Assignment #28

17.18 *The corrosion rate is to be determined for some divalent metal M in a solution containing hydrogen ions. The following corrosion data are known about the metal and solution:*

For Metal M	***For Hydrogen***
$V_{(M/M^{2+})} = -0.47V$	$V_{(H^+/H_2)} = 0\,V$
$i_0 = 5 \times 10^{-10}\ A/cm^2$	$i_0 = 2 \times 10^{-10}\ A/cm^2$
$\beta = +0.15$	$\beta = -0.12$

(a) Assuming that activation polarization controls both oxidation and reduction reactions, determine the rate of corrosion of metal M (in mol/cm^2-s).

(b) Compute the corrosion potential for this reaction.

17.19 *The influence of increasing solution velocity on the overvoltage-versus log-current density behavior for a solution that experiences combined activation–concentration polarization is indicated in Figure 17.27. On the basis of this behavior, make a schematic plot of corrosion rate versus solution velocity for the oxidation of a metal; assume that the oxidation reaction is controlled by activation polarization.*

17.22 *For each form of corrosion other than uniform, do the following:*

(a) Describe why, where, and the conditions under which the corrosion occurs.

(b) Cite three measures that may be taken to prevent or control it.

17.24 *Briefly explain why, for a small anode-to-cathode area ratio, the corrosion rate will be higher than for a large ratio.*

17.28 *For each of the metals listed in the following table, compute the Pilling–Bedworth ratio. Also, on the basis of this value, specify whether you would expect the oxide scale that forms on the surface to be protective, and then justify your decision. Density data for both the metal and its oxide are also tabulated.*

Metal	***Metal Density (g/cm^3)***	***Metal Oxide***	***Oxide Density (g/cm^3)***
Zr	*6.51*	ZrO_2	*5.89*
Sn	*7.30*	SnO_2	*6.95*
Bi	*9.80*	Bi_2O_3	*8.90*