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→弱 / 弱→强.

- eg. Explain why Cu cannot react w/ $H_2SO_{4\,(aq)}$ while Fe can.

  草稿 - $Cu + H_2SO_4 \rightarrow CuSO_4 + H_2$ → 尽量选有element的一方比较 (∵不知道什么时候能拆成ion)
  $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

  作答 - ∵ Strength of reducing agent: $Cu < H_2$ ∴ No reaction
  ∵ Strength of reducing agent: $Fe > H_2$ ∴ ✓ reaction

- eg2. There are 2 green solutions, containing $Cr^{3+}_{(aq)}$ / $Ni^{2+}_{(aq)}$ respectively.
  The following is a part of the electrochemical series.

$$Cr^{3+}_{(aq)} + 3e^- \rightleftharpoons Cr_{(s)}$$
$$Co^{2+}_{(aq)} + 2e^- \rightleftharpoons Co_{(s)}$$
$$Ni^{2+}_{(aq)} + 2e^- \rightleftharpoons Ni_{(s)}$$

  Briefly describe and explain how the solutions can be distinguished.

  作答 - Add identical $Co_{(s)}$ to both solutions respectively.

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

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

2 Acidifying reactants

- acid: similar to catalysts

	$MnO_4^-{}_{(aq)}$	$Cr_2O_7^{2-}{}_{(aq)}$
conc./dilute $HCl_{(aq)}$	✗ ($MnO_4^- + 2Cl^- \rightarrow Mn^{2+} + Cl_2$, Cl^-把MnO_4^-变成了Mn^{2+},不能与RA. react了)	✓ ($Cr_2O_7^{2-} + Cl^- \rightarrow Cr^{3+} + Cl_2$, but RA. strength: $Cr_2O_7^{2-} < Cl_2$ → no rxn)
dilute $H_2SO_{4\,(aq)}$	✓	
conc. $H_2SO_{4\,(l)}$ conc./dilute $HNO_{3\,(aq)}$	✗ ($H_2SO_{4\,(l)}$ / NO_3^-也是很强的O.A.,会把RA.抢走 → 不知道最后真正与RA. react的是MnO_4^-还是acid)	

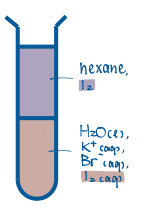
3 Proving the strengths of O.A./R.A.

- eg. Prove O.A. strength: $Cl_2 > Br_2 > I_2$

  a. Theoretically
  > ∵ no.of e^- shell ↑ down Grp VII
  ∴ nucleus attraction to incoming e^- ↓
  ∴ strength of O.A. decreases down Grp VII (→ oxidating power)
  ∴ $Cl_2 > Br_2 > I_2$

  b. Experimentally
  > exp.1 - prove O.A. strength: $Cl_2 > Br_2$
  - Add $KBr_{(aq)}$ into $Cl_{2\,(aq)}$
  - $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$
  - Soln turns from pale yellowish green to brown.
  - ∴ strength of O.A.: $Cl_2 > Br_2$

  > exp.2 - prove O.A. strength: $Br_2 > I_2$
  - Add $Br_{2\,(aq)}$ into $KI_{(aq)}$ mixed w/ hexane (→ oil) w/ shaking.
  - $Br_2 + 2I^- \rightarrow 2Br^- + I_2$
  - Upper organic layer will be purple.
    Lower aqueous layer will be brown.
  - ∴ strength of O.A.: $Br_2 > I_2$



  > ∴ strength of O.A.: $Cl_2 > Br_2 > I_2$