

# Balancing redox reactions and O.C.s

## 1 Half equation method

### STEPS

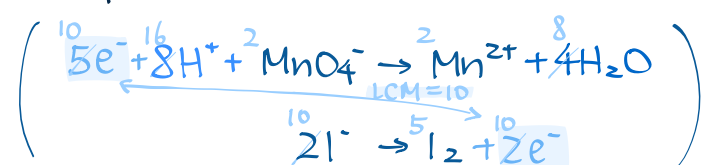
- Half equ. = O.A., R.A. 各自的 rx, 有电子
- Full equ. = 两个 half equ. 结合在一起, 没电子
- 四部曲
  - 1 欠O加水
  - 2 欠H加H<sup>+</sup>
  - 3 加电子平衡电荷
  - 4 左右两边的 LCM 加在一起

HALF EQU.

FULL EQU.

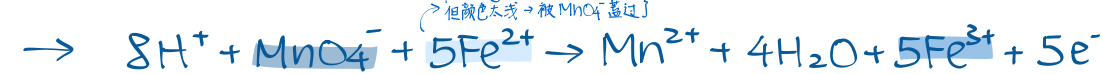
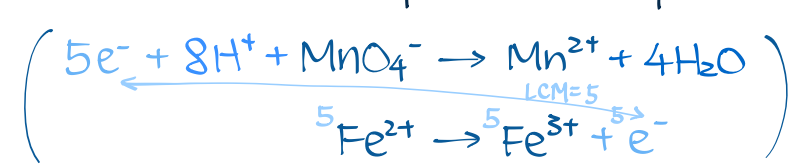
### EXAMPLES

1.  $\text{MnO}_4^- + \text{I}^-$



$\rightarrow$  sol<sup>n</sup> changes from purple to brown

2. (acidified)  $\text{MnO}_4^- \text{ aq} + \text{FeSO}_4 \text{ aq}$



$\rightarrow$  sol<sup>n</sup> changes from purple to pale yellowish brown

### Common mistakes

1.  $\text{MnO}_4^- \rightarrow \text{Mn}^{2+}$
2. 写了  $\text{SO}_4^{2-}$  作 R.A. (可是不在表上  $\Rightarrow$  很弱,  $\text{Fe}^{2+}$  更强)
3. 写错 half equ.  
 $\text{KMnO}_4 \rightarrow \text{Mn}^{2+}$  这是 (aq), 要排 spectator ion  
 $\text{FeSO}_4 \rightarrow \text{Fe}^{3+}$  如果是 (s) / (cr), 则靠四部曲平衡  
 $\rightarrow$  eg.  $\text{Zn} + \text{CuO} \rightarrow \text{ZnO} + \text{Cu}$   
 $\text{Cu}^{2+} \rightarrow \text{Cu}$   
 $2e^- + 2H^+ + \text{CuO} \rightarrow \text{Cu} + \text{H}_2\text{O}$

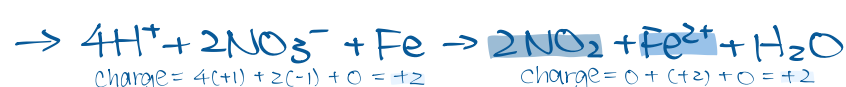
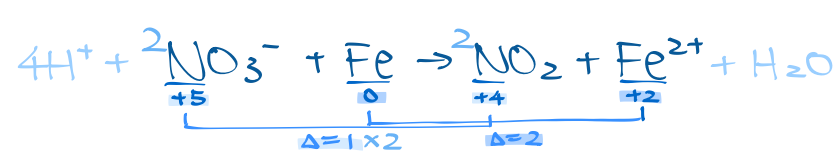
## 2 Change in O.N. method

### STEPS

- 四部曲
  - 1 写 O.N. (for 氧化态变了 atoms)
  - 2 写每个 element O.N. 变了多少
  - 3 R.A., O.A. 式各至乘至  $\Delta$  O.N. 的 LCM
  - 4 欠O加水, 欠H加H<sup>+</sup> (不用平衡电荷)

### EXAMPLES

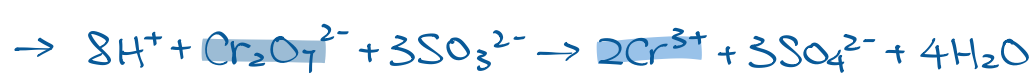
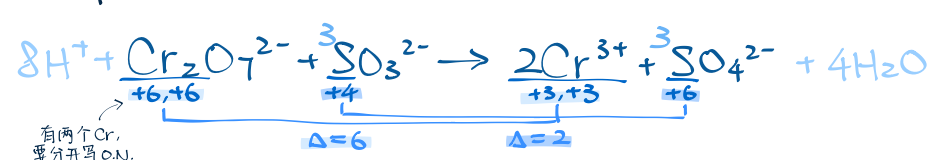
1. conc. nitric acid + Fe



$\rightarrow$  brown fumes evolve

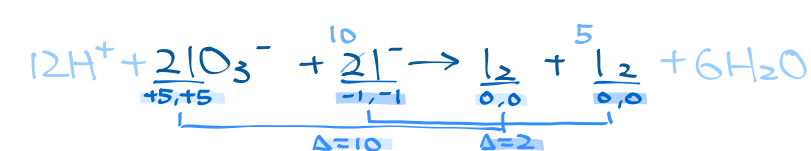
sol<sup>n</sup> changes from colourless to green

2.  $\text{Cr}_2\text{O}_7^{2-} + \text{SO}_3^{2-}$



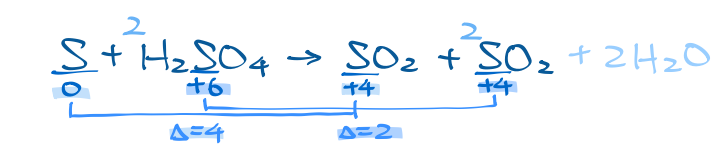
$\rightarrow$  sol<sup>n</sup> changes from orange to green

3a. Potassium iodate ( $\text{KIO}_3$ ) is mixed w/ potassium iodide to give  $\text{I}_2$ .



$\rightarrow$  sol<sup>n</sup> changes from colourless to brown

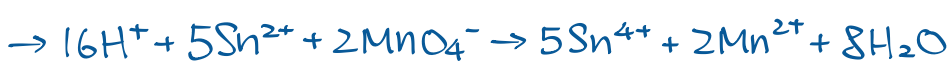
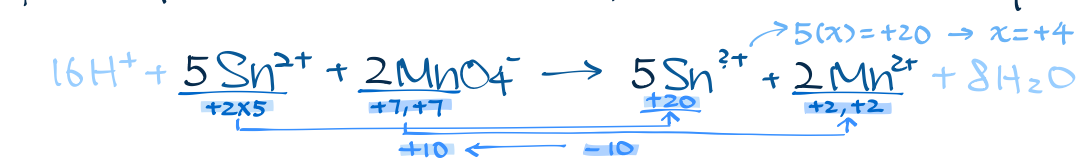
3b. Sulphur is added to conc.  $\text{H}_2\text{SO}_4$  (cr) to give  $\text{SO}_2$ .



$\rightarrow$  Sulphur dissolves  
choking smell

4a.  $100\text{cm}^3$  0.1M  $\text{Sn}^{2+}$  reacts w/  $100\text{cm}^3$  0.1M  $\text{MnO}_4^-$  completely.

If  $\text{MnO}_4^-$  is reduced to  $\text{Mn}^{2+}$ , write balanced equ. + O.C.



$\rightarrow$  sol<sup>n</sup> changes from purple to colourless.

If only  $80\text{cm}^3$  0.1M  $\text{Sn}^{2+}$  is added, state & explain 1 O.C.

$\rightarrow$  purple colour intensity  $\downarrow$  / purple colour becomes paler.

$\rightarrow \text{Sn}^{2+} \text{ mol} : \text{MnO}_4^- \text{ mol} = 0.008 : 0.004$   
 $= 2 : 1 < 5 : 2$

$\therefore \text{MnO}_4^-$  is in excess, remaining  $\text{MnO}_4^-$  provides purple colour.

$\therefore$  Since  $[\text{MnO}_4^- \text{ aq}]$  decreases, colour intensity decreases.

4b.  $200\text{cm}^3$  0.05M  $\text{SO}_2$  reacts w/  $200\text{cm}^3$  0.2M  $\text{MnO}_4^-$  completely.

If  $\text{SO}_2$  oxidizes to become  $\text{SO}_x^{2-}$ ,  $\text{MnO}_4^-$  reduces to become  $\text{Mn}^{2+}$ , write balanced equ.

