Find Ox #'s for

① H_2CO C:

② PCl_3 P:

③ HSO_4^- S:

④ $KMnO_4$ Mn:

⑤ $Mg_3(PO_4)_2$ P:

Identify oxidizing and reducing agents

① $2Na + 2HCl \longrightarrow 1H_2 + 2NaCl$

② $2KMnO_4 + 6NaCl \longrightarrow 2MnO_2 + 3Cl_2$ (some H_2O, KOH, NaOH also involved)

Balance (Test Level)

① $H^+ + I^- + NO_3^- \longrightarrow I_2 + NO + H_2O$

② $H_2O + MnO_4^- + Br^- \longrightarrow MnO_2 + BrO_3^- + OH^-$

OWL:

① Acid conditions: balance, adding H_2O's and H^+'s as needed

$$ClO_3^- + SO_2 \longrightarrow Cl_2 + SO_4^{2-}$$

② Base: end with H_2O's, OH^- as needed (long!!)

$$MnO_4^- + SO_2 \longrightarrow MnO_2 + SO_4^{2-}$$

$Fe^{3+} \longrightarrow Fe^{2+}$	$+.77\ V$
$Cu^{2+} \longrightarrow Cu$	$+.34V$
$2H^+ \longrightarrow H_2$	0
$Pb^{2+} \longrightarrow Pb$	$-.13$
$Ni^{2+} \longrightarrow Ni$	$-.25$
$Cr^{3+} \longrightarrow Cr^{2+}$	$-.74$

① $Ni + Fe^{3+} \longrightarrow Fe^{2+} + Ni^{2+}$ Balance, and find E°_{cell}

② $Sn + Cu^{2+} \longrightarrow Cu + Sn^{2+}$ $E^\circ_{cell} = +0.48\ V$

Find E°_{ox} for $Sn \rightarrow Sn^{2+}$,
E°_{red} for $Sn^{2+} \rightarrow Sn$

③ Rank the oxidizing agents by strength

④ Rank the reducing agents by strength

⑤ Which will react with Cu^{2+}?

⑥ " " Cu°?

19-14

① $Zn + Fe^{2+} \longrightarrow Zn^{2+} + Fe \qquad E^\circ = 0.32\,V$

What is the reduction potential for Fe^{2+} ($Fe^{2+} \rightarrow Fe^\circ$) given the above potential, and given that $Zn^{2+} \longrightarrow Zn \quad E^\circ_{red} = -0.76$.

② Find E° for product favored reaction involving the following, and balance the reaction.

$Fe^{3+} \longrightarrow Fe^{2+} \quad 0.77$

$Cu^{2+} \longrightarrow Cu \quad 0.34$

a. keep more favorable one as reduction
b. reverse less favorable to make it an oxidation
c. sum E°_{ox} and E°_{red}
d. adjust coefficients to balance e's

③ Ditto for $Br_2 \longrightarrow 2Br^- \quad +1.06$

$Zn^{2+} \longrightarrow Zn \quad -0.76$

① Predict/Rank E_{ox}° for

Li Mg Fe H_2 Ag

② Rank/Predict E_{red}° for

Li^+ Mg^{2+} Fe^{2+} H^+ Ag^+

③ Rank F_2 Cl_2 I_2 as oxidizing agents

④ $F^{\ominus}$ $Cl^{\ominus}$ $I^{\ominus}$ as reducing agents

⑤ Reduction potentials for Ni^{2+} and Sn^{2+} are $-0.25V$ and $-0.16\,V$.

a. Which of Ni^{2+} and Sn^{2+} is stronger <u>oxidizing</u> agent?

b. Which of Ni and Sn is stronger <u>reducing</u> agent?

c. Which of Ni and Sn would react with H^+?

Activity e⁻ love (19-16)

① $3A + 2B^{3+} \longrightarrow 2B + 3A^{2+}$

$B + C^{2+} \longrightarrow C + B^{2+}$

$A + D^{2+} \longrightarrow$ No Reaction

Rank activity of A, B, C, D

Rank activity of A^{2+}, B^{3+}, C^{2+}, D^{2+}

Rank e⁻ love:

↓

$Ag^{+} \longrightarrow Ag$ +0.80

$Cu^{2+} \longrightarrow Cu$ +0.34

$Zn^{2+} \longrightarrow Zn$ −0.76

$Al^{3+} \longrightarrow Al$ −1.66

$Mg^{2+} \longrightarrow Mg$ −2.36

② Which species react with Cu^{2+}?

③ Which react with Zn^{0}?

④ Which element loves e's most? Least?

⑤ $NiCl_2 + H_2 \longrightarrow Ni + 2HCl$ $E^{\circ} = -0.28V$

a. Product favored?

b. Is reduction potential for Ni^{2+} positive?

① $Cu + \underset{+0.77V}{Fe^{3+}} \longrightarrow Cu^{2+} + \underset{+0.34V}{Fe^{2+}}$

Balance the reaction, and find ΔG° given the reduction potentials shown.

② $Zn + Cr^{3+} \longrightarrow Zn^{2+} + Cr \quad \Delta G^\circ = -11.6 \frac{kJ}{mol}$

a. Balance the reaction, and calculate E°.

b. If the reduction potential for Zn^{2+} is $-0.76V$, what is the reduction potential for Cr^{3+}?

③ $\underset{+0.80V}{Ag^+} + Fe^{2+} \rightleftharpoons Ag^\circ + \underset{+0.77V}{Fe^{3+}}$

Calculate K, given reduction potentials.

① Calculate actual voltage for

$Mg / Mg^{2+}(0.10\,M) // Cu^{2+}(0.001\,M) / Cu$

given the following reduction potentials:

Mg^{2+}	-2.37 V
Cu^{2+}	$+0.34$ V

Logic Steps

② Same for $Cu / Cu^{2+}(1.0\,M) // Ag^{+}(0.032\,M) / Ag$

E_{red}°	
Ag^{+}	$+0.80$ V
Cu^{2+}	$+0.34$ V

③ $2\,Ag^{+}(aq) + Zn(s) \longrightarrow 2\,Ag(s) + Zn^{2+}(aq)$

E_{red}^{0}: $+0.80$; -0.76

If a cell with $[Ag^{+}] = 0.20\,M$ has $E_{actual} = 1.63$ V, what is $[Zn^{2+}]$?

19-26

① How many grams of Al (27 g/mol) is produced in 1.0 h by electrolysis of $AlCl_3$ at 10.0 A current?

② At 3.2 A, how long will it take to make 10g of Zn (65.4 g/mol) from $ZnBr_2$?

③

$Hg^{2+} \rightarrow Hg$	0.9 V
$Cu^{2+} \rightarrow Cu$	0.2 V
$Co^{2+} \rightarrow Co$	−0.3 V
$2H_2O \rightarrow H_2 + 2OH^-$	−0.4 V
$Mn^{2+} \rightarrow Mn$	−1.2 V
$Mg^{2+} \rightarrow Mg$	−2.4 V

What metals could be formed at cathode in water?