

# Strength of O.A.s and R.A.s

## 1 Feasibility of an reaction

- 比较 full equ. 两边的 O.A. / R.A., 看是强  $\rightarrow$  弱 / 弱  $\rightarrow$  强.

- eg. Explain why Cu cannot react w/  $\text{H}_2\text{SO}_4$  (aq) while Fe can.

草稿 -  $\text{Cu} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2$   $\rightarrow$  尽量选有 element 的一方比较  
(: 不知道什么时候能排成 ion)

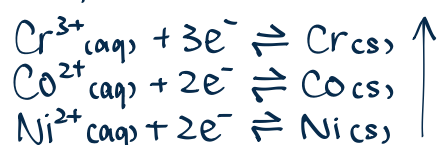
$\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{FeSO}_4 + \text{H}_2$

作答 -  $\therefore$  strength of reducing agent:  $\text{Cu} < \text{H}_2$   $\therefore$  No reaction

$\therefore$  strength of reducing agent:  $\text{Fe} > \text{H}_2$   $\therefore$   $\checkmark$  reaction

- eg2. There are 2 green solutions, containing  $\text{Cr}^{3+}$  (aq) /  $\text{Ni}^{2+}$  (aq) respectively.

The following is a part of the electrochemical series.



Briefly describe and explain how the solutions can be distinguished.

作答 - Add identical  $\text{Co}(\text{s})$  to both solutions respectively.

$\text{Cr}^{3+}$  (aq): strength of reducing agent:  $\text{Cr} > \text{Co}$   $\rightarrow 2\text{Cr}^{3+} + 3\text{Co}(\text{s}) \rightarrow 2\text{Cr}(\text{s}) + 3\text{Co}^{2+}$  (弱出强)  
Solution remains green

$\text{Ni}^{2+}$  (aq): strength of reducing agent:  $\text{Co} > \text{Ni}$   $\rightarrow \text{Ni}^{2+} + \text{Co}(\text{s}) \rightarrow \text{Ni}(\text{s}) + \text{Co}^{2+}$  (强出弱)  
Solution turns from green to pink

## 2 Acidifying reactants

- acid: similar to catalysts

	$\text{MnO}_4^-$ (aq)	$\text{Cr}_2\text{O}_7^{2-}$ (aq)
conc./dilute $\text{HCl}$ (aq)	$\times$ ( $\text{MnO}_4^- + 2\text{Cl}^- \rightarrow \text{Mn}^{2+} + \text{Cl}_2$ , Cl $^-$ 把 $\text{MnO}_4^-$ 变成了 $\text{Mn}^{2+}$ , 不能与 RA react)	$\checkmark$ ( $\text{Cr}_2\text{O}_7^{2-} + \text{Cl}^- \rightarrow \text{Cr}^{3+} + \text{Cl}_2$ , but RA strength: $\text{Cr}_2\text{O}_7^{2-} < \text{Cl}_2 \rightarrow$ no rx)
dilute $\text{H}_2\text{SO}_4$ (aq)	$\checkmark$	
conc. $\text{H}_2\text{SO}_4$ (l)	$\times$	
conc./dilute $\text{HNO}_3$ (aq)	$\times$ ( $\text{H}_2\text{SO}_4$ (l) / $\text{NO}_3^-$ 也是很强的 O.A., 会把 RA 搞走) $\rightarrow$ 不知道最后真正与 RA react 的是 $\text{MnO}_4^-$ 还是 acid)	

## 3 Proving the strengths of O.A. / R.A.

- eg. Prove O.A. strength:  $\text{Cl}_2 > \text{Br}_2 > \text{I}_2$

a. Theoretically

>  $\therefore$  no# of  $\text{e}^-$  shell  $\nleftrightarrow$  down Grp VII

$\therefore$  nucleus attraction to incoming  $\text{e}^- \nleftrightarrow$

$\therefore$  strength of O.A. decreases down Grp VII

$\therefore \text{Cl}_2 > \text{Br}_2 > \text{I}_2$   $\rightarrow$  oxidating power

b. Experimentally

> exp. 1 - prove O.A. strength:  $\text{Cl}_2 > \text{Br}_2$

- Add  $\text{KBr}$  (aq) into  $\text{Cl}_2$  (aq)

-  $\text{Cl}_2 + 2\text{Br}^- \rightarrow 2\text{Cl}^- + \text{Br}_2$

- Sol<sup>n</sup> turns from pale yellowish green to brown.

-  $\therefore$  strength of O.A.:  $\text{Cl}_2 > \text{Br}_2$

> exp. 2 - prove O.A. strength:  $\text{Br}_2 > \text{I}_2$

- Add  $\text{Br}_2$  (aq) into  $\text{KI}$  (aq) mixed w/ hexane w/ shaking.  $\rightarrow$  orl

-  $\text{Br}_2 + 2\text{I}^- \rightarrow 2\text{Br}^- + \text{I}_2$

- Upper organic layer will be purple.

Lower aqueous layer will be brown.

-  $\therefore$  strength of O.A.:  $\text{Br}_2 > \text{I}_2$

>  $\therefore$  strength of O.A.:  $\text{Cl}_2 > \text{Br}_2 > \text{I}_2$

