

重要无机化学反应

(汇 编)

上海化工学院无机化学教研组

一九七九年二月



汇 编 说 明

为了帮助大学生学好无机化学叙述部分，我们以常用化学试剂为线索，分别介绍这些试剂的主要性质、反应及其与各种金属离子的化学反应共 1200 多条便于学生遇到问题及时查阅求得解答。

编排方法如下：每章开头几个化学方程式是该试剂的主要性质，接着是按英语字母次序排列的各种金属离子与它反应的化学反应方程式。

汇编的主要参考书是：《常用试剂与金属离子的反应》 周伯劲编

《重要无机化学反应》 陈寿椿编

为了减少篇幅，未对反应进行的条件及现象作详尽的说明，只对某些特殊反应作了简要的说明，要求学生在无机化学理论部分基本掌握的基础上使用本“汇编”或在使用时随时复习有关理论部分内容。

由于汇编时间匆忙，肯定有不少错误和缺点，欢迎读者提出批评意见。

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第一章 水—水解作用

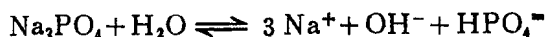
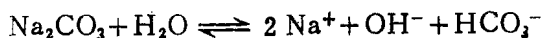
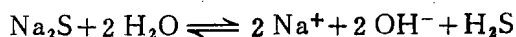
1. 盐类水解:

№	生成盐		水	解	溶液的 反应	
	碱	酸				
1	强	弱	发	生	水	解 碱性 pH>7
2	弱	强	发	生	水	解 酸性 pH<7
3	弱	弱	强	烈	水	解 接近中性 pH≈7*
4	强	强	不	水	解	中 性 pH=7

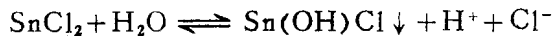
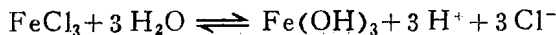
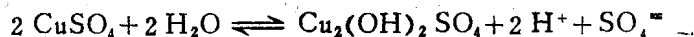
*在酸的电离常数大于碱的电离常数时, 微现酸性, 反之则微现碱性。

2. 例举:

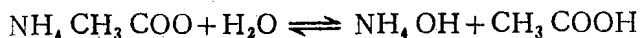
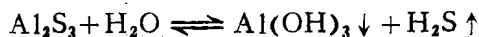
(1) 强碱、弱酸盐:



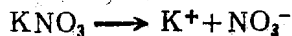
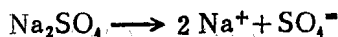
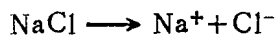
(2) 强酸、弱碱盐:



(3) 弱酸、弱碱盐:

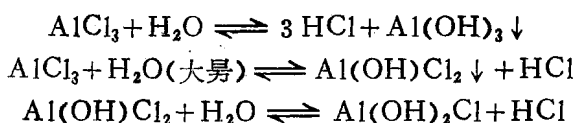


(4) 强酸、强碱盐:



3. 生成氢氧化物沉淀的金属盐的水解:

(1) Al:



(2) 砷: 在浓酸性溶液中三价砷以 AsO^- 盐存在, 在酸性较弱的溶液中水解生成无色可溶性的偏亚砷酸。



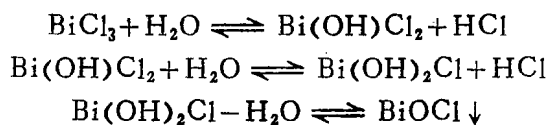
(3) 铍:



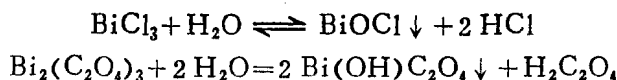
在 pH 值再增高时, 开始析出氢氧化铍白色沉淀。



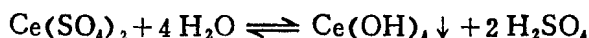
(4) 铋:



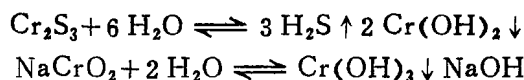
总:



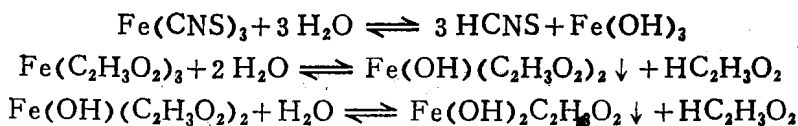
(5) 铈:



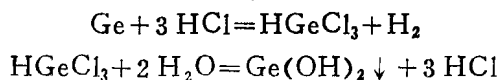
(6) 铬:



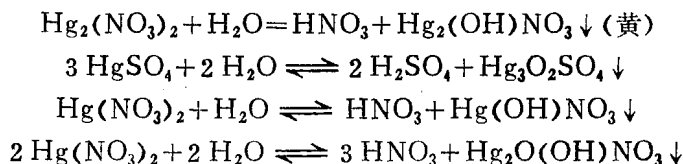
(7) 铁:



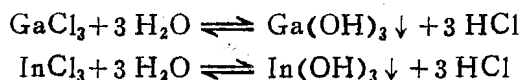
(8) 锗:



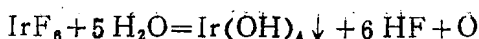
(9) 汞:



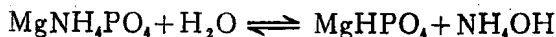
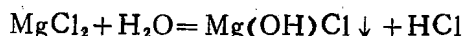
(10) 镓和铟:



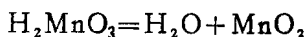
(11) 铱:



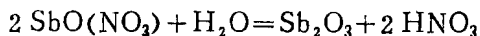
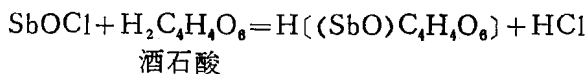
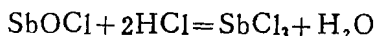
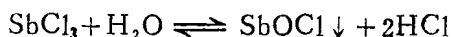
(12) 镉:



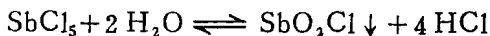
(13) 锰:



(14) 锑:

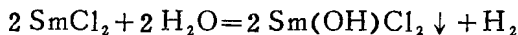


5 价锑盐:

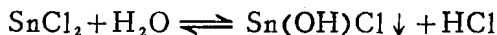


所有无机锑盐中只有 SbF_3 , SbF_5 不能水解生成沉淀。

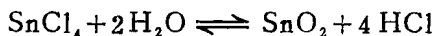
(15) 钐:



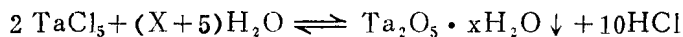
(16) 锡:



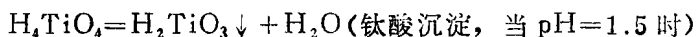
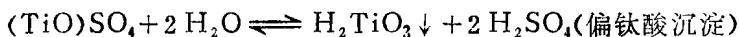
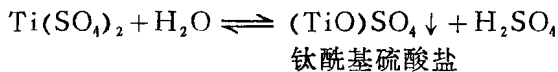
如浓的四价锡盐 > 60% SnCl_4 不生成碱式盐沉淀。



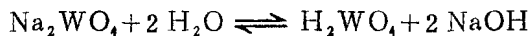
(17) 铌、钽: 五价铌钽极易水解



(18) 钛:



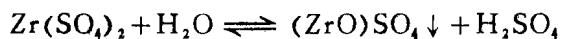
(19) 钨:



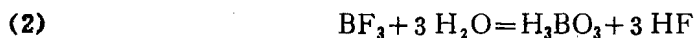
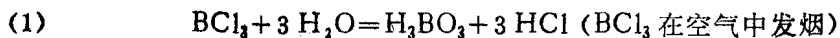
(20) 钒:



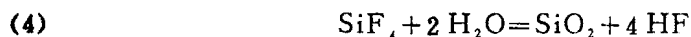
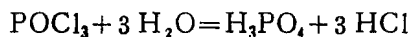
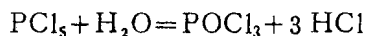
(21) 锆:



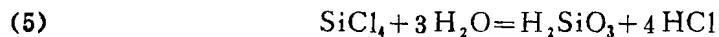
4. 非金属卤化物的水解:



$\text{BF}_3 + \text{HF} = \text{H}(\text{BF}_4)$ 氟硼酸为强酸。(比 HF 强)

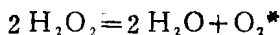


$\text{SiF}_4 + 2 \text{HF} = \text{H}_2(\text{SiF}_6)$ 氟硅酸为强酸



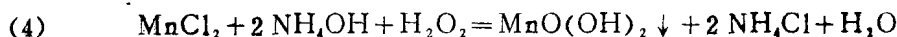
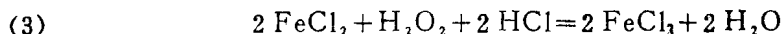
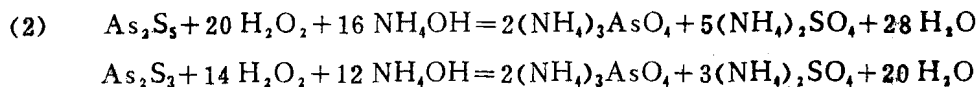
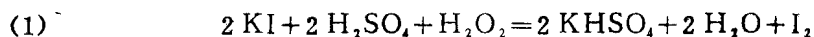
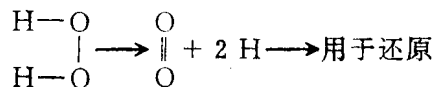
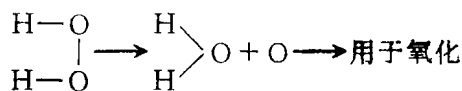
第二章 过氧化氢 (H₂O₂)

1. 不稳定性:

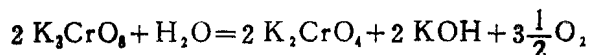
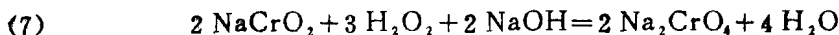
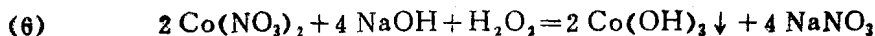
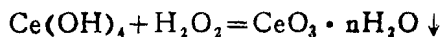


*某些客观条件会使分解加速进行: ①温度; ②重金属离子 (Fe, Cu, Ni, Cr, Mn); ③金属粉末 (如: Ag, Pt, Hg); ④金属氧化物和氢氧化物; ⑤活性表面 (如活性炭); ⑥尘埃悬浮物; ⑦合适的 pH 值; ⑧光线。

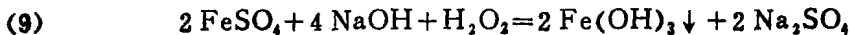
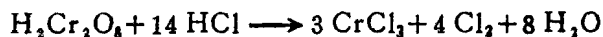
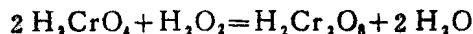
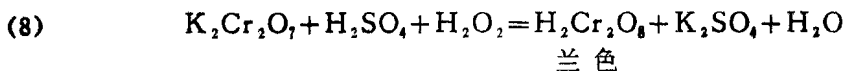
2. 氧化—还原性:



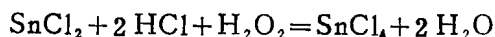
(5) 四价铈在氨性溶液中所生成的黄色氢氧化铈沉淀能被多量的过氧化氢氧化产生红棕色的过氧化铈沉淀 $\text{CeO}_3 \cdot n\text{H}_2\text{O}$ 。



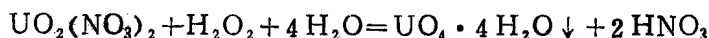
K_3CrO_8 是一种过氧化物, 叫过铬酸钾, 易分解出 O_2 。



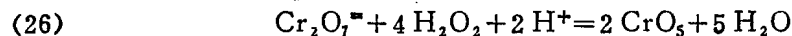
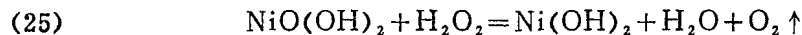
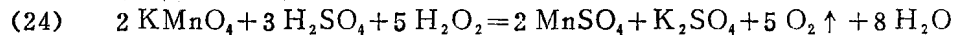
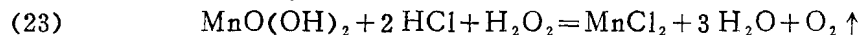
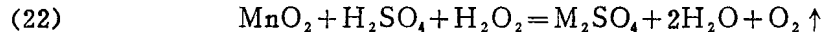
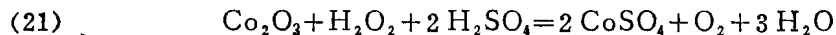
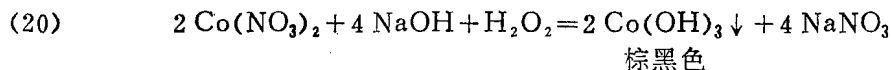
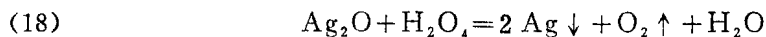
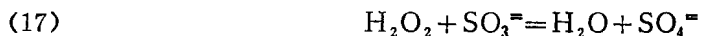
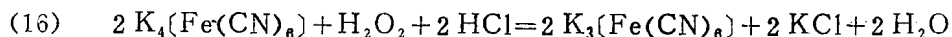
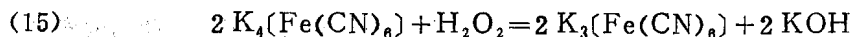
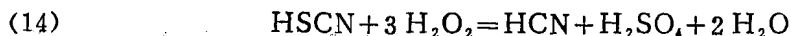
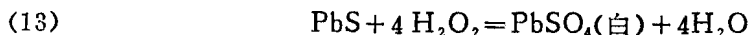
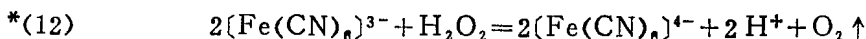
(10) 在酸性溶液中:



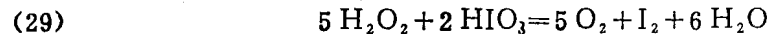
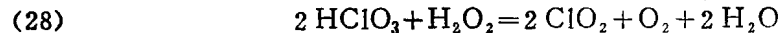
(11) 在碳酸钠或碳酸铵的溶液中,六价铀可被过氧化氢氧化,生成四氧化铀之黄色沉淀。



硫酸可阻止沉淀产生。



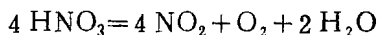
(27) $\text{Ti}(\text{SO}_4)_2$ 与 H_2O_2 的微酸性溶液作用后,发生橙红色反应。在极稀的溶液中,其颜色呈黄色它的变化往往随过钛酸 ($\text{TiO}_3 \cdot n\text{H}_2\text{O}$) 或 $\text{H}_2\text{TiO}_2(\text{SO}_4)_2$ 而不同。



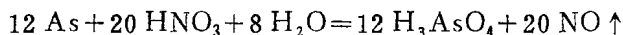
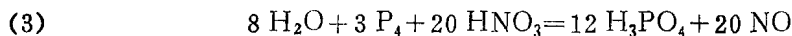
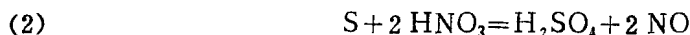
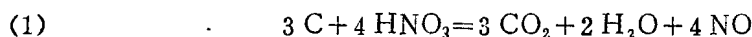
*(12)~(30)为补遗的重要方程式。

第三章 硝酸 (HNO₃)

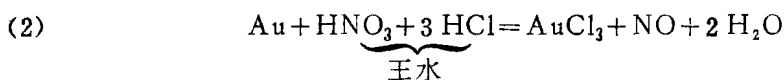
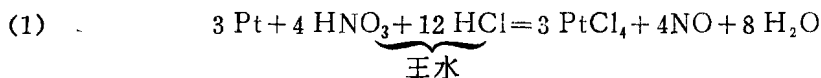
1. 不稳定性:



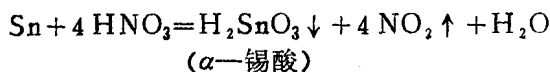
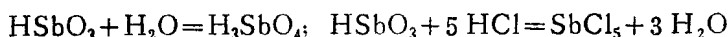
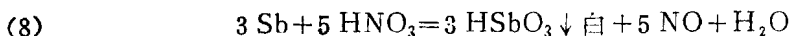
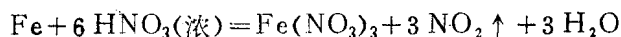
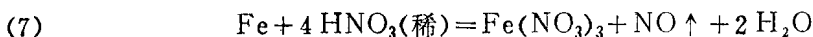
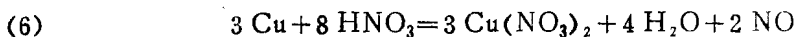
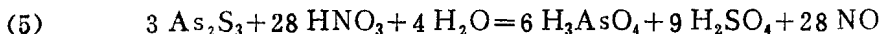
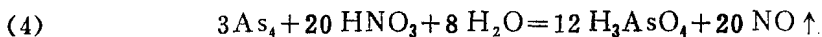
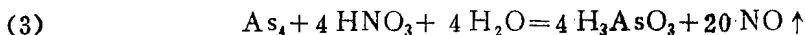
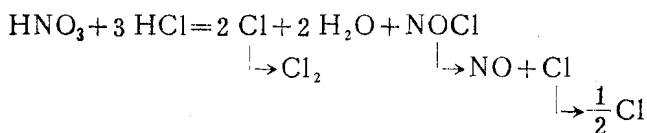
2. 与非金属作用:

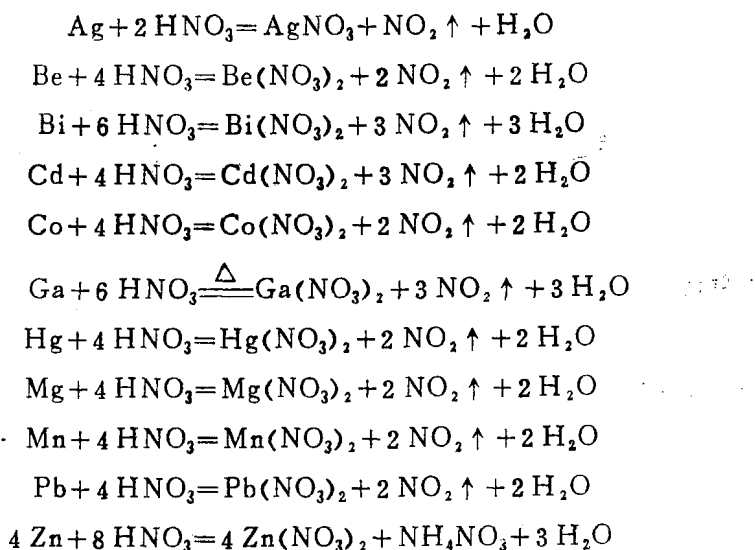


3. 与金属作用:

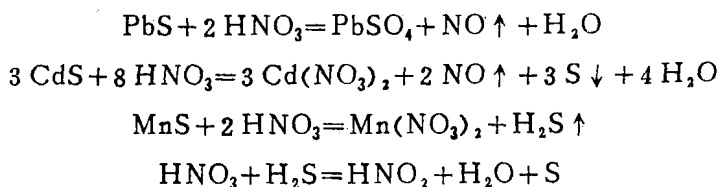


*王水的作用:

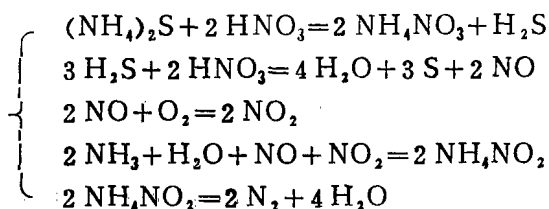
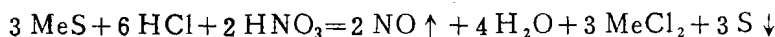




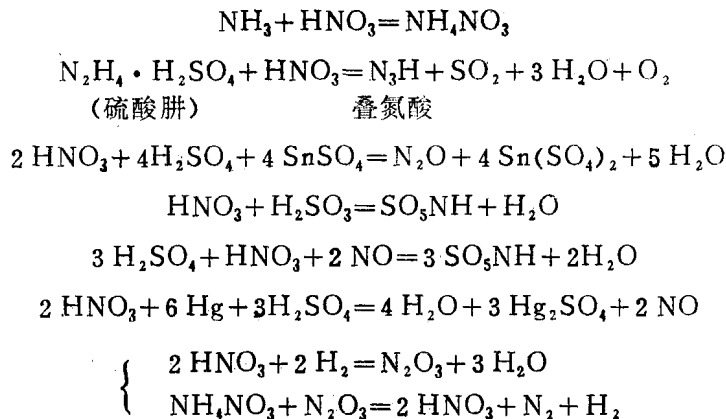
4. 与硫化物作用:



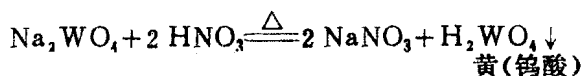
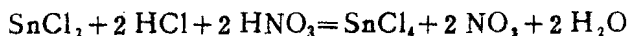
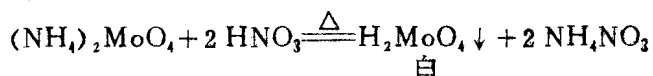
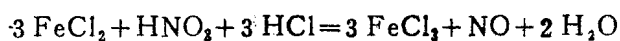
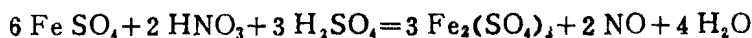
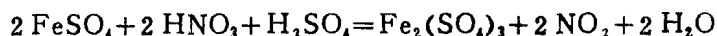
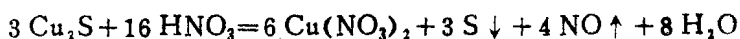
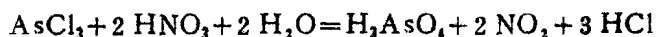
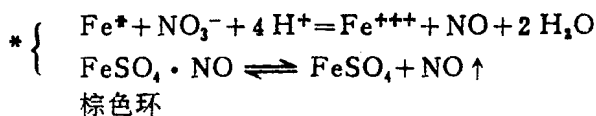
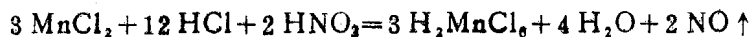
* 设 Me 二为价金属,



5. 与化合物作用:

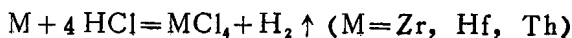
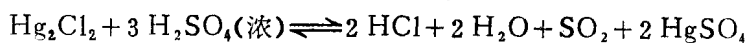
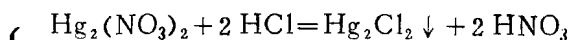
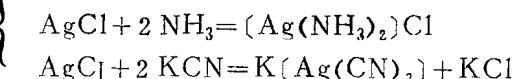
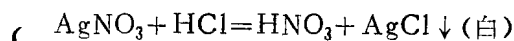
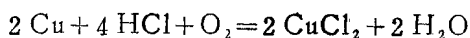
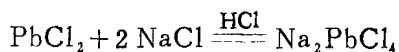
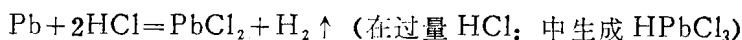
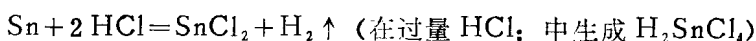
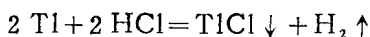
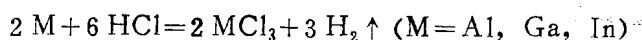
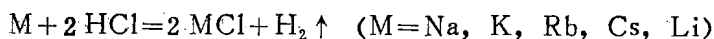
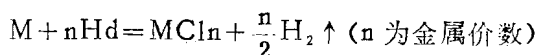
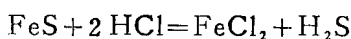
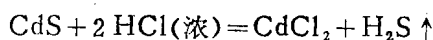
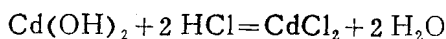
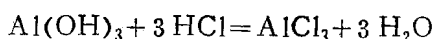
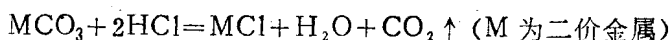
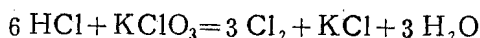
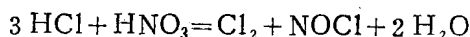
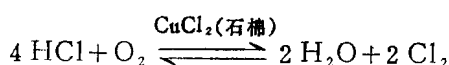


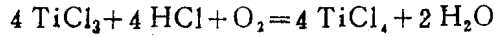
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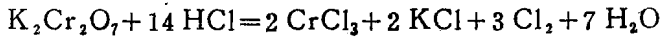
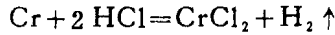
(亚锰离子的饱和液在浓 HCl 中与 HNO₃ 相遇, 则生成黑棕色之三氯化锰 MnCl₃ 液, 式中 Cl 由硝酸氧化盐酸而来)

第四章 盐 酸 (HCl)

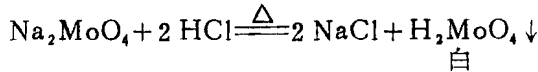




紫红

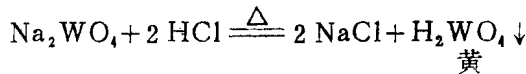


砖红色



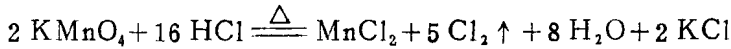
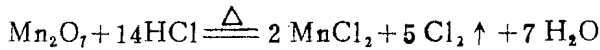
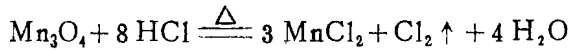
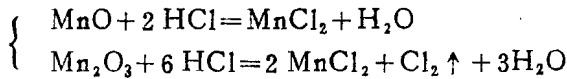
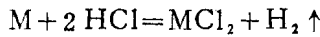
白

(W 不溶于 HCl)

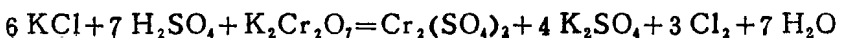
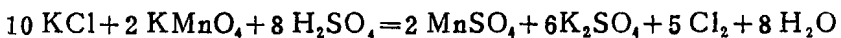
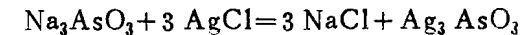
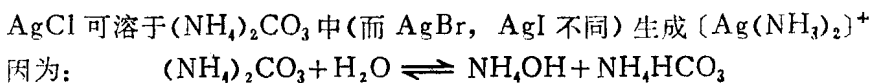
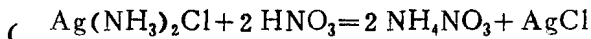
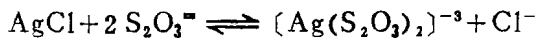
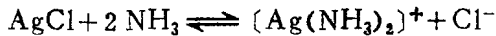
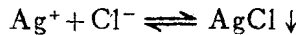


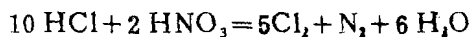
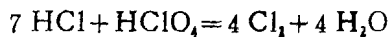
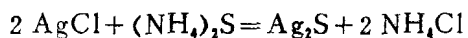
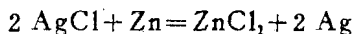
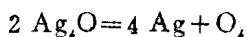
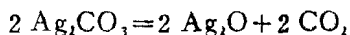
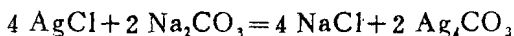
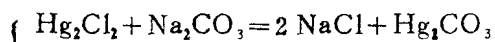
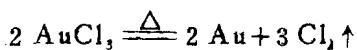
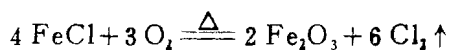
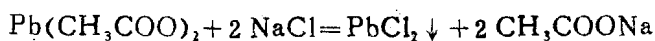
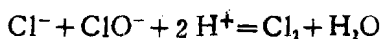
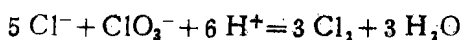
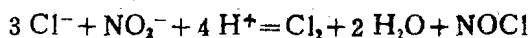
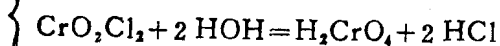
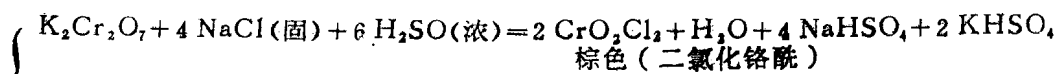
黄

M = Fe, Co, Ni:

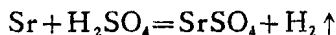
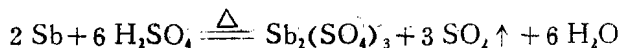
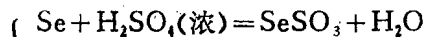
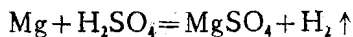
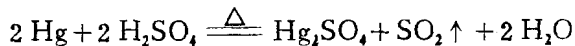
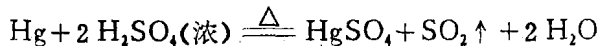
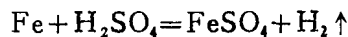
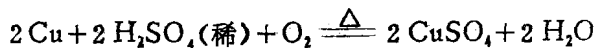
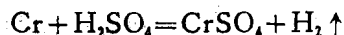
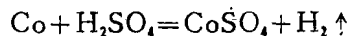
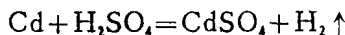
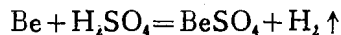
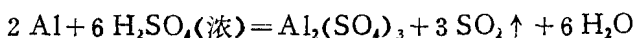
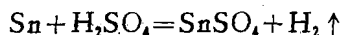
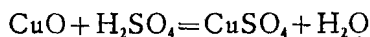
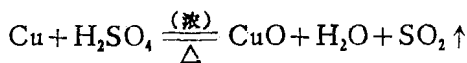
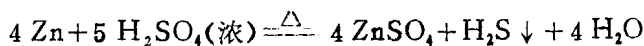
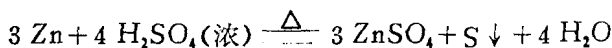
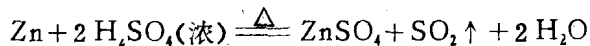
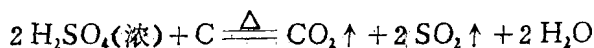


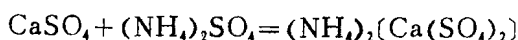
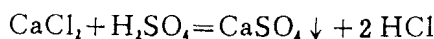
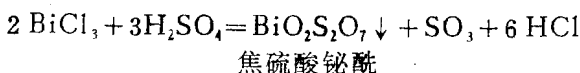
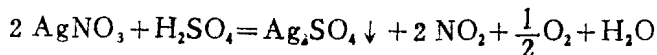
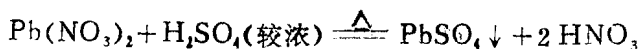
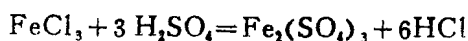
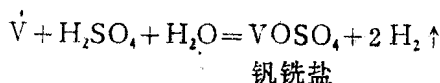
Cl⁻ 反应



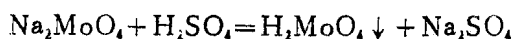
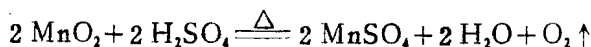
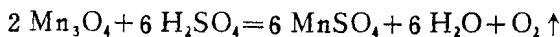
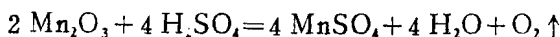
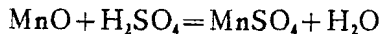
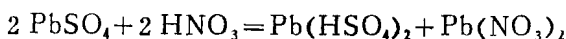
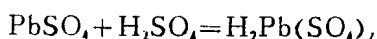
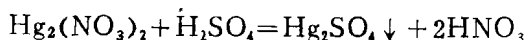
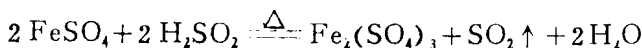


第五章 硫酸 (H₂SO₄)

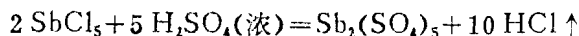
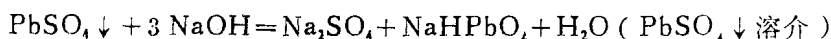
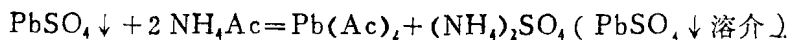




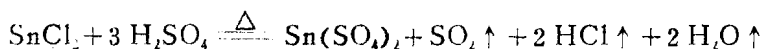
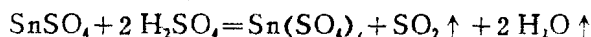
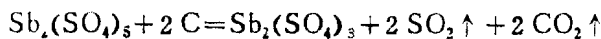
(CaSO₄ ↓ 可溶于浓 (NH₄)₂SO₄、SrSO₄ 和 BaSO₄ 没有这个性质)



白



如有有机物或炭存在则 Sb⁺⁵ 被还原为 Sb³⁺



SO₄²⁻ 离子的反应:

