

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

IONS LIST

acetate	$\text{C}_2\text{H}_3\text{O}_2^-$	ferric	Fe^{3+}	oxalate	$\text{C}_2\text{O}_4^{2-}$
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	$\text{S}_2\text{O}_3^{2-}$
dichromate	$\text{Cr}_2\text{O}_7^{2-}$ (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^- , $\text{C}_2\text{H}_3\text{O}_2^-$

Generally soluble:

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 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-} , $\text{C}_2\text{O}_4^{2-}$, CrO_4^{2-}
 Insoluble except alkali metals and NH_4^+

GASES THAT FORM

→ $\text{H}_2\text{CO}_3 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ → $\text{NH}_4\text{OH} \rightarrow \text{NH}_3 + \text{H}_2\text{O}$
 → $\text{H}_2\text{SO}_3 \rightarrow \text{SO}_2 + \text{H}_2\text{O}$ → H_2S
 → $\text{HNO}_2 \rightarrow \text{NO} + \text{NO}_2 + \text{H}_2\text{O}$ → HCN

WEAK ELECTROLYTES

Weak Acids (esp. $\text{HC}_2\text{H}_3\text{O}_2$ 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 ($\text{NH}_4\text{OH} \approx \text{NH}_3(\text{aq})$) 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 → $\text{Mn}^{2+} + \text{H}_2\text{O}$
 MnO_2 in acid solution → $\text{Mn}^{2+} + \text{H}_2\text{O}$
 MnO_4^- in neutral or basic sol'n → MnO_2
 $\text{Cr}_2\text{O}_7^{2-}$ in acid solution → $\text{Cr}^{3+} + \text{H}_2\text{O}$
 $\text{Cr}_2\text{O}_7^{2-}$ with a base → $\text{CrO}_4^{2-} + \text{H}_2\text{O}$
 CrO_4^{2-} in basic solution → $\text{CrO}_2^- + \text{H}_2\text{O}$
 HNO_3 , concentrated → $\text{NO}_2 + \text{H}_2\text{O}$
 HNO_3 , dilute (e.g. 6 M) → $\text{NO} + \text{H}_2\text{O}$
 H_2SO_4 , hot, concentrated → $\text{SO}_2 + \text{H}_2\text{O}$
 Free halogens (e.g. Cl_2) → halide ions (Cl^-)
 H_2O_2 in acid solution → H_2O
 Note: H_2O_2 decomposes → $\text{H}_2\text{O} + \text{O}_2$
 Na_2O_2 → NaOH
 HClO_4 → $\text{Cl}^- + \text{H}_2\text{O}$

Other Oxidizers

Metal-"ic" ions (e.g. Sn^{4+} , Fe^{3+}) → "-ous" ions (Sn^{2+} , Fe^{2+})
 H_2O → $\text{H}_2 + \text{OH}^-$

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^-)
 $\text{S}_2\text{O}_3^{2-}$ → $\text{S}_4\text{O}_6^{2-}$

Other Reducers

Metal-"ous" ions (e.g. Sn^{2+}) → "-ic" ions (Sn^{4+})
 H_2O → $\text{O}_2 + \text{H}^+$