Competitive Exams: Chemistry MCQs (Practice_Test 13 of 31)

1. In acid solution, dichromate ion oxidizes ferrous iron to ferric iron as illustrated in the partial equation: Fe2 ++ Cr2O72- ⟺ Fe3 ++ Cr3 + When this equation is balanced, the right side of the equation will be as follows:
   a. ⟺ Fe3 ++ 2 Cr3 ++ 7 H2O
   b. ⟺ 6 Fe3 ++ 2 Cr3 ++ 7 H2O
   c. ⟺ 3 Fe3 ++ 2 Cr3 ++ 7 H2O
   d. ⟺ Fe3 ++ 2 Cr3 ++ H2O
   e. The correct response is not given.
2. You have observed all of the reactions listed below. Which of these reactions IS a reduction-oxidation reaction?
   a. HCl (aq) + H2O (l) → H3O + (aq) + Cl- (aq)
   b. Fe2O3 (s, iron oxide) + 2Al (s) → 2Fe (s) + Al2O3 (s, aluminum oxide)
   c. Cu2 + (aq) + 4NH3 (aq) → Cu (NH3) 42 + (aq)
   d. NH4NO3 (s, ammonium nitrate) → NH4 + (aq) + NO3- (aq)
   e. None of these is a reduction-oxidation reaction.
3. In an electrochemical process called “electrolysis” H2 gas and O2 gas can be obtained by passing an electric current through liquid water, 2H2O (l) → 2H2 (g) + O2 (g) Which species is the OXIDIZING AGENT and which species is the REDUCING AGENT in this reaction, respectively?
   a. H2O (l) ; H2 (g)
   b. O2 (g) ; H2O (l)
   c. H2O (l) ; H2O (l)

d. O2 (g) ; H2 (g)

e. H2 (g) ; H2O (l)

4. In recitation, you saw that silver tarnish (Ag2S (s)) can be converted to silver metal (Ag (s)) by placing the tarnished silver piece in a dilute solution of baking soda contained in an aluminum pan. The following half-reactions are involved, Ag2S (s) + 2H3O + (aq) + 2e_____ > 2Ag (s) + H2S (g) + 2H2O (l) Al3 + (aq) + 3e ⇾ Al (s) Which of the following is the correct overall balanced equation for the reaction?

   a. Ag2S + 2H3O ++ Al ⇾ 2Ag + H2S + Al3 ++ 2H2O

   b. 6Ag + 3H2S + 6H2O + 2Al3 + ⇾ 2Al + 3Ag2S + 6H3O +

   c. Ag2S + Al ⇾ Ag + Al3 +

   d. 2Al + 3Ag2S + 6H3O + ⇾ 6Ag + 3H2S + 6H2O + 2Al3 +

   e. Ag2S + 2H3O ++ Al ⇾ 2Ag + H2S + 2H2O + Al3 ++ e-

5. Which of the following statements about porous disks in voltaic cells is TRUE?

   a. Free electrons flow through the porous disk to maintain electrical neutrality in the two half-cells.

   b. Ions present in the two half-cells flow through the porous disk to maintain electrical neutrality in both half-cells.

   c. A porous disk contains a strong electrolyte like potassium chloride (KCl) .

   d. The wire must be connected directly to the porous disk in order for the porous disk to be able to maintain electrical neutrality in the two half-cells.

   e. In some cases, a porous disk functions as the cathode.

6. In the Standard Hydrogen Electrode, a platinum wire is used as the electrode. Consider the following standard reduction potentials, half reactionEo, V Zn2 + (aq) + 2e_____ > Zn (s) -0.76 2H3O + (aq) + 2e ⇾ 2H2O (l) + H2 (g) 0.00 Pt2 + (aq) + 2e ⇾ Pt (s) 1.20

7. Which of the following statements best describes what would happen if the platinum wire in the Standard Hydrogen Electrode were replaced with a zinc wire? Note: Assume that this is the only change made to the half-cell.

   a. Zinc ion in the solution would be reduced; the mass of the zinc electrode would increase.

   b. The pH of the solution would decrease.

   c. The zinc electrode would be oxidized; the mass of the zinc electrode would decrease.

d. This change would have no effect-the Standard Hydrogen Electrode would continue to function properly.

e. It is impossible to tell.

8. In recitation, you examined a diagram of a voltaic cell constructed from zinc and copper in which a tube containing a porous disk and a solution of KCl was placed in each half-cell (recall, the two tubes were not connected) . Which of the following statements best describes why this cell has a cell potential of 0.00 V?

a. The sum of the zinc and copper half-cell potentials is equal to 0.00 V.

b. Electrical neutrality cannot be maintained in the half-cells and the KCl tubes.

c. All voltaic cells which use zinc in one of the half-cells have a cell potential of 0.00 V.

d. The tubes needed to contain a weak electrolyte, like AgCl, in order for the cell to function.

e. There was not enough information given to solve the problem.

9. Which of the following statements best describes what will happen when magnesium metal is added to an aqueous solution containing 1.0 M ferric ion (Fe3 +) at 25oC? half reactionEo, V Mg2 + (aq) + 2e_____ > Mg (s) -2.375 Fe3 + (aq) + 3e ⇾ Fe (s) -0.036

a. Mg (s) will be oxidized; Fe3 + (aq) will be reduced; the standard cell potential will be 2.339 V.

b. Mg (s) will be oxidized; Fe3 + (aq) will be reduced; the standard cell potential will be-2.339 V.

c. Fe3 + (aq) will be oxidized; Mg (s) will be reduced; the standard cell potential will be-2.339 V.

d. Fe3 + (aq) will be oxidized; Mg (s) will be reduced; the standard cell potential will be 2.339 V.

e. There is not enough information given to answer the question.

10. In recitation, you explored the electrochemistry of the “fruit clock” Which of the following statements best describes why the clock functions best when citrus fruits (i.e.. . lemons, oranges, limes, etc.) are used?

a. Citrus fruits work best because they are often brightly colored.

b. Only fruits and vegetables that grow on trees can be used to power the fruit clock.

c. Citrus fruits contain very high concentrations of copper ion.

d. Acid is a product in one of the half-reactions involved.

e. Acid is a reactant in one of the half-reactions involved.

11. Suppose you have been given the task of selecting a metal to be used as the sacrificial anode for the cathodic protection of a buried iron fuel tank. Considering the following standard reduction potentials, half reactionEo, V Pd2 + (aq) + 2e_____ > Pd (s) 0.99 Ag + (aq) + e → Ag (s) 0.80 Cu2 + (aq) + 2e → Cu (s) 0.34 Ni2 + (aq) + 2e → Ni (s) -0.23 Fe2 + (aq) + 2e → Fe (s) -0.41

12. which of the following metals could be used as the sacrificial anode in this application?

    a. Pd

    b. Ag

    c. Cu

    d. Ni

    e. None of these.

13. In lecture, one area of current research in electrochemistry was described: The development of improved batteries for use in electric cars. Which of the following properties of batteries are researchers currently trying to improve?

    a. range (the number of miles that can be driven before the batteries must be recharged)

    b. cost

    c. lifetime (the number of times the batteries can be recharged before they must be replaced)

    d. recharge time (the time required to fully recharge the batteries)

    e. Researchers are currently trying to improve all of the above:

14. Use the Standard Reduction Potentials given below to calculate Kf for Zn (NH3) 42 + at 25oC. Zn2 + (aq) + 4NH3 (aq) ⇔ Zn (NH3) 42 + (aq) , Kf = ? half reactionEo, V Zn (NH3) 42 + (aq) + 2e- ⇔ Zn (s) + 4NH3 (aq) -1.04 Zn2 + (aq) + 2e- ⇔ Zn (s) -0.76

15. The cell potential for the electrochemical reaction shown below depends upon the Cl-and Cu2 + concentrations. Calculate the cell potential (in V) at 25oC if [Cu2 +] = 3.5 M and [Cl-] = 1.7 M. Note: The number of moles of electrons transported in this reaction is equal to 2.

Cu2 + (aq) + 2Cl- (aq) + 2Ag (s) → Cu (s) + 2AgCl (s) , Eo = 0.12 V

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