Unit 6 - Week 4

Assignment 4

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-14, 23:59 IST.

INSTRUCTIONS:
(A) The marks that each question carries is marked against the question.
(B) There can be more than one correct answer for descriptive questions.
(C) Take the E° values from appropriate sources, when not mentioned
(D) Take: F= 96500 C mol^{-}

1) Pourbaix diagram cannot be used to predict *2 points*

- [ ] Stability of a metal
- [ ] Passivity of a metal
- [ ] Passivity of an alloy
- [ ] Potential and pH that impart corrosion of metals
- [ ] Corrosion rate of a metal

No, the answer is incorrect.
Score: 0
Accepted Answers:
Passivity of an alloy
Corrosion rate of a metal

2) Which are the incorrect statements with respect to Pourbaix diagram? *2 points*

- [ ] Metals whose equilibrium potentials in a solution of a given pH and concentration of metal ions lie below the equilibrium potential for H^+/H will not corrode
- [ ] The passive region of a metal in its Pourbaix diagram depends only on the potential held on the metal and the pH of the solution
- [ ] In aqueous solutions, corrosion of metals exhibiting negative equilibrium potential cannot be stopped without causing hydrogen evolution.
- [ ] Pourbaix diagram as a limitation to predict corrosion behavior of a metal for a given pH of the solution, as the surface pH of the metal is expected to be different from that of the bulk solution pH.
- [ ] The voltage applied across anode and cathode across an electrochemical cell depends on water pH as the equilibrium potential for H^+/H and O_2, H^+/H_2O equilibria depend on water pH.

No, the answer is incorrect.
Score: 0
Accepted Answers:
Metals whose equilibrium potentials in a solution of a given pH and concentration of metal ions lie below the equilibrium potential for H^+/H will not corrode
The passive region of a metal in its Pourbaix diagram depends only on the potential held on the metal and the pH of the solution
The voltage applied across anode and cathode across an electrochemical cell depends on water pH as the equilibrium potential for H^+/H and O_2, H^+/H_2O equilibria depend on water pH.

3) Which of the following statements are true? *2 points*

- [ ] Raise in temperature need not increase corrosion rate of a metal/alloy
- [ ] Increasing concentration of a corrosive media need not cause increase in corrosion rate of a metal/alloy
- [ ] Increase in velocity of an environment need not always increase corrosion rate of a metal/alloy
- [ ] It must be possible to control corrosion of a metal/alloy by merely controlling the solution species responsible for corrosion
- [ ] Localized corrosion can occur even in pure metals

No, the answer is incorrect.
Score: 0
Accepted Answers:
Raise in temperature need not increase corrosion rate of a metal/alloy
Increasing concentration of a corrosive media need not cause increase in corrosion rate of a metal/alloy
Increase in velocity of an environment need not always increase corrosion rate of a metal/alloy
It must be possible to control corrosion of a metal/alloy by merely controlling the solution species responsible for corrosion
Localized corrosion can occur even in pure metals

4) A ferritic stainless steel having 30 wt.% Cr showed a corrosion current density of 6×10^{-6} A cm^{-2}. Determine the corrosion rate in mm y^{-1} for the given ferritic stainless steel. Its specific gravity is 8.73. (Given: Atomic mass of iron = 55.9, Atomic mass of Cr = 52; iron corrodes in +2 state and Cr in + 3 state) *3 points*

- 0.0071
- 0.0085
- 0.0055
- 0.0023

No, the answer is incorrect.
Score: 0
Accepted Answers:
0.0055

5) Corrosion rate of steel in water of pH = 5 was found to be 100 mpy. Determine the corrosion potentials of steel in this medium if steel was to corrode as ferrous ions and ignore the effect of carbon. Following data are provided: Given β_c = 120 mV $decade^{-1}$, $i_{oH+/H} = 10^{-7}$ A cm^{-2}, $p^{H2} = 1$ atm Density of iron= 7.8 g cm^{-3}, Atomic mass of iron= 55.9. *2 points*

- -0.8211 V(SHE)
- -0.7231 V(SHE)
- -0.6953 V(SHE)
- -0.5432 V(SHE)

No, the answer is incorrect.
Score: 0
Accepted Answers:
-0.6953 V(SHE)

6) What would be the answer to the above problem if iron is to corrode as ferric ions? *2 points*

- -0.8421 V(SHE)
- -0.7164 V(SHE)
- -0.6463 V(SHE)
- -0.5432 V(SHE)

No, the answer is incorrect.
Score: 0
Accepted Answers:
-0.7164 V(SHE)

7) Aluminum corrodes in sea water at a rate of 1.0 gmd. What is the rate in mm y^{-1}? If this corrosion rate applies to lead, what is the corresponding rate in mm y^{-1}? (Given density of Aluminum = 2.7 g cm^{-3}, Density of lead = 11.34 g cm^{-3}) *3 points*

- 1.351×10^{-4} mm y^{-1}, 0.321×10^{-4} mm y^{-1}
- 1.563×10^{-4} mm y^{-1}, 0.453×10^{-4} mm y^{-1}
- 1.299×10^{-4} mm y^{-1}, 0.167×10^{-4} mm y^{-1}
- 1.984×10^{-4} mm y^{-1}, 0.632×10^{-4} mm y^{-1}

No, the answer is incorrect.
Score: 0
Accepted Answers:
1.351×10^{-4} mm y^{-1}, 0.321×10^{-4} mm y^{-1}

8) A steel pipeline needs to be laid to transport water to a utility of a company. Polarization resistance determined by the electrochemical test was found to be 100 ohm cm^{-2}. The measured β_c and β_a values were 120 and 60 mV $decade^{-1}$ respectively. Assuming the corrosion rate of the pipeline to be uniform in nature and does not change with time and the operating pressure requires a minimum pipeline thickness of 5 mm, what will be the initial (design) thickness required for the pipeline for it to lose a required life of 25 years. (Given atomic mass of iron= 55.9, density of iron= 7.8 g cm^{-3}) *4 points*

- 55.825 mm
- 62.516 mm
- 50.127 mm
- 53.697 mm

No, the answer is incorrect.
Score: 0
Accepted Answers:
55.825 mm