Electrochemistry R and R Worksheet
7/29/24

1) Balance the net ionic equation for the reaction of the dioxovanadium(V) ion, VO_2^+, with zinc in acid solution to form VO^{2+}.

$$VO_2^+(aq) + Zn(s) \rightarrow VO^{2+}(aq) + Zn^{2+}(aq)$$

2) Aluminum metal is oxidized in aqueous base, with water serving as the oxidizing agent. The products of the reaction are $[Al(OH)_4]^-(aq)$ and $H_2(g)$. Write a balanced net ionic equation for this reaction.

3) Consider the following half-reactions:

Half-Reaction	$E°$ (V)
$Cu^{2+}(aq) + 2\ e^- \rightarrow Cu(s)$	+0.34
$Sn^{2+}(aq) + 2\ e^- \rightarrow Sn(s)$	−0.14
$Fe^{2+}(aq) + 2\ e^- \rightarrow Fe(s)$	−0.44
$Zn^{2+}(aq) + 2\ e^- \rightarrow Zn(s)$	−0.76
$Al^{3+}(aq) + 3\ e^- \rightarrow Al(s)$	−1.66

a) Based on E° values, which metal is the most easily oxidized?

b) Which metals on this list are capable of reducing $Fe^{2+}(aq)$ to Fe(s)?

c) Write a balanced chemical equation for the reaction of $Fe^{2+}(aq)$ with Sn(s). Is this reaction product-favored or reactant-favored at equilibrium?

d) Write a balanced chemical equation for the reaction of $Zn^{2+}(aq)$ with Sn(s). Is this reaction product-favored or reactant-favored at equilibrium?

4) Use standard reduction potentials for the half-reactions $AgBr(s) + e^- \rightarrow Ag(s) + Br^-(aq)$ and $Ag^+(aq) + e^- \rightarrow Ag(s)$ to calculate the value of K_{sp} for AgBr.

5)

a) Calculate the standard cell potential delivered by a voltaic cell using the following reaction:

$$Zn(s) + 2\ H_2O(\ell) + 2\ OH^-(aq) \rightarrow [Zn(OH)_4]^{2-}(aq) + H_2(g)$$

b) If all dissolved species are 2.5×10^{-2} M and the pressure of H_2 is 1.0 bar, calculate the non-standard cell potential for the reaction above.