

# 高中化学方程式手册

CHEMICAL EQUATION



## 总目录

- 无机化学方程式
- 热化学方程式
- 有机反应方程式
- 离子方程式
- 电极方程式

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- 5 氢氧燃料电池(酸性介质)
- 6 氢氧燃料电池(碱性介质)
- 7 铅蓄电池(放电)
- 8 Al—NaOH—Mg原电池
- 9 CH<sub>4</sub>燃料电池(碱性介质)
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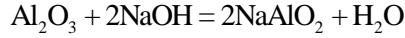
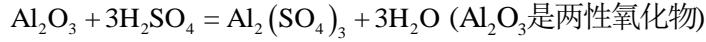
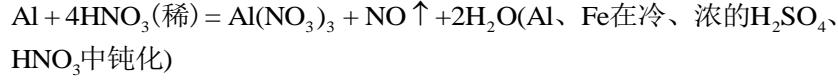
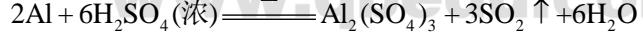
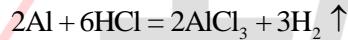
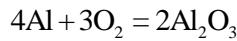
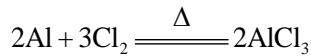
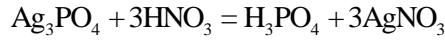
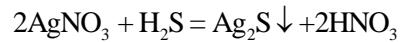
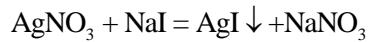
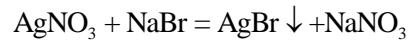
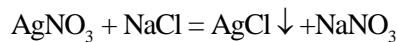
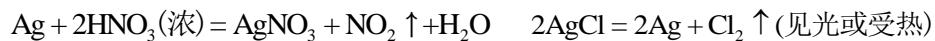
- 1 电解CuCl<sub>2</sub>溶液
- 2 电解精炼铜
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- 8 电解KNO<sub>3</sub>溶液
- 9 电解CuSO<sub>4</sub>溶液
- 10 电解AgNO<sub>3</sub>溶液
- 11 铅蓄电池充电

# 1. 无机化学方程式

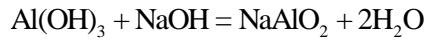
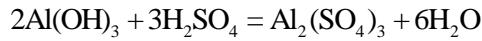
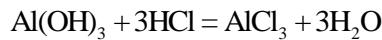
A

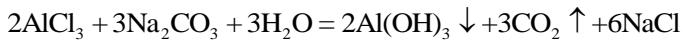
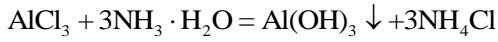
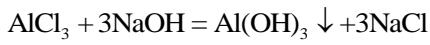
Ag

Al

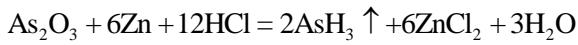
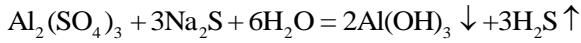
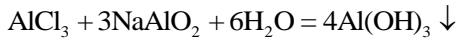
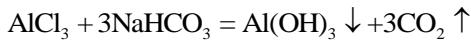


**Al<sub>2</sub>O<sub>3</sub>、 Al(OH)<sub>3</sub>**



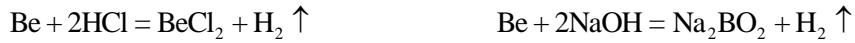
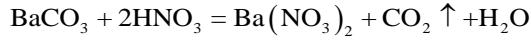
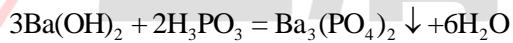
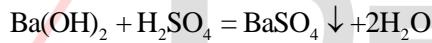


## 铝盐

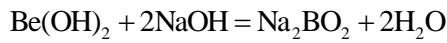
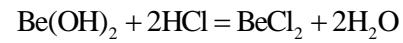
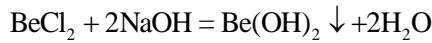


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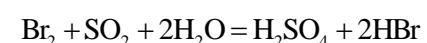
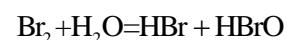
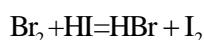
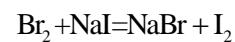
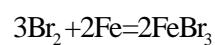
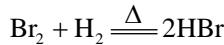
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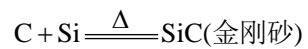
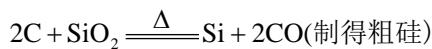
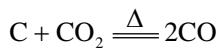
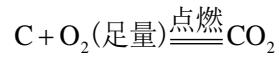
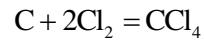
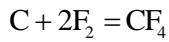
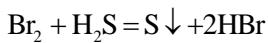
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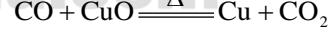
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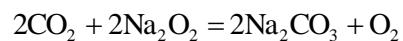
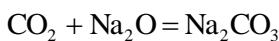
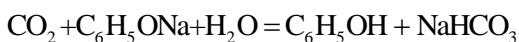
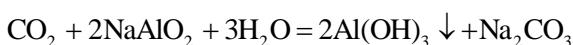
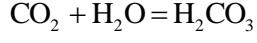
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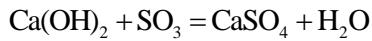
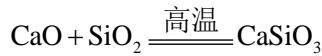
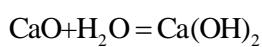


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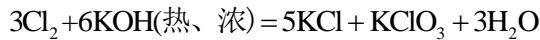
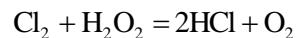
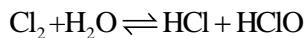
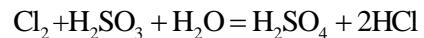
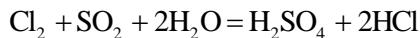
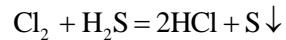
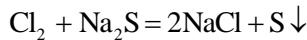
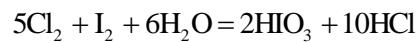
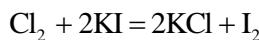
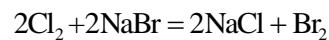
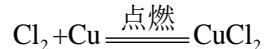
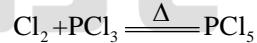
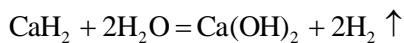
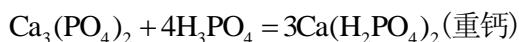
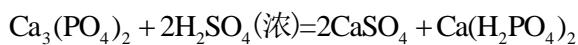
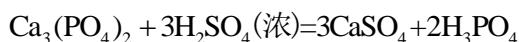


# CO<sub>2</sub>

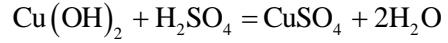
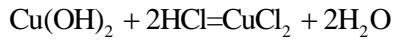
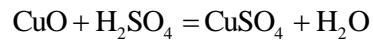
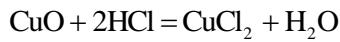
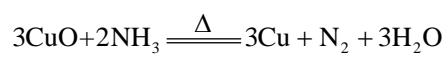




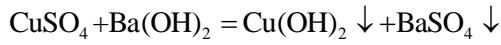
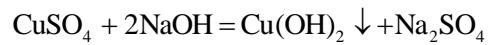
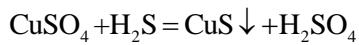
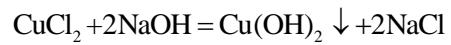
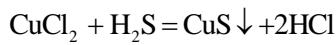
**Ca**  
 $\text{CaCO}_3 + 2\text{HCO}_3 = \text{Ca}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{CO}_2 \uparrow$  (用  $\text{HNO}_3$  和浓  $\text{H}_2\text{SO}_4$  不能制备  
 $\text{H}_2\text{S}$ 、 $\text{HI}$ 、 $\text{HBr}$ 、 $\text{SO}_2$ )等还原性气体)



**Cl**

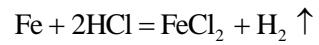
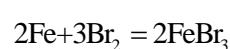
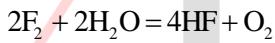
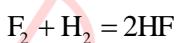


## Cu

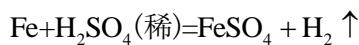
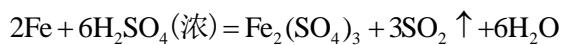
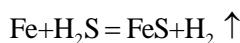
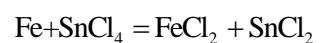
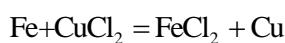


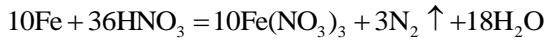
## F

### F<sub>2</sub>

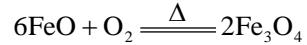
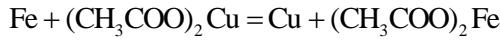


## Fe





Fe(Al) + H<sub>2</sub>SO<sub>4</sub> (浓) 室温下钝化



## FeO



## Fe<sub>2</sub>O<sub>3</sub>



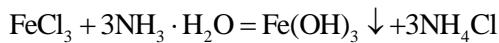
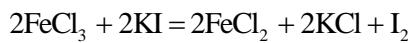
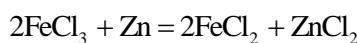
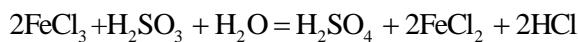
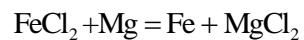
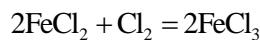
## Fe<sub>3</sub>O<sub>4</sub>



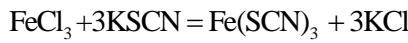
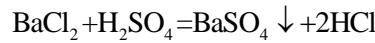
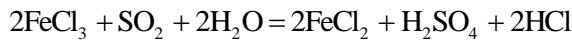
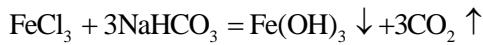
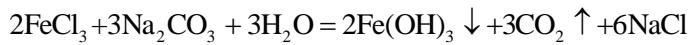
## Fe(OH)<sub>2</sub>、Fe(OH)<sub>3</sub>

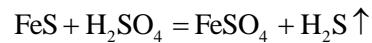
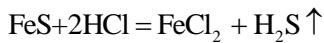


## FeCl<sub>2</sub>

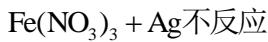
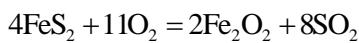


## FeCl<sub>3</sub>

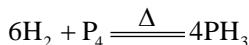




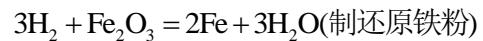
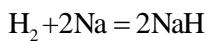
## FeS



## H



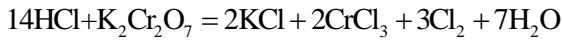
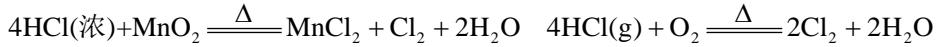
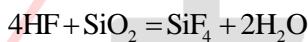
## H<sub>2</sub>



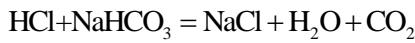
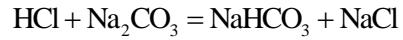
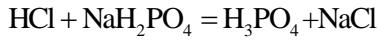
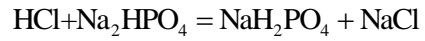
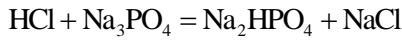
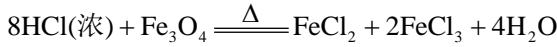
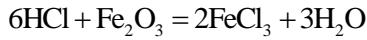
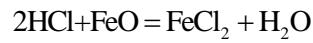
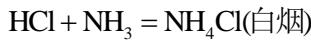
## Hg



## HF



## HCl

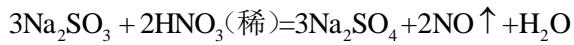
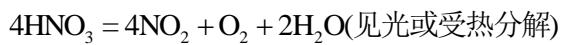
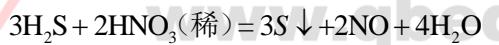
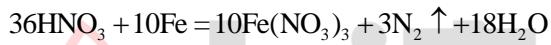
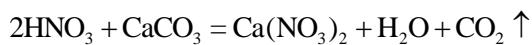
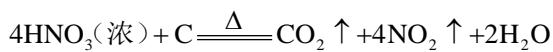
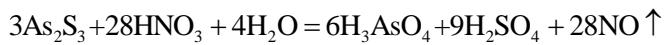
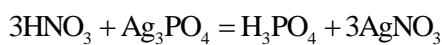
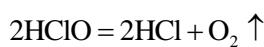


<b>HBr</b> $2\text{HI} \xrightarrow{\Delta} \text{H}_2 + \text{I}_2$	$\text{HBr} + \text{NaOH} = \text{NaBr} + \text{H}_2\text{O}$	$2\text{HBr} + \text{Cl}_2 = 2\text{HCl} + \text{Br}_2$
<b>HI</b> $2\text{HI} + \text{Cl}_2 = 2\text{HCl} + \text{I}_2$		$\text{HI} + \text{NaOH} = \text{NaI} + \text{H}_2\text{O}$
<b>H<sub>2</sub>O</b> $2\text{F}_2 + 2\text{H}_2\text{O} = 4\text{HF} + \text{O}_2$	$2\text{Na} + 2\text{H}_2\text{O} = 2\text{NaOH} + \text{H}_2 \uparrow$	$\text{Cl}_2 + \text{H}_2\text{O} = \text{HCl} + \text{HClO}$
$3\text{Fe} + 4\text{H}_2\text{O(g)} \xrightarrow{\text{高温}} \text{Fe}_3\text{O}_4 + 4\text{H}_2$	$2\text{Na} + 2\text{H}_2\text{O} = 2\text{NaOH} + \text{H}_2 \uparrow$	$\text{Mg} + 2\text{H}_2\text{O} = \text{Mg(OH)}_2 + \text{H}_2 \uparrow$
$\text{SO}_2 + \text{H}_2\text{O} = \text{H}_2\text{SO}_3$	$3\text{NO}_2 + \text{H}_2\text{O} = 2\text{HNO}_3 + \text{NO}$	$2\text{H}_2\text{O} \xrightarrow{\text{电解}} 2\text{H}_2 \uparrow + \text{O}_2$
$\text{SO}_3 + \text{H}_2\text{O} = \text{H}_2\text{SO}_4$	$\text{N}_2\text{O}_5 + \text{H}_2\text{O} = 2\text{HNO}_3$	
$\text{P}_2\text{O}_5 + \text{H}_2\text{O}(\text{冷}) = 2\text{HPO}_3$	$\text{P}_2\text{O}_5 + 3\text{H}_2\text{O}(\text{热}) = 2\text{H}_3\text{PO}_4$	
$\text{CO}_2 + \text{H}_2\text{O} = \text{H}_2\text{CO}_3$		
<b>H<sub>2</sub>O<sub>2</sub></b> $2\text{H}_2\text{O}_2 = 2\text{H}_2\text{O} + \text{O}_2 \uparrow$	$\text{H}_2\text{O}_2 + \text{Cl}_2 = 2\text{HCl} + \text{O}_2$	
$5\text{H}_2\text{O}_2 + 2\text{KMnO}_4 + 6\text{HCl} = 2\text{MnCl}_2 + 2\text{KCl} + 5\text{O}_2 \uparrow + 8\text{H}_2\text{O}$		
$\text{H}_2\text{S} + \text{Cl}_2 = 2\text{HCl} + \text{S} \downarrow$	$\text{H}_2\text{S} + \text{Mg} = \text{MgS} + \text{H}_2$	
$2\text{H}_2\text{S} + 3\text{O}_2(\text{足量}) = 2\text{SO}_2 + 2\text{H}_2\text{O}$	$2\text{H}_2\text{S} + \text{O}_2(\text{少量}) = 2\text{S} + 2\text{H}_2\text{O}$	
$2\text{H}_2\text{S} + \text{SO}_2 = 3\text{S} + 2\text{H}_2\text{O}$	$\text{H}_2\text{S} + \text{H}_2\text{SO}_4(\text{浓}) = \text{S} \downarrow + \text{SO}_2 + 2\text{H}_2\text{O}$	
$\text{H}_2\text{S} \xrightarrow{\Delta} \text{H}_2 + \text{S}$	$3\text{H}_2\text{S} + 2\text{HNO}_3(\text{稀}) = 3\text{S} \downarrow + 2\text{NO} + 4\text{H}_2\text{O}$	
$5\text{H}_2\text{S} + 2\text{KMnO}_4 + 3\text{H}_2\text{SO}_4 = 2\text{MnSO}_4 + \text{K}_2\text{SO}_4 + 5\text{S} + 8\text{H}_2\text{O}$		
<b>H<sub>2</sub>S</b> $3\text{H}_2\text{S} + \text{K}_2\text{Cr}_2\text{O}_7 + 4\text{H}_2\text{SO}_4 = \text{Cr}_2(\text{SO}_4)_3 + \text{K}_2\text{SO}_4 + 3\text{S} + 7\text{H}_2\text{O}$	$3\text{H}_2\text{S} + 4\text{Na}_2\text{O}_2 + 2\text{H}_2\text{O} = \text{Na}_2\text{SO}_4 + 6\text{NaOH}$	
$\text{H}_2\text{S} + \text{Fe} = \text{FeS} + \text{H}_2 \uparrow$	$\text{H}_2\text{S} + \text{CuCl}_2 = \text{CuS} \downarrow + 2\text{HCl}$	
$\text{H}_2\text{S} + 2\text{AgNO}_3 = \text{Ag}_2\text{S} \downarrow + 2\text{HNO}_3$	$\text{H}_2\text{S} + \text{HgCl}_2 = \text{HgS} \downarrow + 2\text{HCl}$	
$\text{H}_2\text{S} + \text{Pb}(\text{NO}_3)_2 = \text{PbS} \downarrow + 2\text{HNO}_3$	$\text{H}_2\text{S} + 4\text{NO}_2 = 4\text{NO} + \text{SO}_3 + \text{H}_2\text{O}$	

## H<sub>2</sub>CO<sub>3</sub>

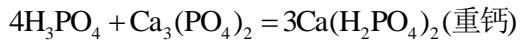


## HClO

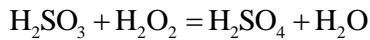
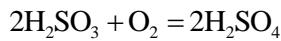
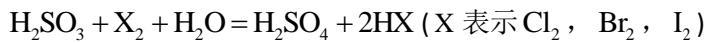
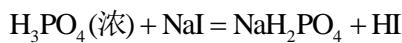
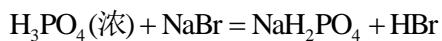


**HNO<sub>3</sub>**

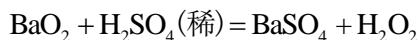
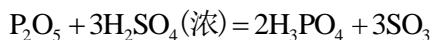
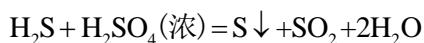
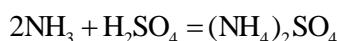
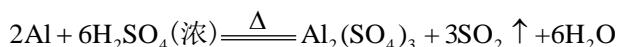
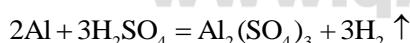
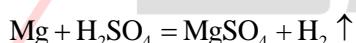
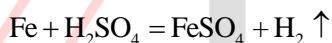
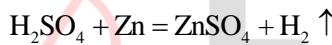
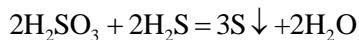
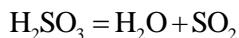
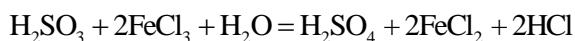
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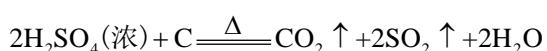
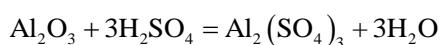
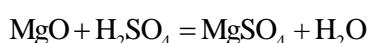
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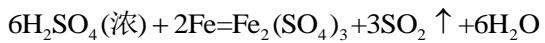
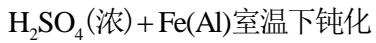
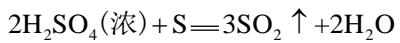


## H<sub>2</sub>SO<sub>3</sub>

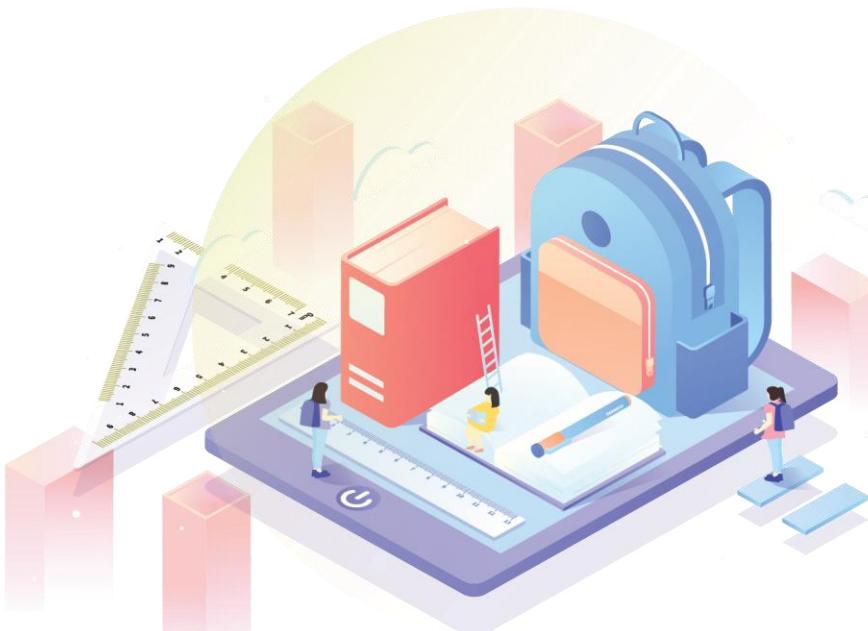
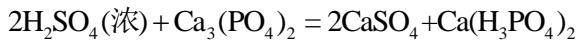
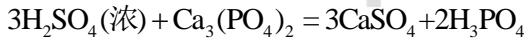
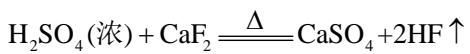


## H<sub>2</sub>SO<sub>4</sub>





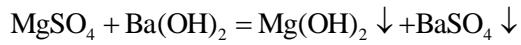
## H<sub>2</sub>SO<sub>4</sub>



		$I_2 + H_2 \xrightleftharpoons{\Delta} 2HI$	$I_2 + Fe \xrightleftharpoons{\Delta} FeI_2$
		$I_2 + 2NaOH = NaI + NaIO + H_2O$	
<b>K</b>	<b>K</b>	$K + O_2 \xrightleftharpoons{\Delta} KO_2$	
		$2K + 2H_2O = 2KOH + H_2 \uparrow$	
		$K_2O + H_2O = 2KOH$	$K_2O + CO_2 = K_2CO_3$
<b><math>K_2O</math>、<math>K_2O_2</math></b>		$2K_2O_2 + 2CO_2 = K_2CO_3 + O_2$	$2K_2O_2 + 2H_2O = 4KOH + O_2$
<b>KOH</b>		$2KOH + CO_2 = K_2CO_3 + H_2O$	$KOH + CO_2 = KHCO_3$
		$K_2CO_3 + 2HCl = 2KCl + CO_2 \uparrow + H_2O$	$K_2CO_3 + CaCl_2 = CaCO_3 \downarrow + 2KCl$
<b><math>K_2CO_3</math></b>		$K_2CO_3 + 2AgNO_3 = Ag_2NO_3 \downarrow + 2KNO_3$	
	<b><math>KHCO_3</math></b>	$KHCO_3 + HCl = KCl + CO_2 \uparrow + H_2O$	
		$2KHCO_3 \xrightleftharpoons{\Delta} K_2CO_3 + CO_2 \uparrow + H_2O$	
<b><math>KClO_3</math></b>		$2KClO_3 \xrightleftharpoons{\Delta} 2KCl + 3O_2 \uparrow$	$KClO_3 + 6HCl = KCl + 3Cl_2 \uparrow + 3H_2O$
<b>KI</b>		$2KI + Cl_2 = 2KCl + I_2$	$KI + AgNO_3 = AgI \downarrow + KNO_3$
		$2KAl(SO_4)_2 + 6NaOH = K_2SO_4 + 3Na_2SO_4 + 2Al(OH)_3 \downarrow$	
<b><math>KAl(SO_4)_2</math></b>		$2KAl(SO_4)_2 + 3Ba(OH)_2 = K_2SO_4 + 3BaSO_4 \downarrow + 2Al(OH)_3 \downarrow$	
		$KAl(SO_4)_2 + 2Ba(OH)_2 = KAlO_2 + 2BaSO_4 \downarrow$	
<b><math>KMnO_4</math></b>		$2KMnO_4 \xrightleftharpoons{\Delta} K_2MnO_4 + MnO_2 + O_2 \uparrow$	
		$2KMnO_4 + 16HCl = 2KCl + 2MnCl_2 + 5Cl_2 \uparrow + 8H_2O$	
		$2KMnO_4 + 5H_2O_2 + 6HCl = 2KCl + 2MnCl_2 + 5O_2 \uparrow + 8H_2O$	

<b>KSCN</b>	3KSCN + FeCl <sub>3</sub> = Fe(SCN) <sub>3</sub> + 3KCl
<b>KH</b>	KH + H <sub>2</sub> O = KOH + H <sub>2</sub> ↑
<b>L</b>	
<b>Li</b>	$\text{Li} + \text{O}_2 \xrightarrow{\Delta} \text{Li}_2\text{O}$ $2\text{Li} + 2\text{H}_2\text{O} = 2\text{LiOH} + \text{H}_2\uparrow$
<b>Li<sub>2</sub>O</b>	$\text{Li}_2\text{O} + \text{CO}_2 = \text{Li}_2\text{CO}_3$
<b>LiOH</b>	$2\text{LiOH} + \text{CO}_2 = \text{Li}_2\text{CO}_3 \downarrow + \text{H}_2\text{O}$
<b>Li<sub>2</sub>CO<sub>3</sub></b>	$\text{Li}_2\text{CO}_3 + 2\text{HCl} = 2\text{LiCl} + \text{CO}_2 \uparrow + \text{H}_2\text{O}$
<b>LiHCO<sub>3</sub></b>	$\text{LiHCO}_3 + \text{HCl} = \text{LiCl} + \text{CO}_2 \uparrow + \text{H}_2\text{O}$
	$2\text{LiHCO}_3 \xrightarrow{\Delta} \text{Li}_2\text{CO}_3 + \text{CO}_2 \uparrow + \text{H}_2\text{O}$
<b>M</b>	
<b>Mg</b>	$2\text{Mg} + \text{O}_2 \xrightarrow{\text{点燃}} 2\text{MgO}$ $\text{Mg} + \text{Cl}_2 \xrightarrow{\text{点燃}} \text{MgCl}_2$ $2\text{Mg} + \text{CO}_2 \xrightarrow{\text{点燃}} 2\text{MgO} + \text{C}$ $\text{Mg} + \text{S} = \text{MgS}$ $\text{Mg} + \text{Br}_2 = \text{MgBr}_2$ $\text{Mg} + 2\text{HCl} = \text{MgCl}_2 + \text{H}_2 \uparrow$ $\text{Mg} + \text{H}_2\text{SO}_4 = \text{MgSO}_4 + \text{H}_2 \uparrow$ $2\text{Mg} + \text{TiCl}_4 (\text{熔融}) = 2\text{MgCl}_2 + \text{Ti}$ $\text{Mg} + 2\text{RbCl} (\text{熔融}) = \text{MgCl}_2 + 2\text{Rb}$
<b>MgO</b>	$\text{MgO} + 2\text{HCl} = \text{MgCl}_2 + \text{H}_2\text{O}$
<b>Mg(OH)<sub>2</sub></b>	$\text{Mg(OH)}_2 + 2\text{HCl} = \text{MgCl}_2 + 2\text{H}_2\text{O}$
<b>MgCO<sub>3</sub></b>	$\text{MgCO}_3 + 2\text{HCl} = 2\text{MgCl}_2 + \text{CO}_2 \uparrow + \text{H}_2\text{O}$
<b>Mg(HCO<sub>3</sub>)<sub>2</sub></b>	$\text{Mg(HCO}_3)_2 + 2\text{HCl} = \text{MgCl}_2 + 2\text{CO}_2 \uparrow + 2\text{H}_2\text{O}$ $2\text{Mg(HCO}_3)_2 \xrightarrow{\Delta} \text{Mg(OH)}_2 \downarrow + \text{CO}_2 \uparrow + \text{H}_2\text{O}$

## MgSO<sub>4</sub>

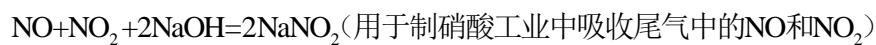
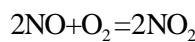
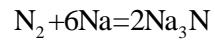


## MnO<sub>2</sub>

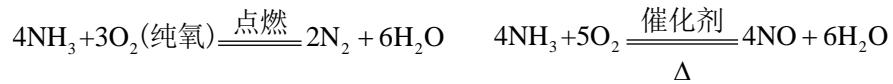
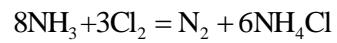
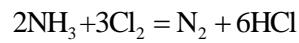
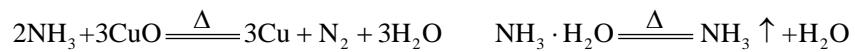
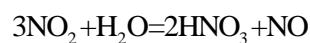


# N

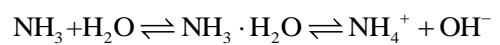
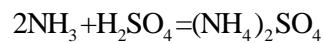
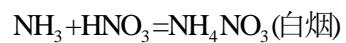
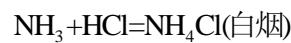
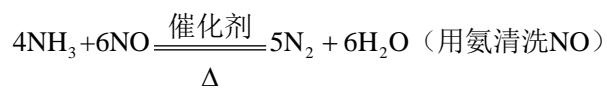
## N<sub>2</sub>

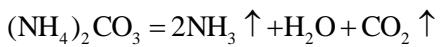
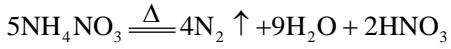
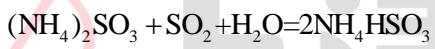
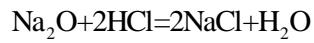
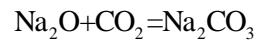
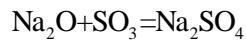
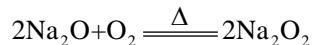
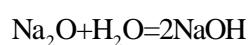
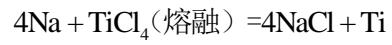
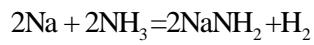
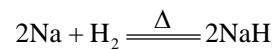
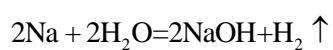
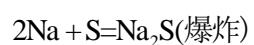
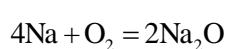


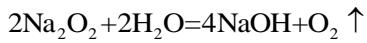
## NO、NO<sub>2</sub>



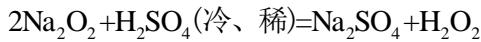
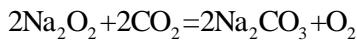
## NH<sub>3</sub>



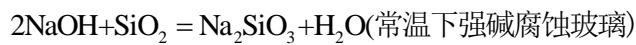
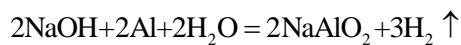
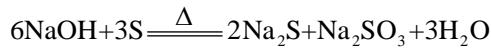
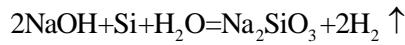
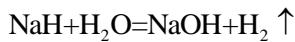
**NH<sub>4</sub>HCO<sub>3</sub>****(NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>****NH<sub>4</sub>Cl****NH<sub>4</sub>NO<sub>3</sub>****(NH<sub>4</sub>)<sub>2</sub>SO<sub>3</sub>****(NH<sub>4</sub>)<sub>2</sub>SO<sub>4</sub>****Na、Na<sub>2</sub>O、Na<sub>2</sub>O<sub>2</sub>**



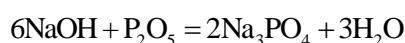
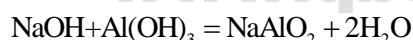
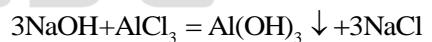
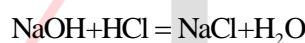
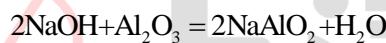
(此反应分两步  $\text{Na}_2\text{O}_2 + 2\text{H}_2\text{O} = 2\text{NaOH} + \text{H}_2\text{O}_2$ ;  $2\text{H}_2\text{O}_2 = 2\text{H}_2\text{O} + \text{O}_2 \uparrow$ 。  
 $\text{H}_2\text{O}_2$  的制备可利用类似的反应)



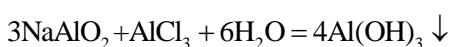
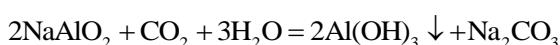
## NaH



## NaOH



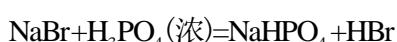
## NaAlO<sub>2</sub>



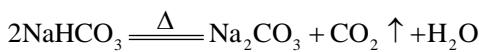
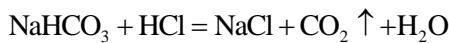
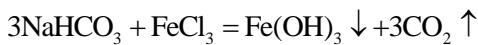
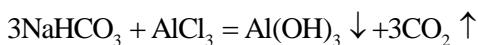
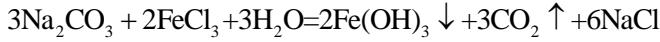
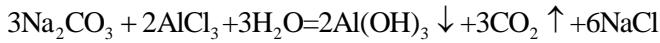
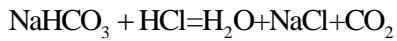
## NaCl、NaClO



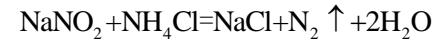
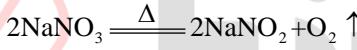
## NaBr、NaI



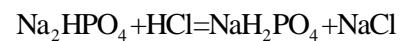
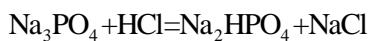
## Na<sub>2</sub>CO<sub>3</sub>、NaHCO<sub>3</sub>



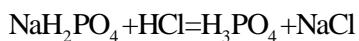
## NaNO<sub>3</sub>、NaNO<sub>2</sub>



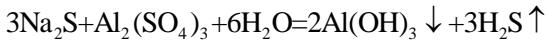
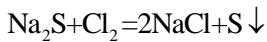
## Na<sub>3</sub>PO<sub>4</sub>、NaH<sub>2</sub>PO<sub>4</sub>



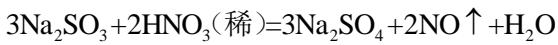
## Na<sub>2</sub>HPO<sub>4</sub>



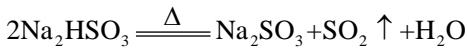
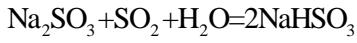
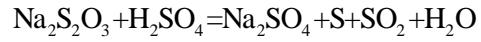
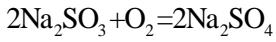
## Na<sub>2</sub>S、NaHS



## Na<sub>2</sub>SO<sub>4</sub>、Na<sub>2</sub>SO<sub>3</sub>

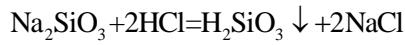


## Na<sub>2</sub>S<sub>2</sub>O<sub>3</sub>

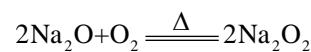
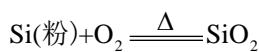
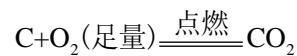
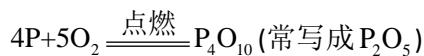
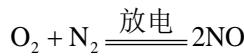
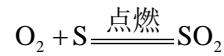
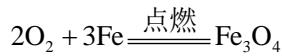
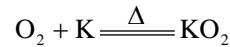
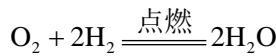
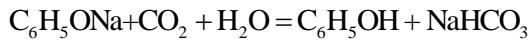


# O

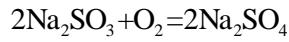
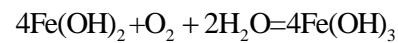
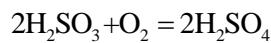
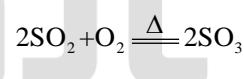
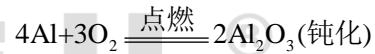
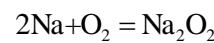
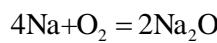
## Na<sub>2</sub>SiO<sub>3</sub>



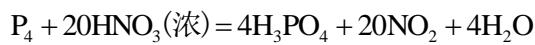
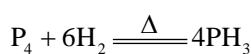
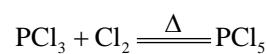
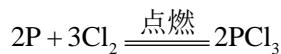
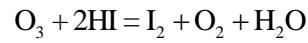
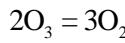
## C<sub>6</sub>H<sub>5</sub>ONa



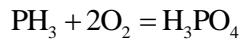
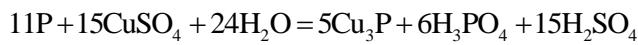
# O<sub>2</sub>



# O<sub>3</sub>

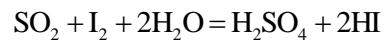
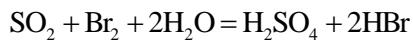
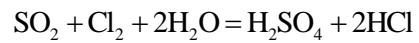
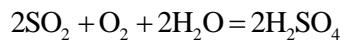
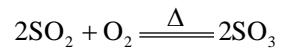


# P

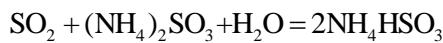
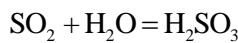
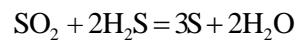
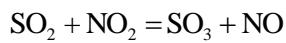


# P

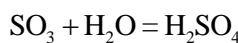
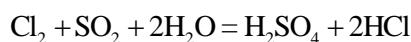
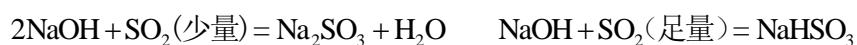
	$P_2O_5 + H_2O \xrightleftharpoons{\text{冷}} 2HPO_3$ $P_2O_5 + 3H_2O \xrightleftharpoons{\text{热}} 2H_3PO_4$ ( $P_2O_5$ 极易吸水、可作气体干燥剂)
<b>P<sub>2</sub>O<sub>3</sub>、 P<sub>2</sub>O<sub>5</sub></b>	$P_2O_5 + 3H_2SO_4 \xrightleftharpoons{\text{浓}} 2H_3PO_4 + 3SO_3$ $P_2O_5 + 2NaOH = 2NaPO_3 + H_2O$ $P_2O_5 + 6NaOH = 2Na_3PO_4 + 3H_2O$
	$Pb + 2HCl = PbCl_2 + H_2 \uparrow$ $PbO_2 + 4HCl \xrightleftharpoons{\Delta} PbCl_2 + Cl_2 \uparrow + 2H_2O$
<b>Pb、 PbO<sub>2</sub></b>	<b>铅盐</b> $Pb(NO_3)_2 + H_2S = PbS \downarrow + 2HNO_3$ $(CH_3COO)_2 Pb + H_2S = PbS \downarrow + CH_3COOH$
<b>R</b>	$2Rb + 2H_2O = 2RbOH + H_2 \uparrow$ $RbOH + HCl = RbCl + H_2O$
<b>S</b>	$S + H_2 \xrightleftharpoons{\Delta} H_2S$ $2S + C \xrightleftharpoons{\Delta} CS_2$ $S + Fe \xrightleftharpoons{\Delta} FeS$ $S + 2Cu \xrightleftharpoons{\Delta} Cu_2S$ $3S + 2Al \xrightleftharpoons{\Delta} Al_2S_3$ $S + Zn \xrightleftharpoons{\Delta} ZnS$ $S + O_2 \xrightarrow{\text{点燃}} SO_2$ $S + Fe \xrightleftharpoons{\Delta} FeS$ $S + 6HNO_3 \xrightleftharpoons{\text{浓}} H_2SO_4 + 6NO_2 \uparrow + 2H_2O$ $3S + 4HNO_3 \xrightleftharpoons{\text{稀}} 3SO_2 \uparrow + 4NO \uparrow + 2H_2O$ $3S + 6NaOH \xrightleftharpoons{\Delta} 2Na_2S + Na_2SO_3 + 3H_2O$ $S + 2Na = Na_2S$ (爆炸) $S + Mg = MgS$ $S + 2H_2SO_4 \xrightleftharpoons{\text{浓}} 3SO_2 \uparrow + 2H_2O$



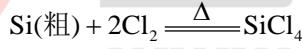
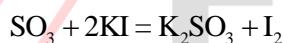
## SO<sub>2</sub>



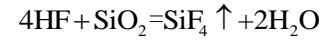
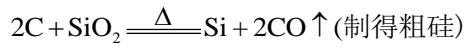
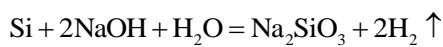
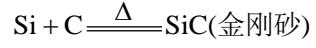
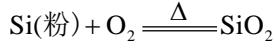
$\text{SO}_2 + \text{Ca}(\text{OH})_2 = \text{CaSO}_3 \downarrow + \text{H}_2\text{O}$  (不能用澄清石灰水鉴别 SO<sub>2</sub> 和 CO<sub>2</sub> 可用品红鉴别)



## SO<sub>3</sub>

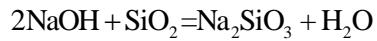


## Si

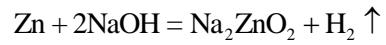
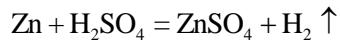
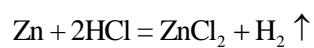


## SiO<sub>2</sub>

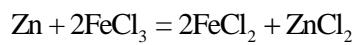




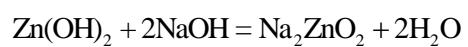
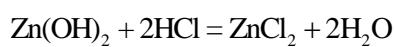
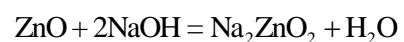
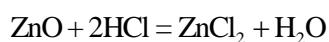
Z



Zn



ZnO



Zn(OH)<sub>2</sub>

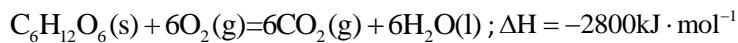
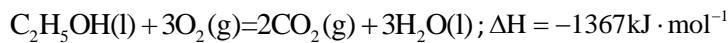
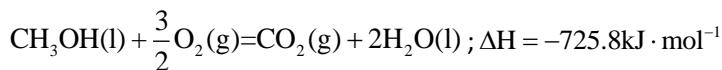
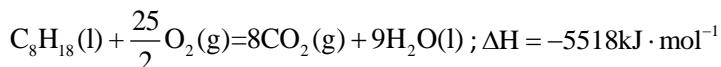
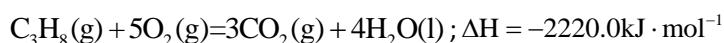
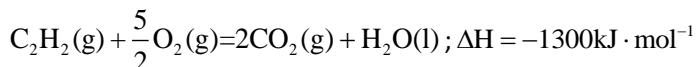
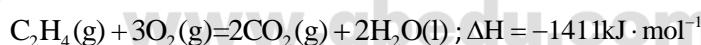
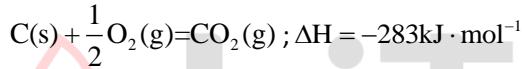
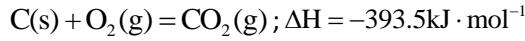
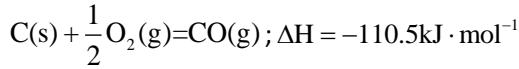
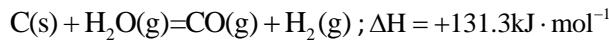
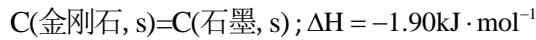
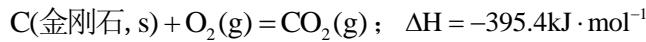
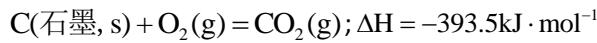
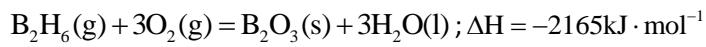


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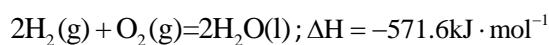
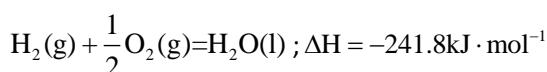
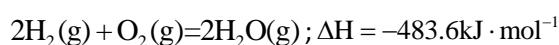
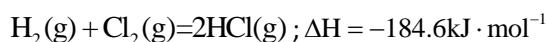


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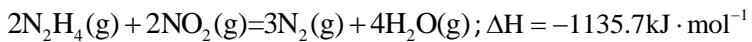
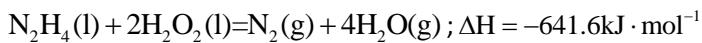
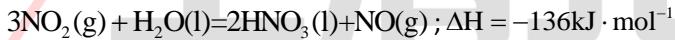
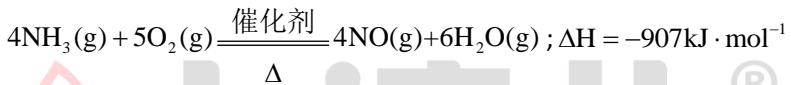
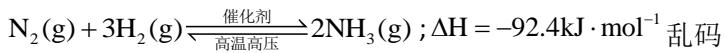
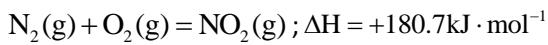
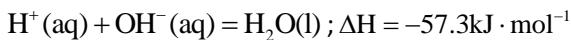
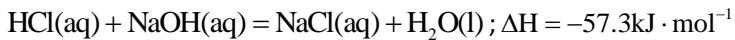
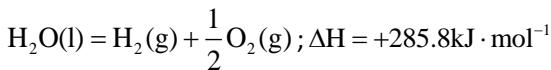
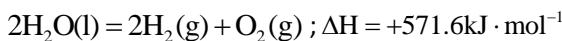
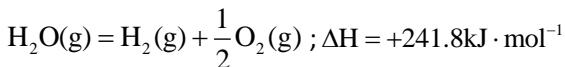
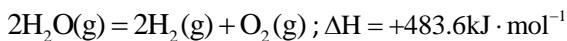
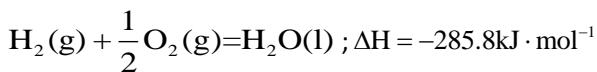


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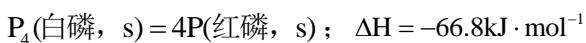


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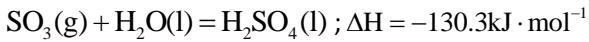
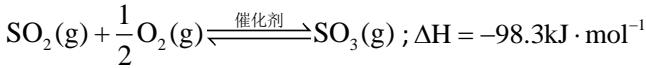
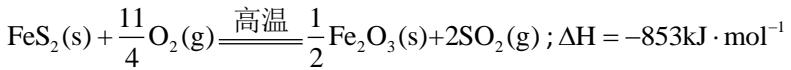
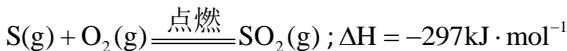
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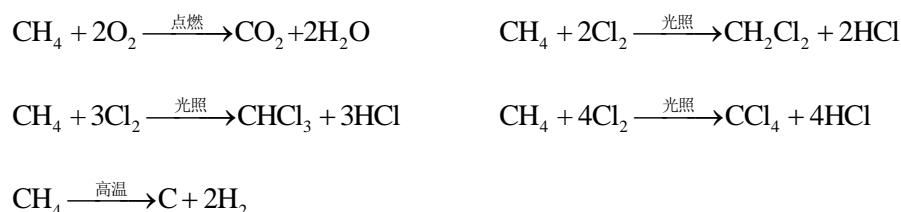
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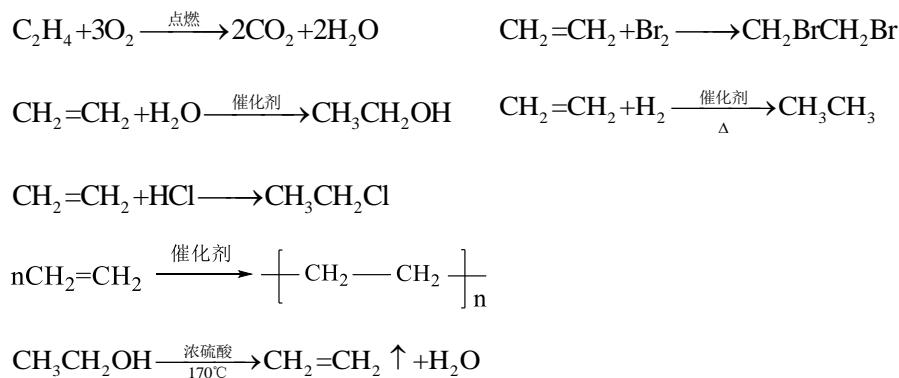
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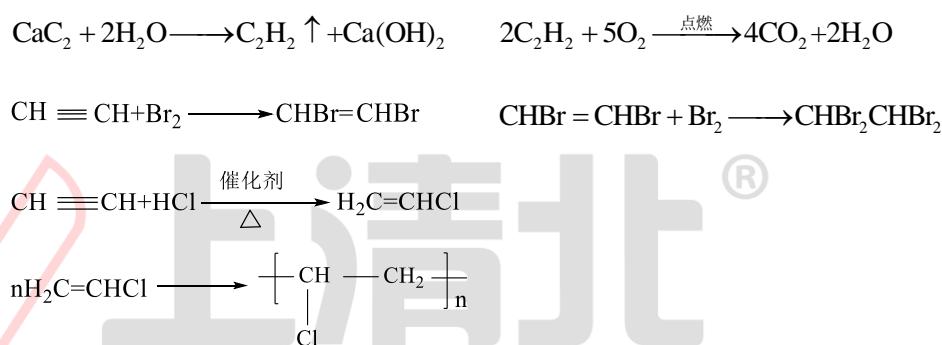
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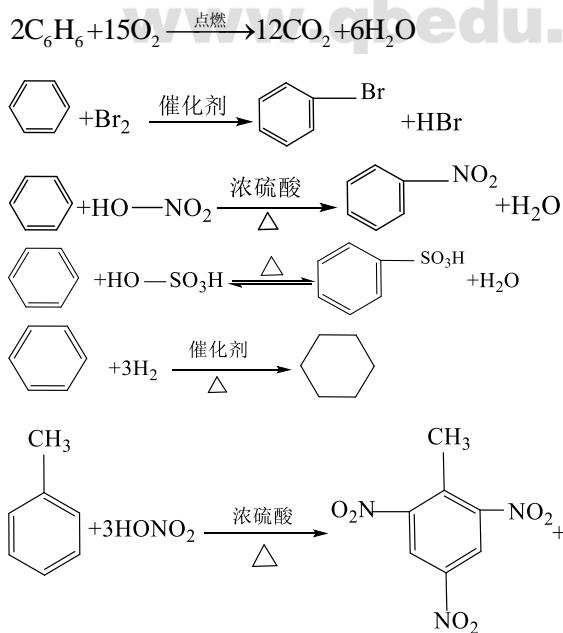
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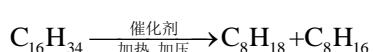
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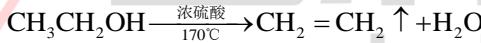
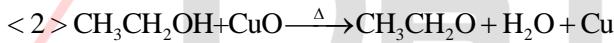
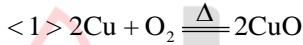
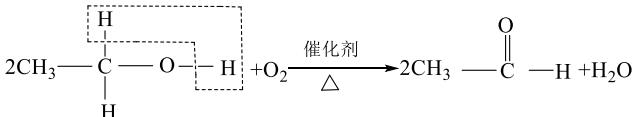
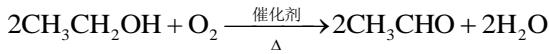
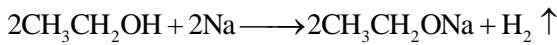
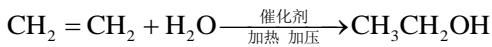
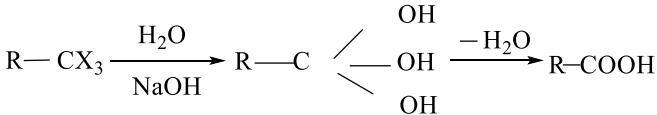
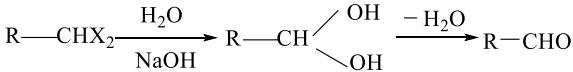
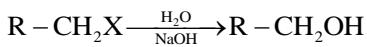
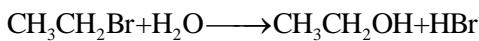
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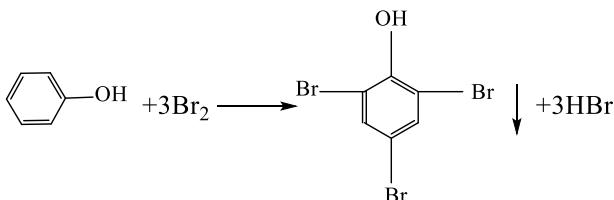
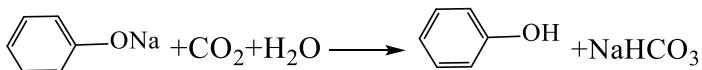
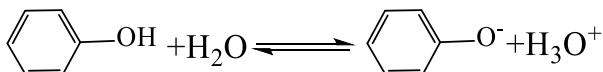
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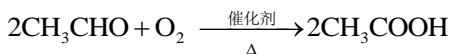
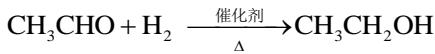
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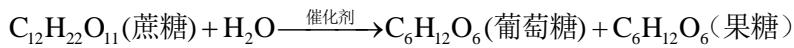
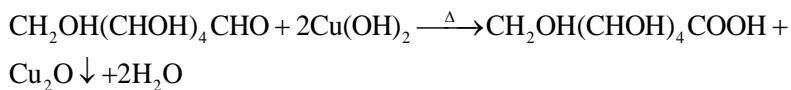
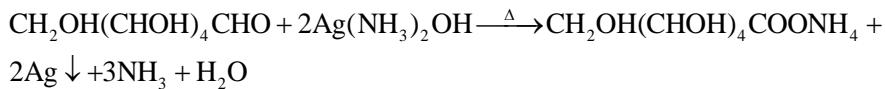
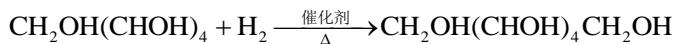
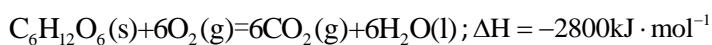
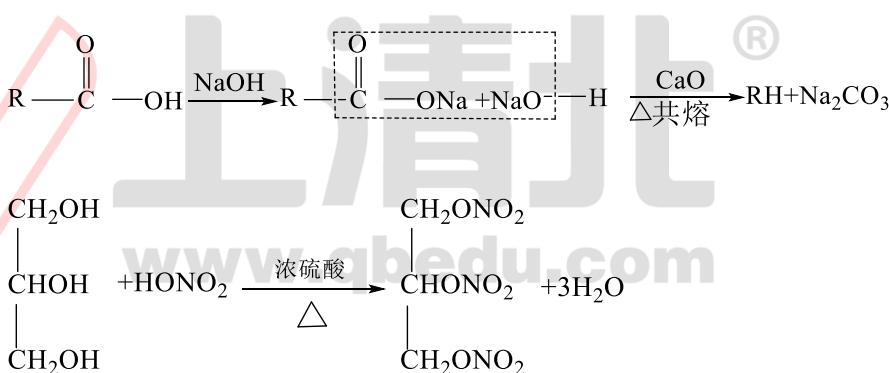
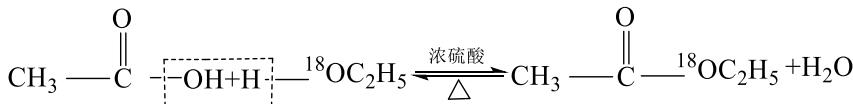
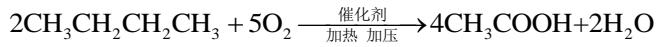
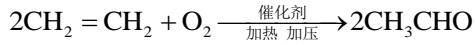
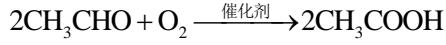
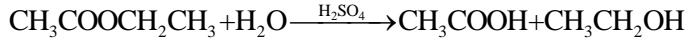
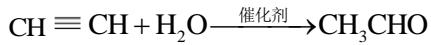
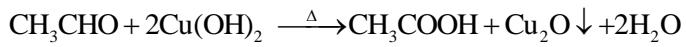
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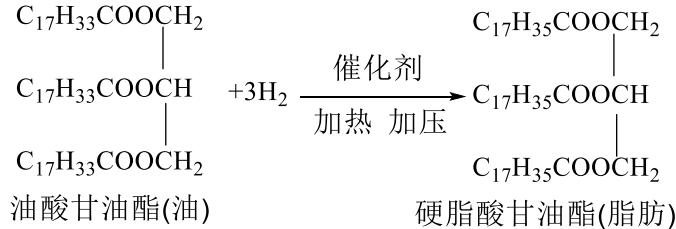
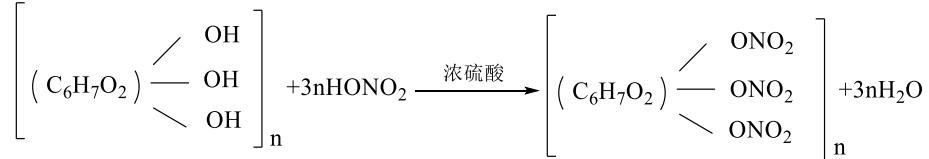
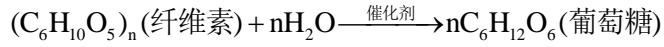
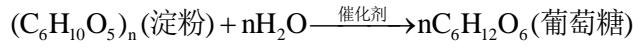
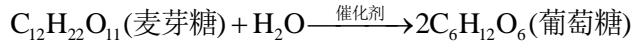


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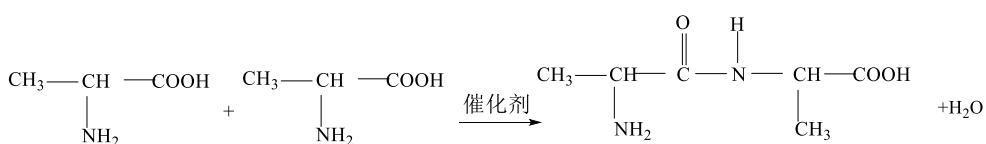
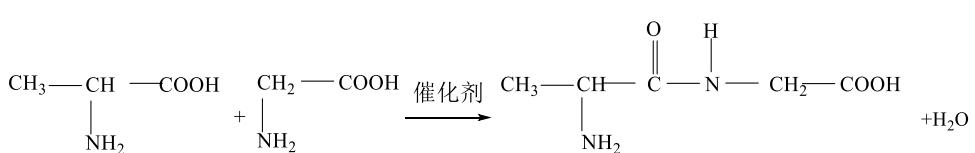
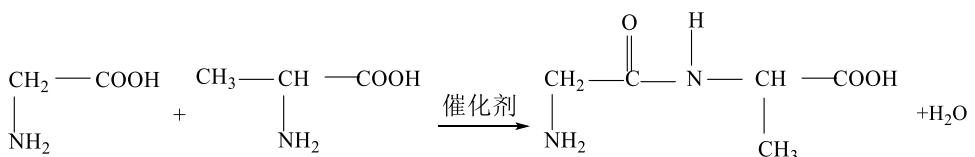
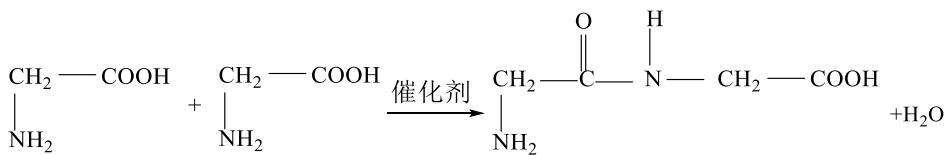
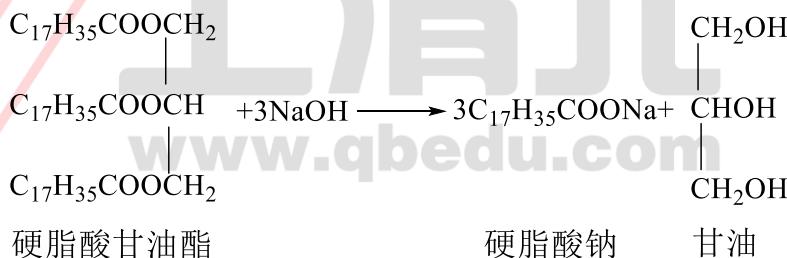
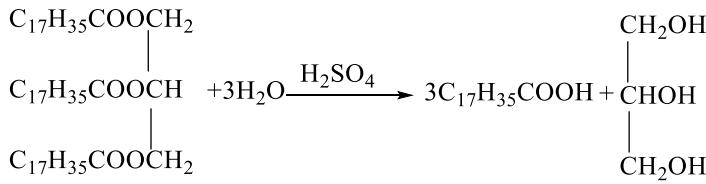


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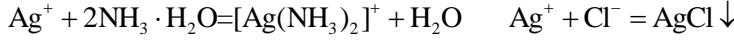
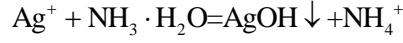
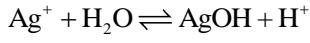
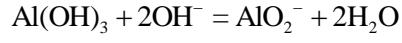
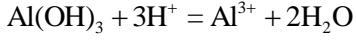
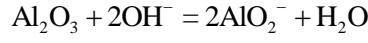
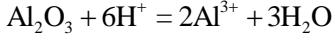
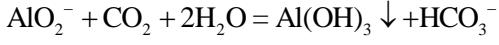
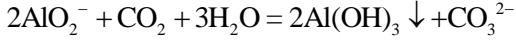
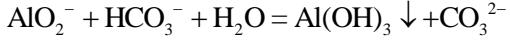
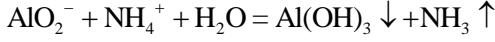
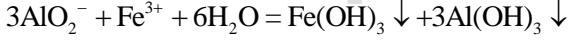
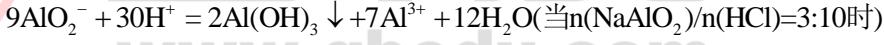
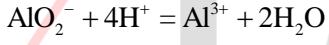
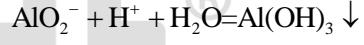
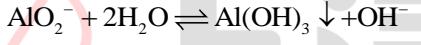
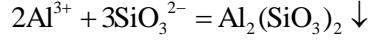
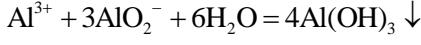
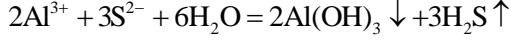
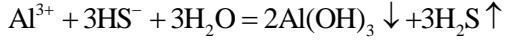
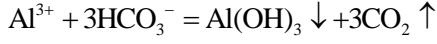
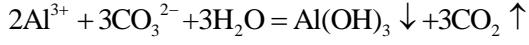
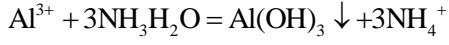
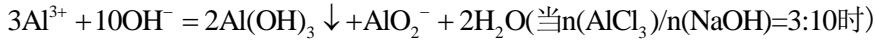
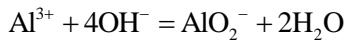
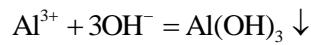
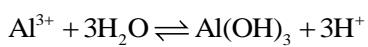
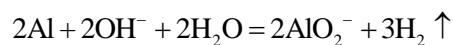
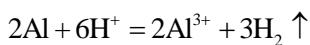
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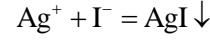
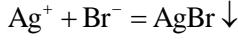
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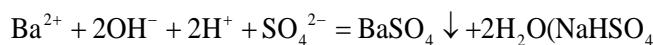
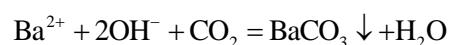
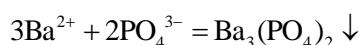
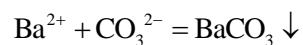
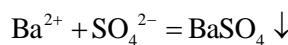
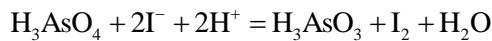
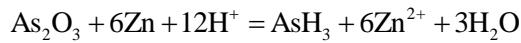
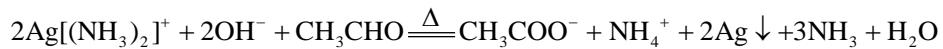
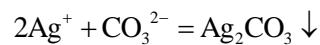
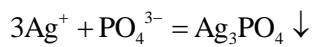
## 4. 离子反应方程式

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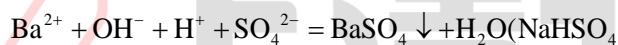


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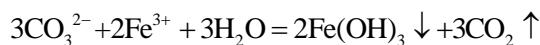
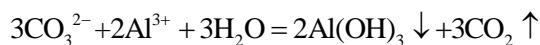
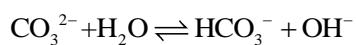
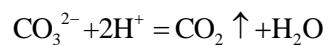
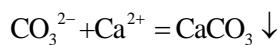
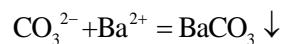
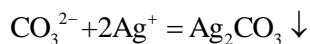
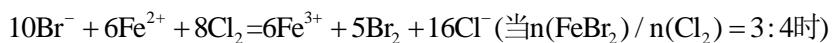
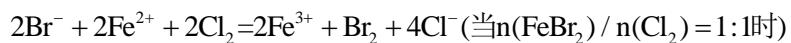
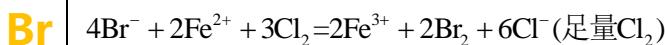
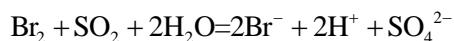
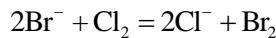
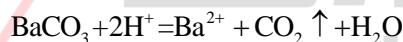




溶液中加 $\text{Ba}(\text{OH})_2$ , 使溶液呈中性)



溶液中加 $\text{Ba}(\text{OH})_2$ , 使 $\text{Ba}^{2+}$ 全部沉淀)

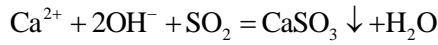
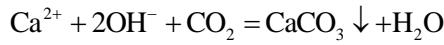
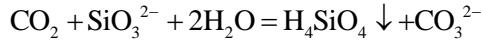
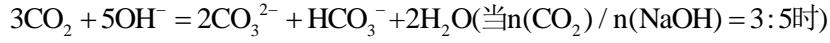
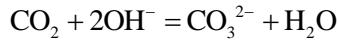
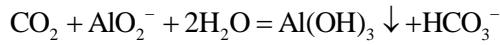
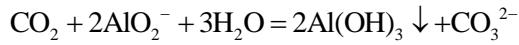


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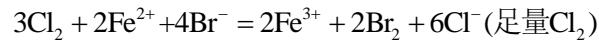
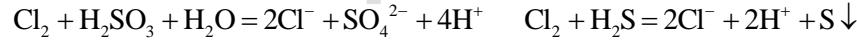
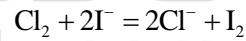
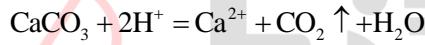
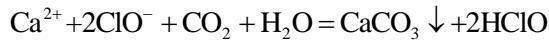
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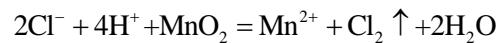
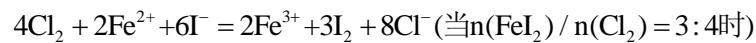
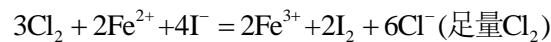
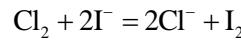
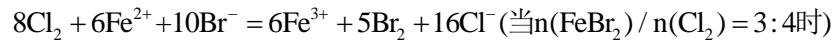
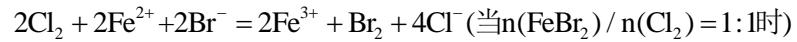
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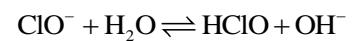
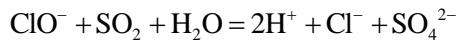
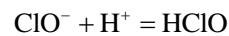
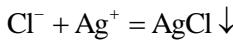


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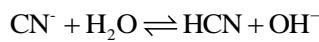


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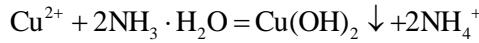
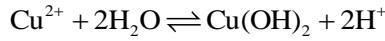
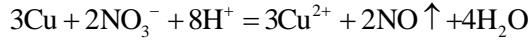
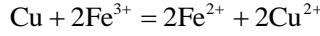
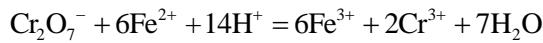




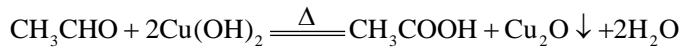
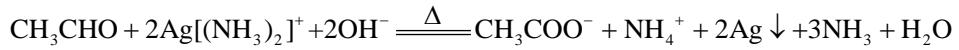
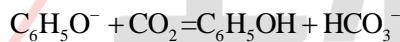
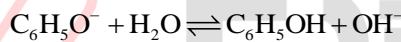
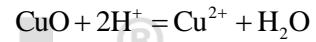
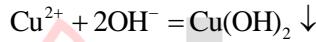
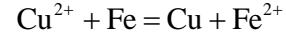
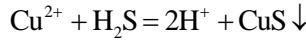
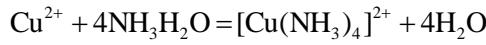
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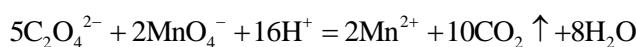
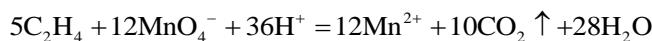
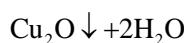
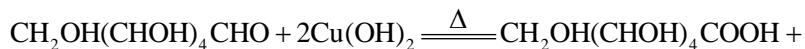
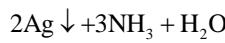
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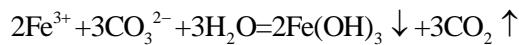
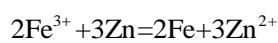
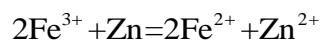
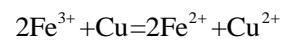
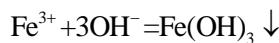
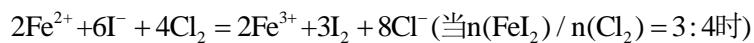
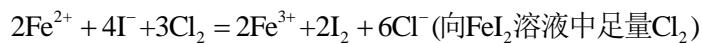
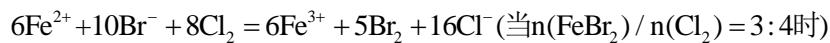
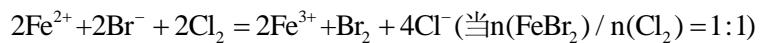
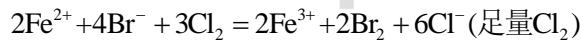
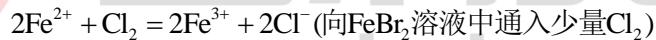
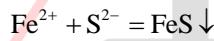
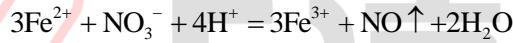
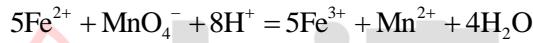
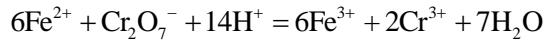
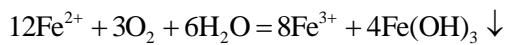
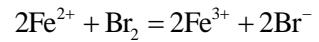
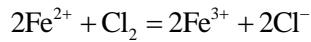
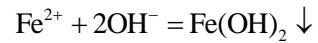
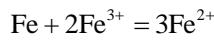
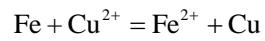
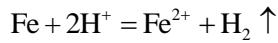
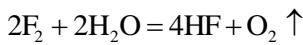


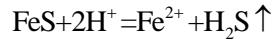
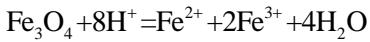
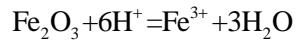
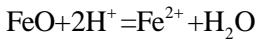
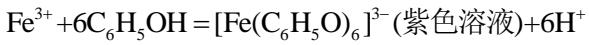
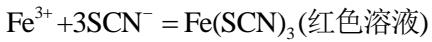
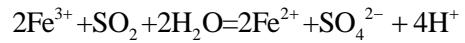
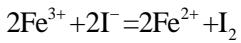
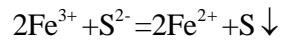
## C<sub>x</sub>H<sub>y</sub>O<sub>z</sub>



F

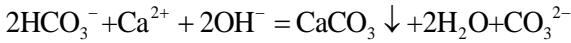
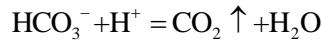
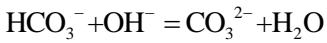
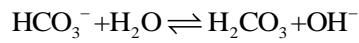
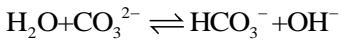
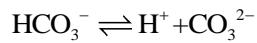
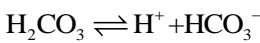
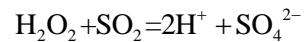
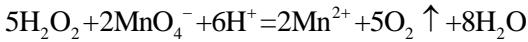
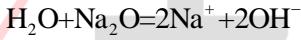
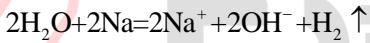
F<sub>2</sub>



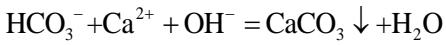


H

H<sup>+</sup>

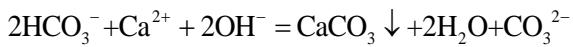


(向NaHCO<sub>3</sub>溶液中加入少量澄清石灰水)

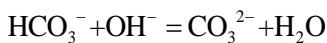


(向Ca(HCO<sub>3</sub>)<sub>2</sub>溶液中加入少量NaOH溶液)

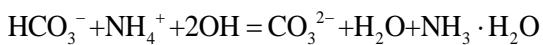
## H<sub>2</sub>CO<sub>3</sub> 系列



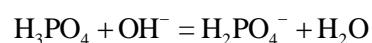
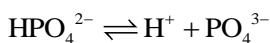
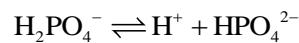
(向 $\text{Ca}(\text{HCO}_3)_2$ 溶液中加入足量 $\text{NaOH}$ 溶液)



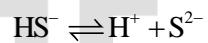
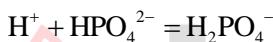
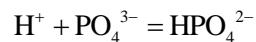
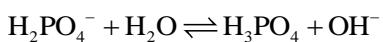
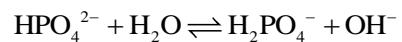
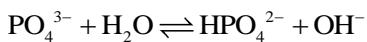
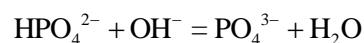
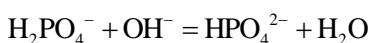
(向 $\text{NH}_4\text{HCO}_3$ 溶液中加入少量 $\text{NaOH}$ 溶液)



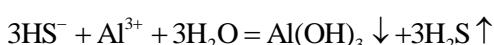
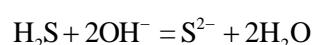
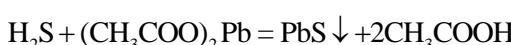
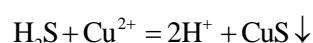
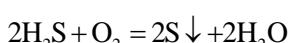
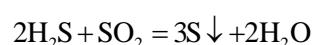
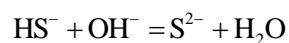
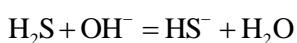
(向 $\text{NH}_4\text{HCO}_3$ 溶液中加入足量 $\text{NaOH}$ 溶液)



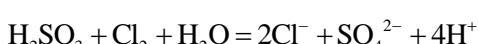
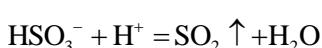
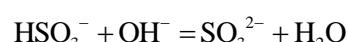
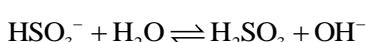
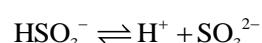
## H<sub>3</sub>PO<sub>4</sub> 系列

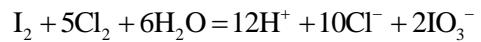
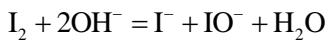
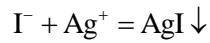
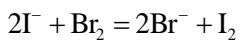
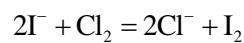
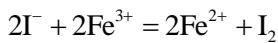


## H<sub>2</sub>S 系列



## H<sub>2</sub>SO<sub>3</sub> 系列



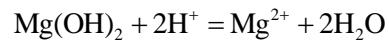
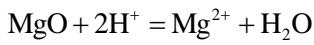
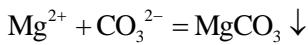
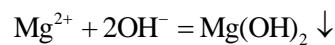
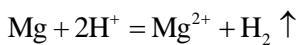


L

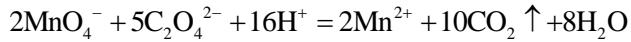
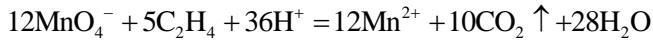
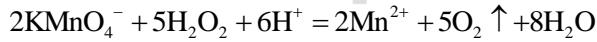
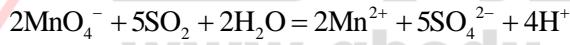
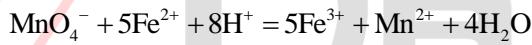
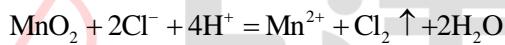


M

Mg

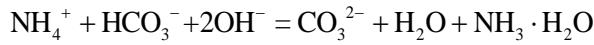
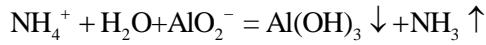
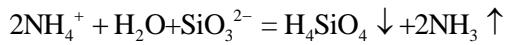
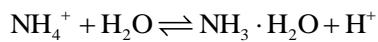
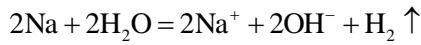


Mn

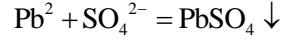
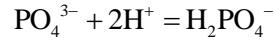
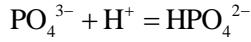
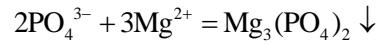
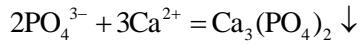
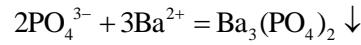
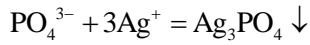
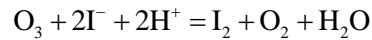
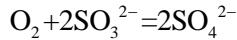
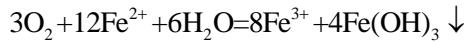
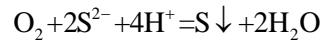
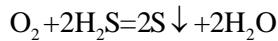
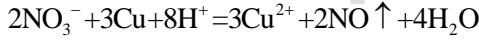
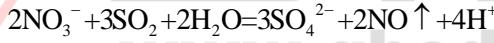
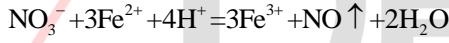
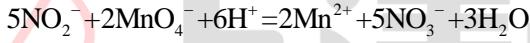
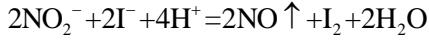
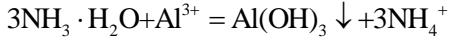
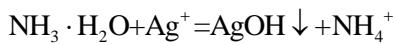
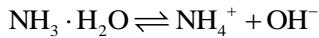
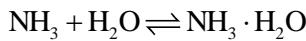


N

Na



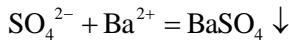
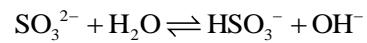
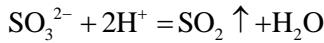
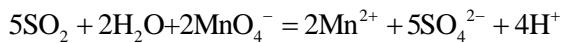
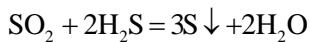
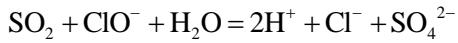
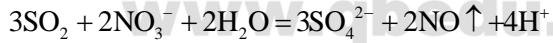
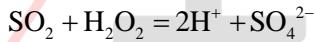
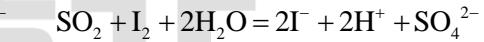
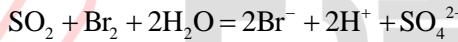
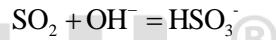
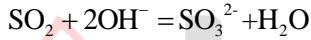
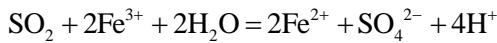
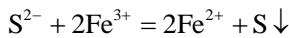
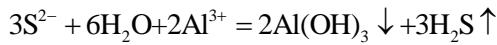
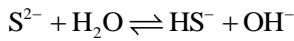
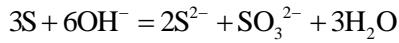
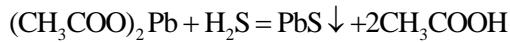
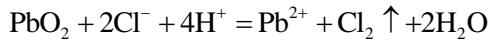
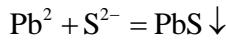
(向NH<sub>4</sub>HCO<sub>3</sub>溶液中加入足量NaOH溶液)



O

NO<sup>2-</sup>、NO<sup>3-</sup>

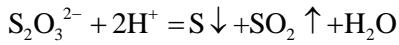
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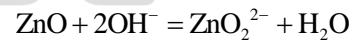
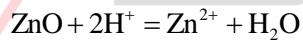
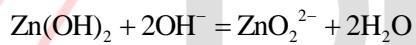
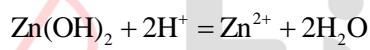
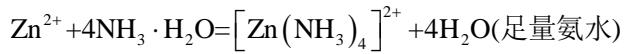
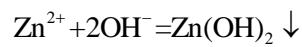
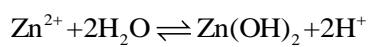
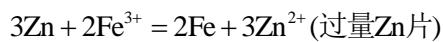
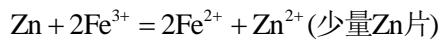
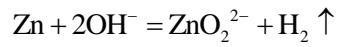
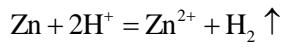
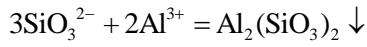
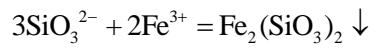
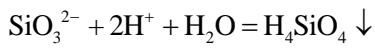
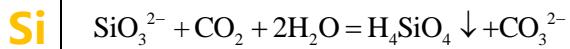
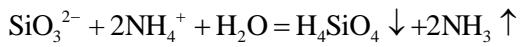
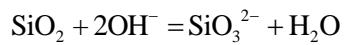
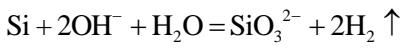


( $\text{NaHSO}_4$ 溶液中加 $\text{Ba}(\text{OH})_2$ , 使溶液呈中性)

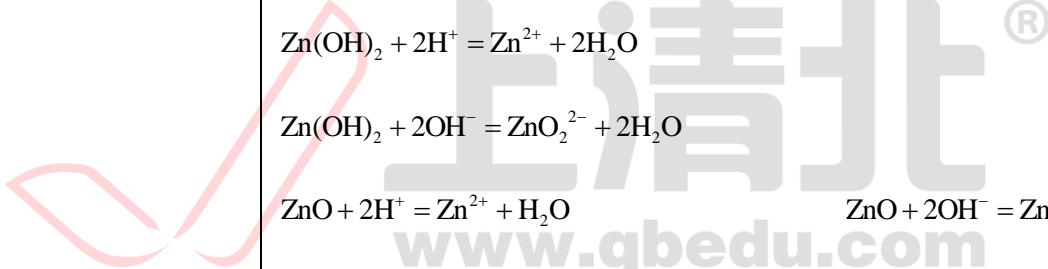


( $\text{NaHSO}_4$ 溶液中加 $\text{Ba}(\text{OH})_2$ , 使 $\text{Ba}^{2+}$ 全部沉淀)





Z

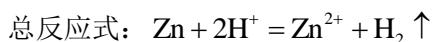
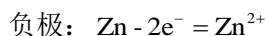
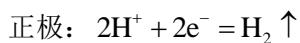




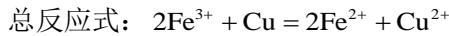
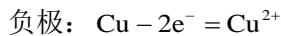
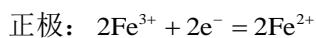
## 5. 原电池电极反应方程式

### 原电池电极 反应方程式

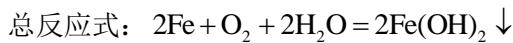
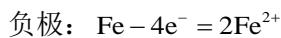
#### 1.Cu-H<sub>2</sub>SO<sub>4</sub>-Zn 原电池



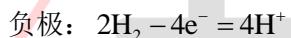
#### 2.Cu-FeCl<sub>3</sub>-C 原电池



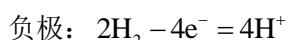
#### 3.钢铁在潮湿的空气中发生吸氧腐蚀



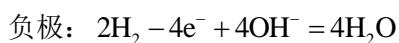
#### 4.氢氧燃料电池 ( 中性介质 )



#### 5.氢氧燃料电池 ( 酸性介质 )

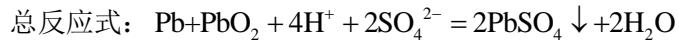
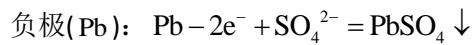


#### 6. 氢氧燃料电池 ( 碱性介质 )

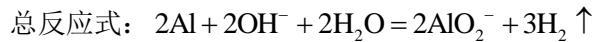
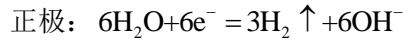


## 原电池电极 反应方程式

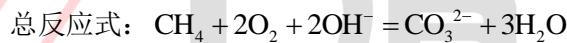
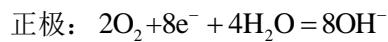
### 7. 铅蓄电池 ( 放电 )



### 8. Al-NaOH-Mg 原电池

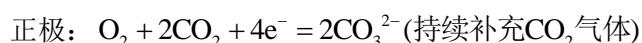


### 9. CH<sub>4</sub> 燃料电池 ( 碱性介质 )

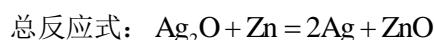


### 10. 熔融碳酸盐燃料电池

(Li<sub>2</sub>CO<sub>3</sub> 和 Na<sub>2</sub>CO<sub>3</sub> 熔融盐作电解液, CO 作燃料)

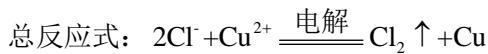
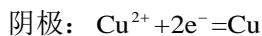
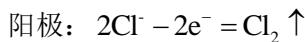


### 11. 银锌纽扣电池 ( 碱性介质 )

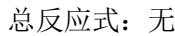


**电解电极  
反应方程式**

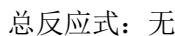
### 1. 电解 CuCl<sub>2</sub> 溶液



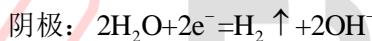
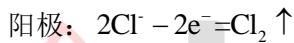
### 2. 电解精炼铜



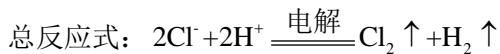
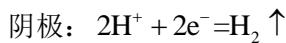
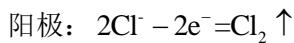
### 3. 电镀铜



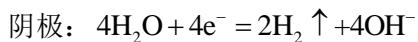
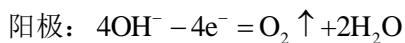
### 4. 电解饱和食盐水



### 5. 电解 HCl 溶液

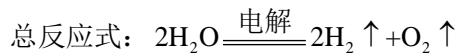
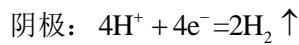
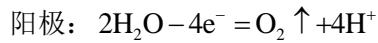


### 6. 电解 NaOH 溶液

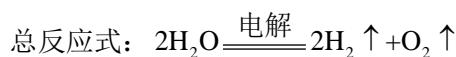
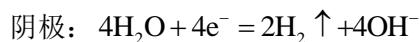
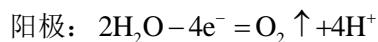


**电解电极**  
**反应方程式**

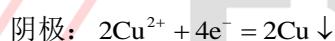
### 7. 电解 $\text{H}_2\text{SO}_4$ 溶液



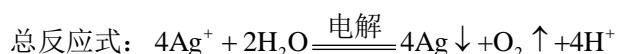
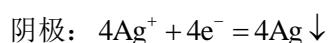
### 8. 电解 $\text{KNO}_3$ 溶液



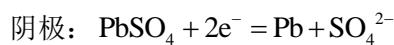
### 9. 电解 $\text{CuSO}_4$ 溶液



### 10. 电解 $\text{AgNO}_3$ 溶液



### 11. 铅蓄电池充电





始终坚持清华北大师资亲授



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