

STUFF I SHOULD KNOW FOR THE AP TEST BUT DO NOT KNOW YET

IONS LIST

| | | | | | |
|-------------|-------------------------|--------------|-------------------|--------------|--------------------|
| acetate | $C_2H_3O_2^-$ | ferric | Fe^{3+} | oxalate | $C_2O_4^{2-}$ |
| aluminum | Al^{3+} | ferrous | Fe^{2+} | oxide | O^{2-} |
| ammonium | NH_4^+ | fluoride | F^- | perbromate | BrO_4^- |
| barium | Ba^{2+} | hydrogen | H^+ | perchlorate | ClO_4^- |
| bicarbonate | HCO_3^- | hydronium | H_3O^+ | periodate | IO_4^- |
| bisulfate | HSO_4^- | hydroxide | OH^- | permanganate | MnO_4^- (purple) |
| bisulfide | HS^- | hypobromite | BrO^- | peroxide | O_2^{2-} |
| bisulfite | HSO_3^- | hypochlorite | ClO^- | phosphate | PO_4^{3-} |
| bromate | BrO_3^- | hypoiodite | IO^- | phosphide | P^{3-} |
| bromide | Br^- | iodate | IO_3^- | phosphite | PO_3^{3-} |
| bromite | BrO_2^- | iodide | I^- | potassium | K^+ |
| calcium | Ca^{2+} | iodite | IO_2^- | silver | Ag^+ |
| carbonate | CO_3^{2-} | lead | Pb^{2+} | sodium | Na^+ |
| chlorate | ClO_3^- | lithium | Li^+ | stannic | Sn^{4+} |
| chloride | Cl^- | magnesium | Mg^{2+} | stannous | Sn^{2+} |
| chlorite | ClO_2^- | manganese | Mn^{2+} | strontium | Sr^{2+} |
| chromate | CrO_4^{2-} (yellow) | mercuric | Hg^{2+} | sulfate | SO_4^{2-} |
| chromium | Cr^{3+} | mercurous | Hg_2^{2+} | sulfide | S^{2-} |
| cupric | Cu^{2+} (blue) | nickel | Ni^{2+} (green) | sulfite | SO_3^{2-} |
| cuprous | Cu^+ (blue) | nitrate | NO_3^- | thiocyanate | SCN^- |
| cyanide | CN^- | nitride | N^{3-} | thiosulfate | $S_2O_3^{2-}$ |
| dichromate | $Cr_2O_7^{2-}$ (orange) | nitrite | NO_2^- | zinc | Zn^{2+} |

SOLUBILITY RULES

Always soluble:

alkali metal ions (Li^+ , Na^+ , K^+ , Rb^+ , Cs^+), NH_4^+ ,
 NO_3^- , ClO_3^- , ClO_4^- , $C_2H_3O_2^-$

Generally soluble: (mnemonics)

Cl^- , Br^- , I^- Soluble except Ag^+ , Pb^{2+} , Hg_2^{2+} (AP/H)
 F^- Soluble except Ca^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+} , Mg^{2+}

(CBS-PM)
 SO_4^{2-} Soluble except Ca^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+} (CBS/PBS)

Generally insoluble:

O^{2-} , OH^- Insoluble except and alkali metals, and NH_4^+
 Ca^{2+} , Sr^{2+} , Ba^{2+} (CBS) somewhat soluble

CO_3^{2-} , PO_4^{3-} , S^{2-} , SO_3^{2-} , $C_2O_4^{2-}$, CrO_4^{2-}
 Insoluble except alkali metals and NH_4^+

GASES THAT FORM

→ H_2CO_3 → CO_2 + H_2O → NH_4OH → NH_3 + H_2O

→ H_2SO_3 → SO_2 + H_2O → H_2S

→ HNO_2 → NO + NO_2 + H_2O → HCN

WEAK ELECTROLYTES

Weak Acids (esp. $HC_2H_3O_2$ and HF)

(Memorize the 8 strong acids... all others are weak)

| | | | |
|----------|-------------------|-----------|---------------|
| HCl | hydrochloric acid | HNO_3 | nitric acid |
| HBr | hydrobromic acid | HIO_4 | periodic acid |
| HI | hydroiodic acid | H_2SO_4 | sulfuric acid |
| $HClO_4$ | perchloric acid | $HClO_3$ | chloric acid |

Ammonium Hydroxide ($NH_4OH \approx NH_3(aq)$) Water (H_2O)

DRIVING FORCES — Double Replacement

- Insoluble Solid (Precipitate)
- Weak Electrolyte (H_2O or Weak Acid)
- Gas Formation

STRONG OXIDIZERS (Oxidizing Agents)

| | |
|-------------------------------------|--------------------------|
| MnO_4^- in acid solution | → Mn^{2+} + H_2O |
| MnO_2 in acid solution | → Mn^{2+} + H_2O |
| MnO_4^- in neutral or basic sol'n | → MnO_2 |
| $Cr_2O_7^{2-}$ in acid solution | → Cr^{3+} + H_2O |
| $Cr_2O_7^{2-}$ with a base | → CrO_4^{2-} + H_2O |
| CrO_4^{2-} in basic solution | → CrO_2^- + H_2O |
| HNO_3 , concentrated | → NO_2 + H_2O |
| HNO_3 , dilute (e.g. 6 M) | → NO + H_2O |
| H_2SO_4 , hot, concentrated | → SO_2 + H_2O |
| Free halogens (e.g. Cl_2) | → halide ions (Cl^-) |
| H_2O_2 in acid solution | → H_2O |
| Note: H_2O_2 decomposes | → H_2O + O_2 |
| Na_2O_2 | → $NaOH$ |
| $HClO_4$ | → Cl^- + H_2O |

Other Oxidizers

Metal-"ic" ions (e.g. Sn^{4+} , Fe^{3+}) → "-ous" ions (Sn^{2+} , Fe^{2+})
 H_2O → H_2 + OH^-

STRONG REDUCERS (Reducing Agents)

| | |
|---|---------------------------------|
| Halide ions (e.g. Cl^-) | → Free halogen (Cl_2) |
| Free metals | → metal ions |
| "ites" SO_3^{2-} or SO_2 , NO_2^- | → "ates" SO_4^{2-} , NO_3^- |
| Free halogens, dil. basic sol'n | → hypohalite ions (ClO^-) |
| Free halogens, conc. basic sol'n | → halate ions (ClO_3^-) |
| $S_2O_3^{2-}$ | → $S_4O_6^{2-}$ |

Other Reducers

Metal-"ous" ions (e.g. Sn^{2+}) → "-ic" ions (Sn^{4+})
 H_2O → O_2 + H^+