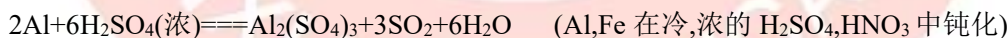
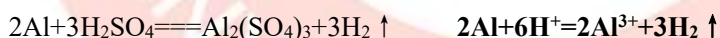
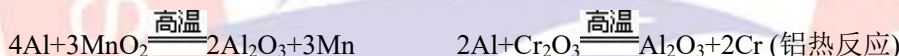
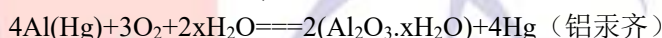
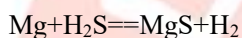
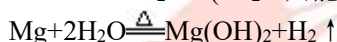
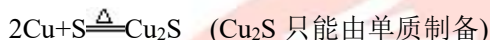
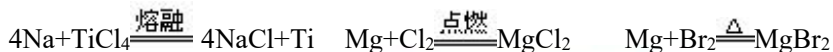
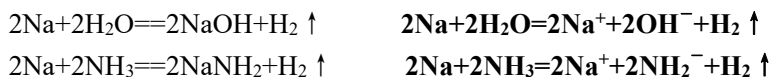
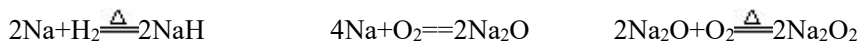
2、还原性



3、歧化反应

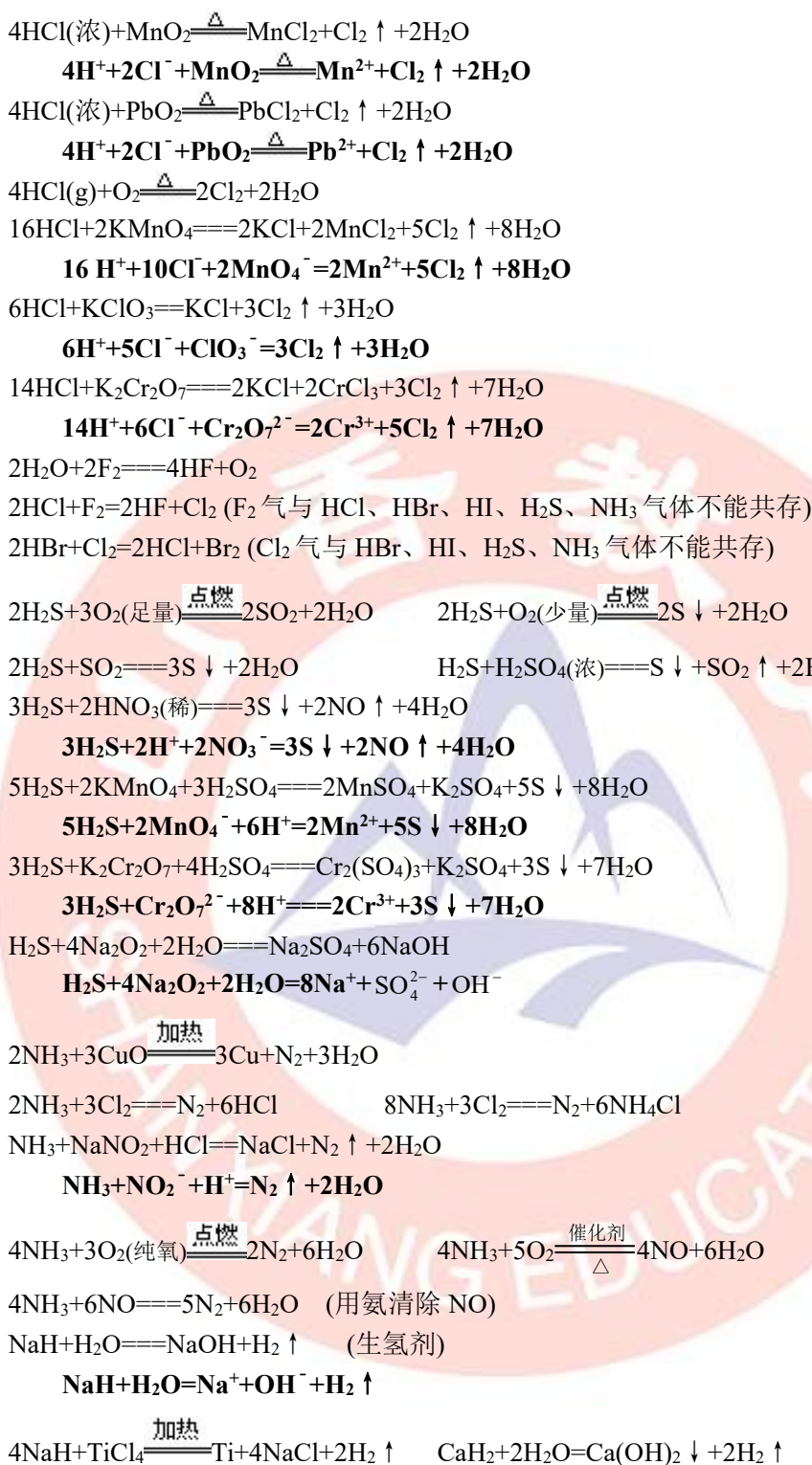


二. 金属单质 (Na, Mg, Al, Fe, Cu) 的还原性



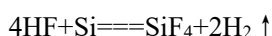
三. 非金属氢化物(HF, HCl, H₂O, H₂S, NH₃) 金属氢化物(NaH)

1、还原性:

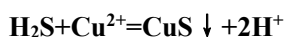


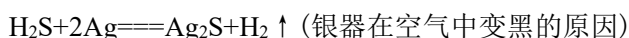
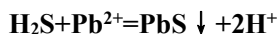
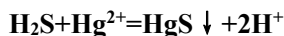
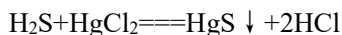
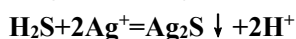
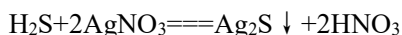
2、酸性:

$4\text{HF}+\text{SiO}_2\rightleftharpoons \text{SiF}_4+2\text{H}_2\text{O}$ (可测定矿样或钢样中 SiO_2 的含量, 玻璃雕刻)

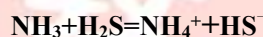
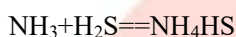
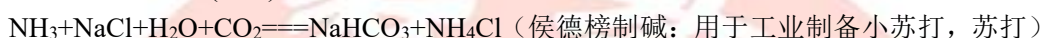
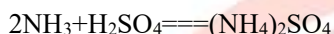
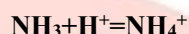
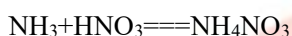
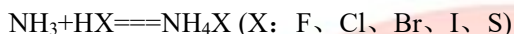


$\text{H}_2\text{S}+\text{CuCl}_2\rightleftharpoons \text{CuS}\downarrow+2\text{HCl}$ (弱酸制强酸的典型反应)

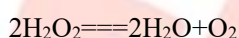
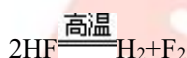




3、NH₃ 的碱性:

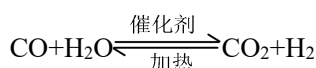
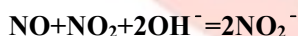
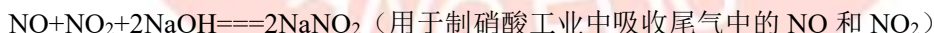
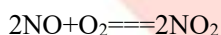
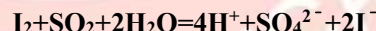
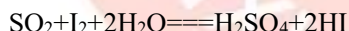
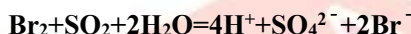
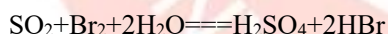
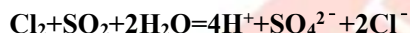
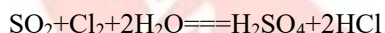
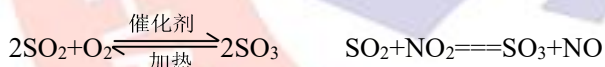
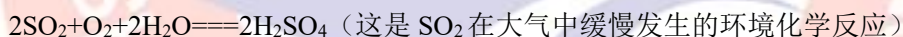


4、不稳定性:

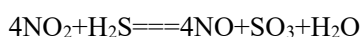
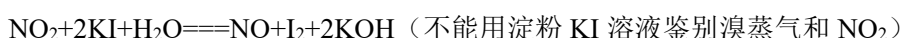
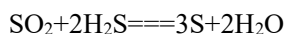


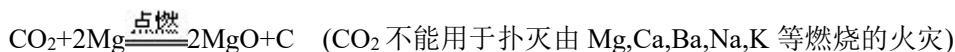
四. 非金属氧化物(SO₃、SO₂、N₂O、NO、N₂O₃、NO₂、N₂O₄、N₂O₅、CO、CO₂、SiO₂、P₂O₃、P₂O₅、Cl₂O、Cl₂O₃、Cl₂O₅、Cl₂O₇、ClO₂)

1、低价态的还原性: (SO₂、CO、NO)

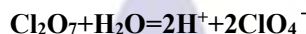
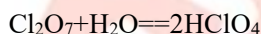
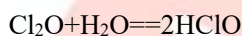
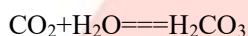
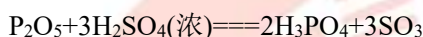
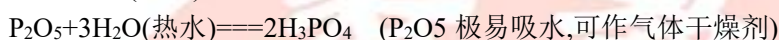
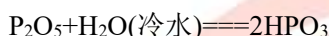
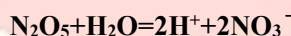
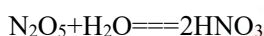
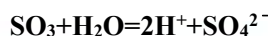
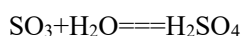
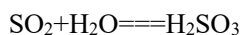


2、氧化性:

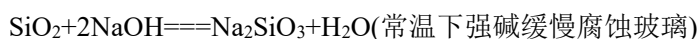
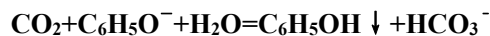
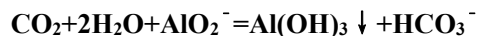
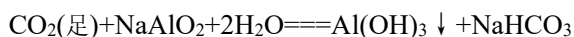
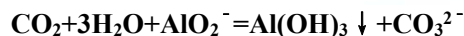
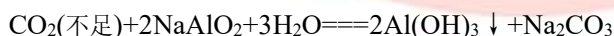
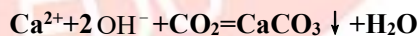
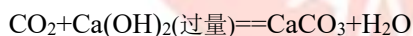
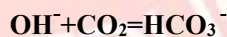
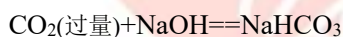
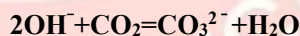
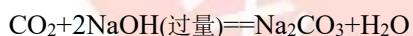
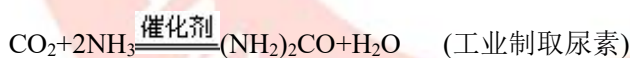
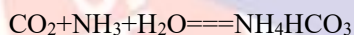
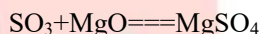
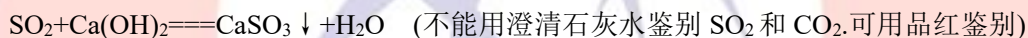
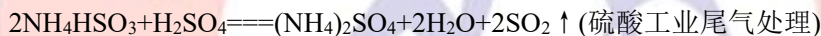
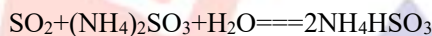
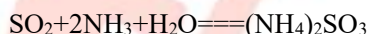


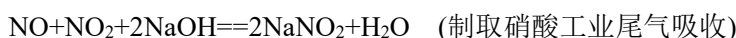


3、与水的作用:



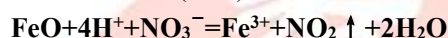
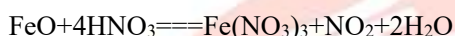
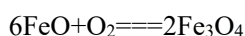
4、与碱性物质的作用:



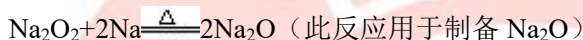


五. 金属氧化物

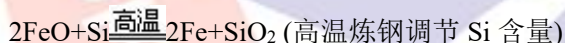
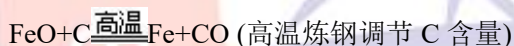
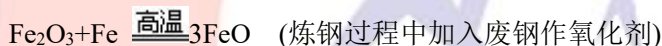
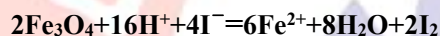
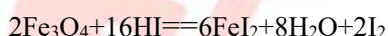
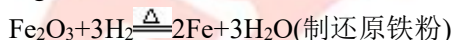
1、低价态的还原性:



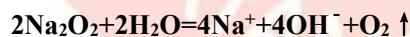
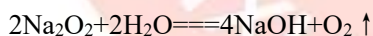
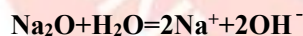
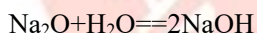
2、氧化性:



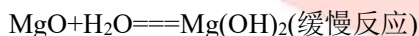
MgO, Al₂O₃ 几乎没有氧化性, 很难被还原为 Mg, Al. 一般通过电解制 Mg 和 Al.



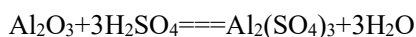
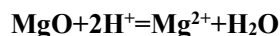
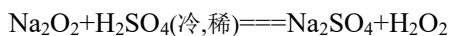
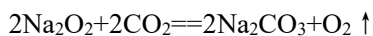
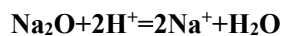
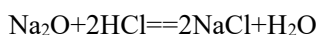
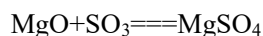
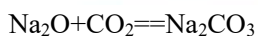
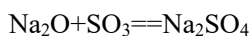
3、与水的作用:

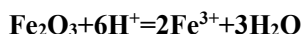
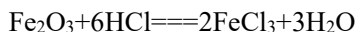
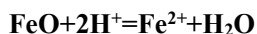
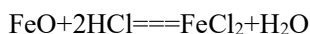
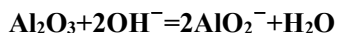
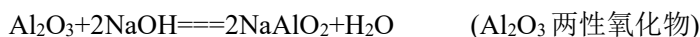
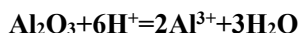


(此反应分两步: $\text{Na}_2\text{O}_2 + 2\text{H}_2\text{O} = 2\text{NaOH} + \text{H}_2\text{O}_2$; $2\text{H}_2\text{O}_2 = 2\text{H}_2\text{O} + \text{O}_2$ H₂O₂ 的制备可利用类似的反应: $\text{BaO}_2 + \text{H}_2\text{SO}_4(\text{稀}) = \text{BaSO}_4 + \text{H}_2\text{O}_2$)



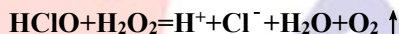
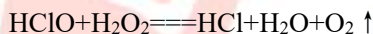
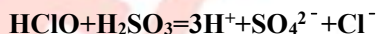
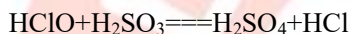
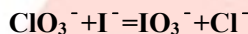
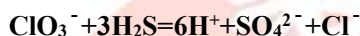
4、与酸性物质的作用:



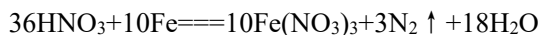
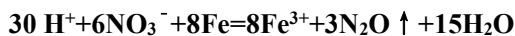
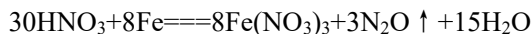
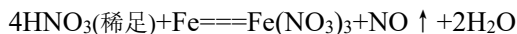
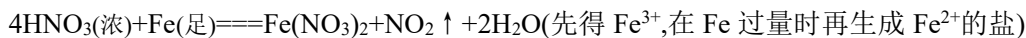
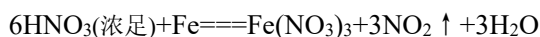
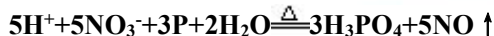
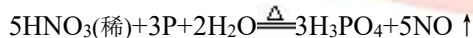
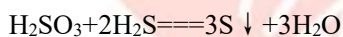
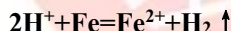
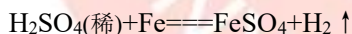
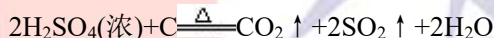


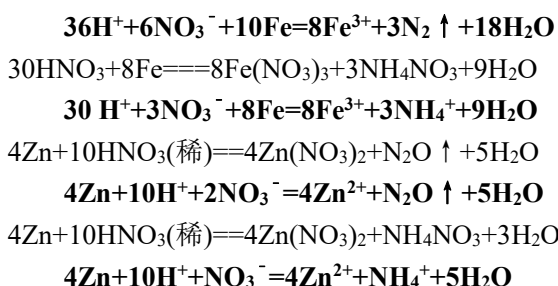
六. 含氧酸

1、氧化性:

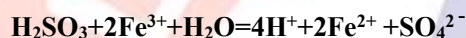
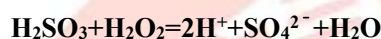
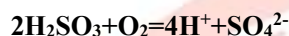
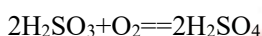
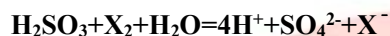
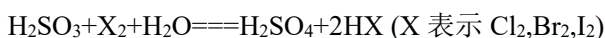


(氧化性: $\text{HClO} > \text{HClO}_2 > \text{HClO}_3 > \text{HClO}_4$,但浓,热的 HClO_4 氧化性很强)

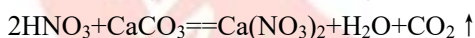
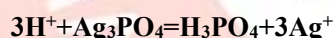
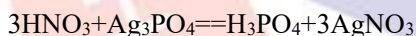
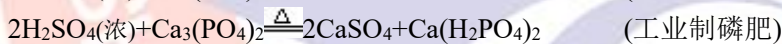
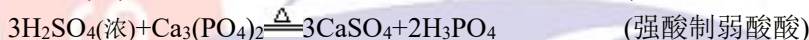




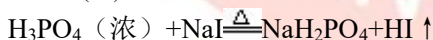
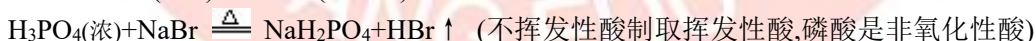
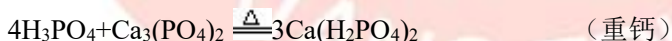
2、还原性:



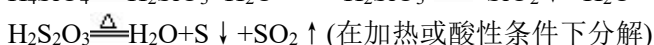
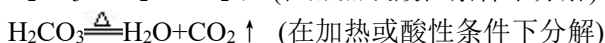
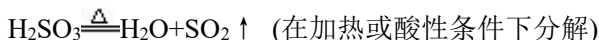
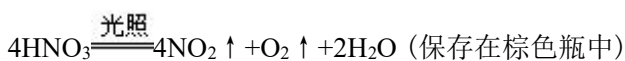
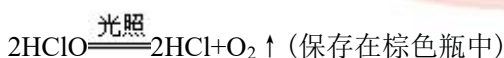
3、酸性:



(用 HNO_3 和浓 H_2SO_4 不能制备 H_2S , HI , HBr , SO_2 等还原性气体)

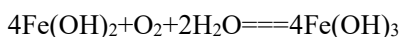


4、不稳定性:

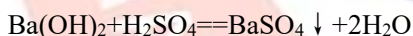
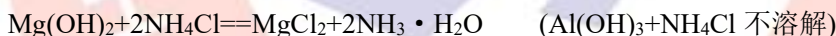
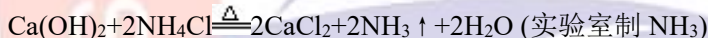
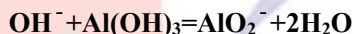
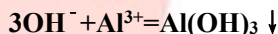
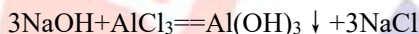
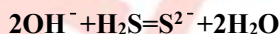
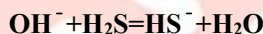
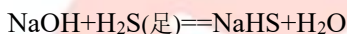
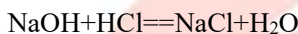
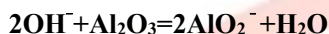
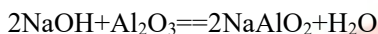
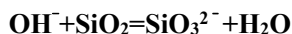
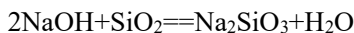
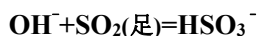
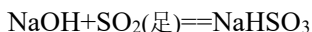
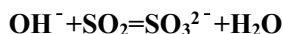


七. 碱

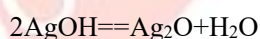
1、低价态的还原性:



2、与酸性物质的作用:

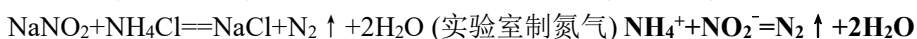
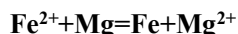
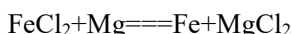
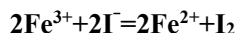
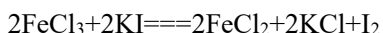
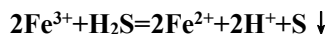
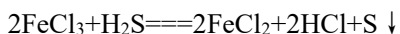
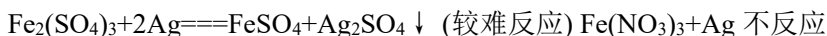
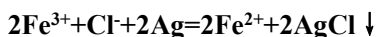
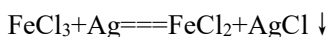
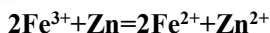
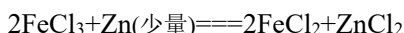
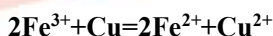
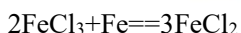


3、不稳定性:



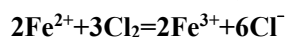
八. 盐

1、氧化性: (在水溶液中)

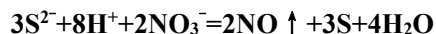


2、还原性:

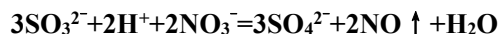
2FeCl₂+3Cl₂====2FeCl₃ (在水溶液中不需加热)



3Na₂S+8HNO₃(稀)====6NaNO₃+2NO↑+3S+4H₂O



3Na₂SO₃+2HNO₃(稀)====3Na₂SO₄+2NO↑+H₂O



2Na₂SO₃+O₂====2Na₂SO₄ (Na₂SO₃ 在空气中易变质)

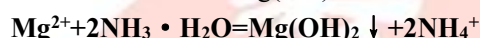
Na₂SO₃+S $\xrightarrow{\Delta}$ Na₂S₂O₃

Na₂S+Cl₂====2NaCl+S↓ (在水溶液中) $\text{S}^{2-}+\text{Cl}_2=2\text{Cl}^-+\text{S}\downarrow$

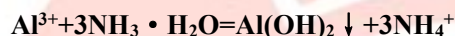
3、与碱性物质的作用:

Ca(OH)₂+CuSO₄====Cu(OH)₂↓+CaSO₄↓ (波尔多液)

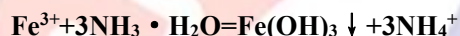
MgCl₂+2NH₃·H₂O====Mg(OH)₂↓+2NH₄Cl



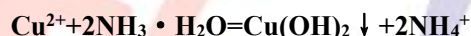
AlCl₃+3NH₃·H₂O====Al(OH)₃↓+3NH₄Cl



FeCl₃+3NH₃·H₂O====Fe(OH)₃↓+3NH₄Cl



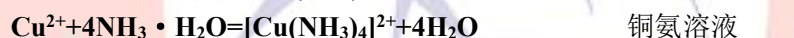
CuSO₄+2NH₃·H₂O(不足)====Cu(OH)₂↓+(NH₄)₂SO₄



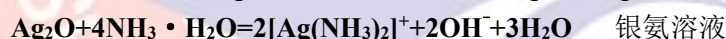
Cu(OH)₂+4NH₃·H₂O=Cu(NH₃)₄(OH)₂+4H₂O



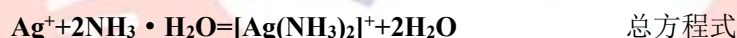
CuSO₄+4NH₃·H₂O(足)====Cu(NH₃)₄SO₄+4H₂O



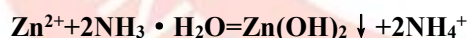
AgNO₃+NH₃·H₂O====AgOH↓+NH₄NO₃ 2AgOH=Ag₂O(灰黑色)+H₂O



AgNO₃+2NH₃·H₂O====Ag(NH₃)₂NO₃+2H₂O

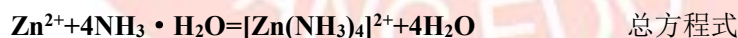


ZnSO₄+2NH₃·H₂O(不足)====Zn(OH)₂↓+(NH₄)₂SO₄



Zn(OH)₂+4NH₃·H₂O=Zn(NH₃)₄(OH)₂+4H₂O

ZnSO₄+4NH₃·H₂O(足)====Zn(NH₃)₄SO₄+4H₂O



4、与酸性物质的作用: 强酸制弱酸, 或不挥发性酸制挥发性酸

Na₃PO₄+2HCl====Na₂HPO₄+2NaCl $\text{PO}_4^{3-}+2\text{H}^+=\text{H}_2\text{PO}_4^-$

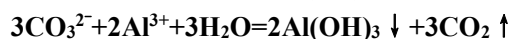
Na₂HPO₄+HCl====NaH₂PO₄+NaCl $\text{HPO}_4^{2-}+\text{H}^+=\text{H}_2\text{PO}_4^-$

NaH₂PO₄+HCl====H₃PO₄+NaCl $\text{H}_2\text{PO}_4^-+\text{H}^+=\text{H}_3\text{PO}_4$

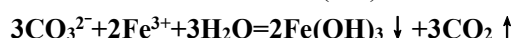
Na₂CO₃+HCl====NaHCO₃+NaCl $\text{CO}_3^{2-}+\text{H}^+=\text{HCO}_3^-$

NaHCO₃+HCl====NaCl+H₂O+CO₂↑ $\text{HCO}_3^-+\text{H}^+=\text{CO}_2\uparrow+\text{H}_2\text{O}$

3Na₂CO₃+2AlCl₃+3H₂O====2Al(OH)₃↓+3CO₂↑+6NaCl (物质之间的双水解反应)



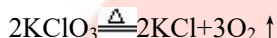
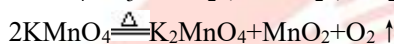
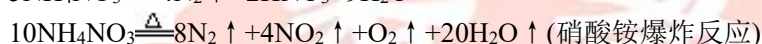
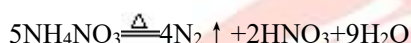
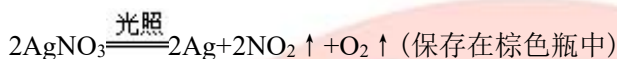
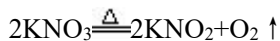
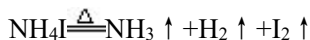
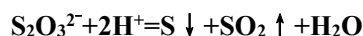
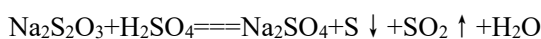
3Na₂CO₃+2FeCl₃+3H₂O====2Fe(OH)₃↓+3CO₂↑+6NaCl (物质之间的双水解反应)



3NaHCO₃+AlCl₃====Al(OH)₃↓+3CO₂↑ (物质之间的双水解反应)

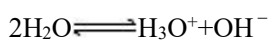
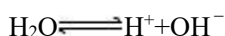
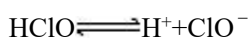
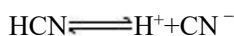
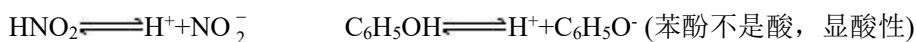
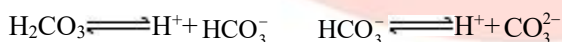
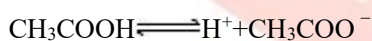
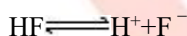
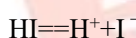
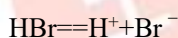
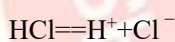
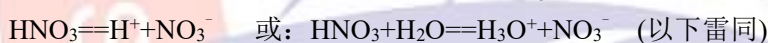


6、不稳定性:

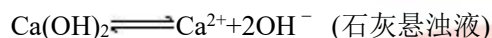
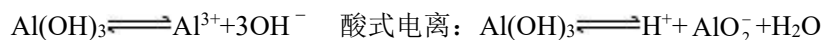
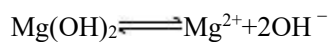
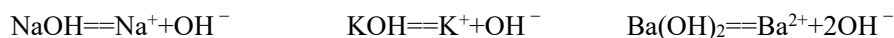


九、电离方程式

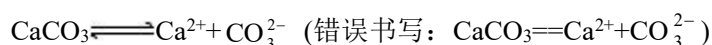
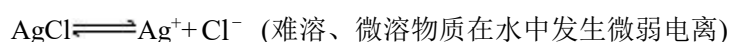
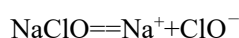
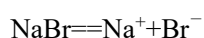
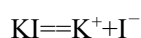
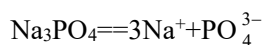
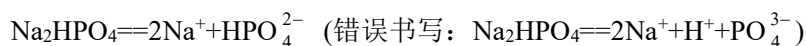
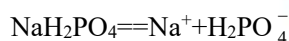
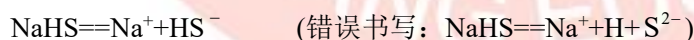
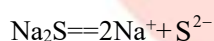
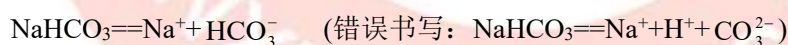
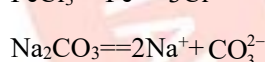
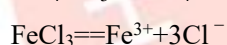
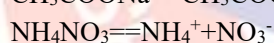
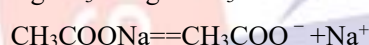
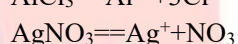
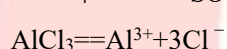
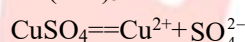
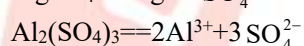
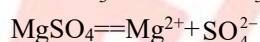
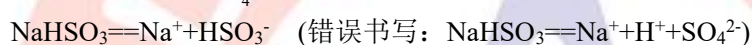
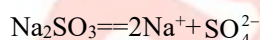
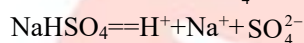
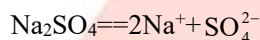
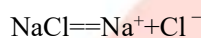
1、酸的电离(H_2SO_4 、 HNO_3 、 HCl 、 HBr 、 HI 、 H_3PO_4 、 HF 、 H_2SO_3 、 CH_3COOH 、 H_2CO_3 、 H_2S 、 HNO_2 、 $\text{C}_6\text{H}_5\text{OH}$ 、 HCN 、 HClO)

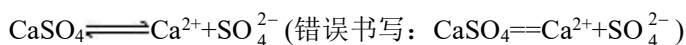


2、碱的电离(NaOH 、 KOH 、 $\text{Ba}(\text{OH})_2$ 、 $\text{Mg}(\text{OH})_2$ 、 $\text{Al}(\text{OH})_3$ 、 $\text{NH}_3 \cdot \text{H}_2\text{O}$)



3、盐的电离(NaCl 、 Na_2SO_4 、 NaHSO_4 、 Na_2SO_3 、 NaHSO_3 、 MgSO_4 、 CaSO_4 、 $\text{Al}_2(\text{SO}_4)_3$ 、 CuSO_4 、 AlCl_3 、 AgNO_3 、 CH_3COONa 、 NH_4NO_3 、 FeCl_3 、 Na_2CO_3 、 NaHCO_3 、 Na_2S 、 NaHS 、 NaH_2PO_4 、 Na_2HPO_4 、 Na_3PO_4 、 KI 、 NaBr 、 NaClO 、 AgCl 、 CaCO_3)



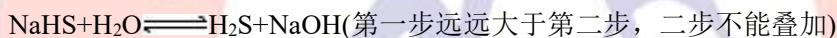
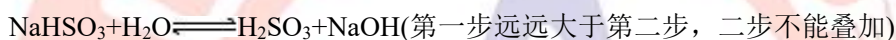
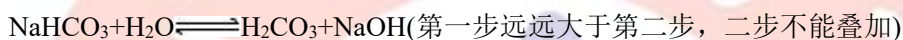
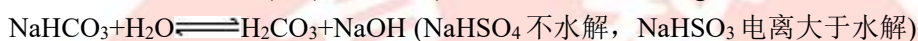
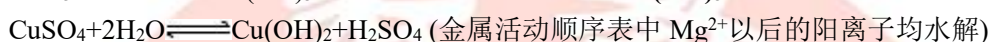
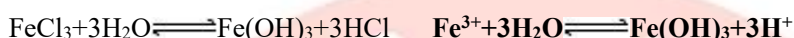


3、熔融电离

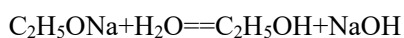
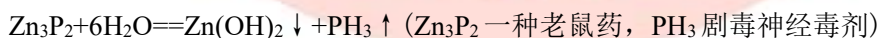
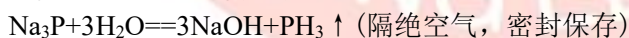
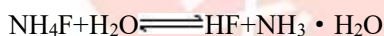
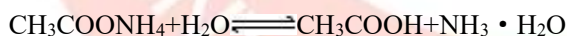


十、水解反应

1、单水解---可逆水解

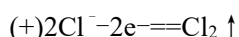


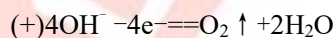
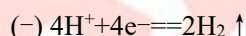
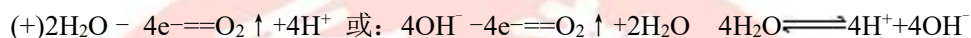
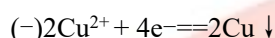
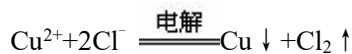
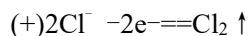
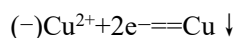
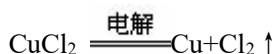
2、双水解



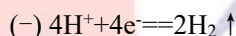
十一、电解及电极方程式

1、电解质溶液在惰性电极条件下, 或阴极是较活泼金属电极, 阳极是惰性电极条件下的电解

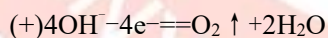




酸性水解:

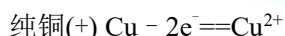
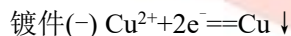


碱性水解:

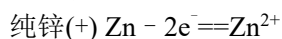
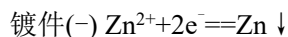


2、电镀: 镀件作阴极, 被镀金属作阳极, 被镀金属的含氧酸盐作电解质溶液

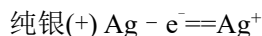
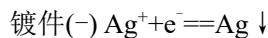
镀铜: CuSO_4 电镀液



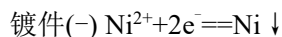
镀锌: ZnSO_4 电镀液

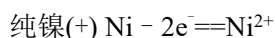


镀银: AgNO_3 电镀液

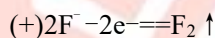
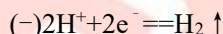
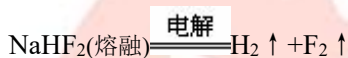
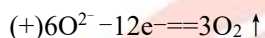
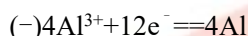
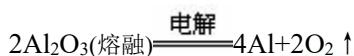
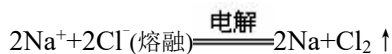
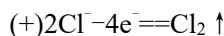
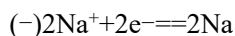


镀镍: NiSO_4 电镀液





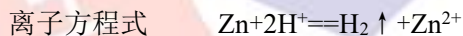
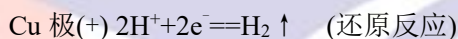
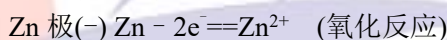
3、熔融状态下的电解:



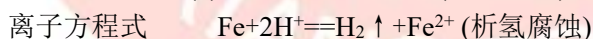
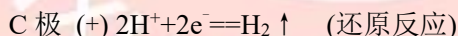
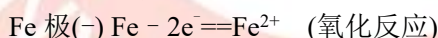
十二、原电池反应 X—Y(电解质溶液) 或 X//电解质溶液//Y

(1)不可逆电池

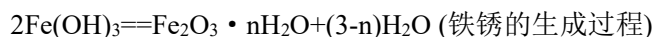
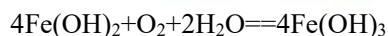
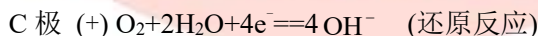
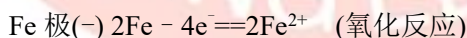
苏打电池: Zn—Cu(H₂SO₄)



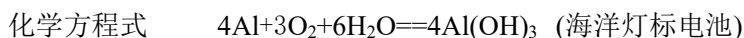
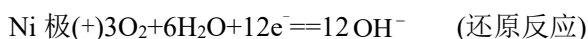
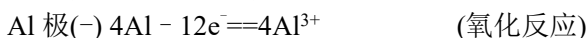
铁碳电池: Fe—C(H₂CO₃)



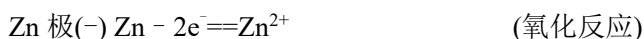
铁碳电池: Fe—C(H₂O、O₂)

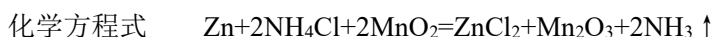
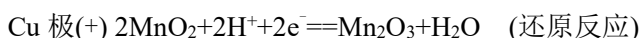


铝镍电池: Al—Ni(NaCl 溶液、O₂)



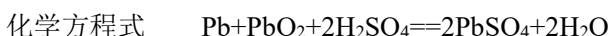
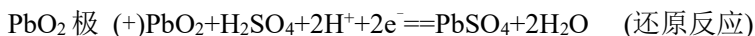
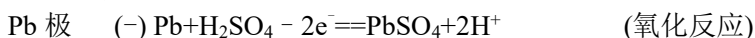
干电池: Zn—MnO₂(NH₄Cl 糊状物) NH₄Cl+H₂O=NH₃·H₂O+HCl



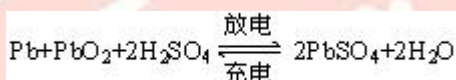
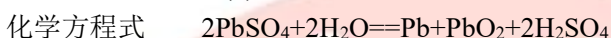
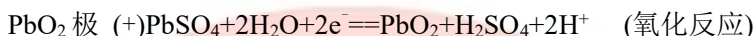
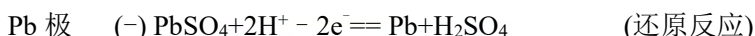


(2)可逆电池

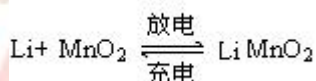
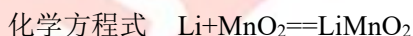
铅蓄电池：Pb—PbO₂(浓硫酸)放电



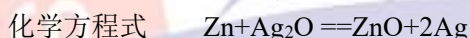
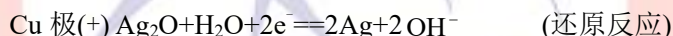
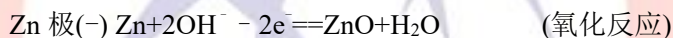
Pb—PbO₂(浓硫酸)充电



锂电池：Li—LiMnO₂(固体介质)

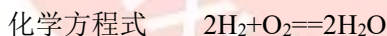
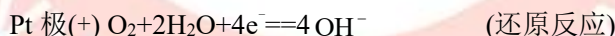
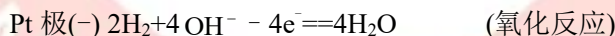


银锌电池：Zn—Ag₂O(NaOH)

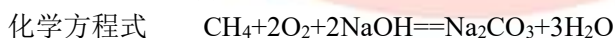
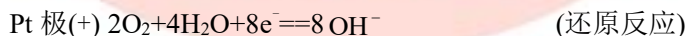
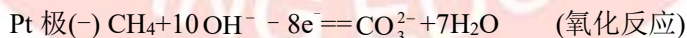


(3)高能燃料电池：

H₂—O₂(NaOH)



CH₄—O₂(NaOH)



十三、热化学方程式

