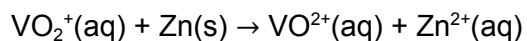


Electrochemistry R and R Worksheet  
7/29/24

1) Balance the net ionic equation for the reaction of the dioxovanadium(V) ion,  $\text{VO}_2^+$ , with zinc in acid solution to form  $\text{VO}^{2+}$ .



2) Aluminum metal is oxidized in aqueous base, with water serving as the oxidizing agent. The products of the reaction are  $[\text{Al}(\text{OH})_4]^-$ (aq) and  $\text{H}_2$ (g). Write a balanced net ionic equation for this reaction.

3) Consider the following half-reactions:

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

a) Based on  $E^\circ$  values, which metal is the most easily oxidized?

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

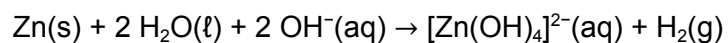
c) Write a balanced chemical equation for the reaction of  $\text{Fe}^{2+}(\text{aq})$  with  $\text{Sn}(\text{s})$ . Is this reaction product-favored or reactant-favored at equilibrium?

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

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

5)

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



b) If all dissolved species are  $2.5 \times 10^{-2} \text{ M}$  and the pressure of  $\text{H}_2$  is 1.0 bar, calculate the non-standard cell potential for the reaction above.