Chemistry Worksheet on Chapter 3 Electrochemistry -Set 1

Q-1: The standard reduction potentials of three metallic cations, A, B, and C, are +0.65, -2.49, and -1.18 V, respectively. The order of the corresponding metal's reducing power is

a) B>C>A
b) A>C>B
c) C>B>A
d) C>A>B

Q-2: The reaction

$$\frac{1}{2} H_2(g) + AgCl(s) \rightarrow H^+(aq) + Cl^-(aq) + Ag(s)$$

occurs in the galvanic cell

a) Ag/AgCl(s)|KCl(soln)|$AgNO_3$|Ag
b) Pt/H_2(g)|KCl(soln)|AgCl(s)\Ag
c) Pt|H_2(g)|HCl(soln)|AgCl(s)|Ag
d) Pt|H_2(g)|HCl(soln)|$AgNO_3$(soln)|Ag

Q-3: Pure water does not conduct electricity because

a) The melting point is low.
b) Is easily broken down
c) Is almost completely unionised
d) Is neutral

Q-4: Calculate the charge required to oxidise one mole of Mn_3O_4 into MnO_4^{2-} in the presence of an alkaline medium.

Q-5: The amount of substance liberated at an electrode is not directly proportional to:

a) Time
b) Current
c) Electrochemical equivalent
d) Conductivity

Q-6: In a cell, Zn(s)|Zn^{2+}|| H^+|H_2(Pt); adding H_2SO_4 to the cathode compartment will result in

a) Decrease E_{cell}
b) Increase E_{cell}

c) Adjust the equilibrium to the left
d) Adjust the equilibrium to the right

Q-7: The E^0 values for the two reduction electrode processes are as follows:

a) Ce^{4+}/Ce^{3+} = 1.61 V
b) Co^{2+}/Co= -0.28V

Calculate the cell potential and ΔGº for the cell reaction.

Q-8: Define the following:

a) Strong Electrolyte
b) Kohlraushís law
c) Molar conductivity

Q-9: The following are the standard reduction potentials for single electrodes at 298 K:

Electrode	Electrode potential (Volt)
Mg^{2+}/Mg	-2.34
Pb^{2+}/Pb	-0.1262
Cr^{2+}/Cr	-0.913

From this we can infer that

a) Pb can reduce both Mg^{2+} and Cr^{2+}
b) Cr can reduce both Mg^{2+} and Pb^{2+}
c) Mg can reduce both Pb^{2+} and Cr^{2+}
d) Mg can reduce both Pb^{2+} but not Cr^{2+}

Q-10: Given that $E^0(Fe^{3+}, Fe)$= -0.4 V and $E^0(Fe^{2+}, Fe)$=-0.44V, the value of $E^0(Fe^{3+},Fe^{2+})$ is

a) 0.76 V
b) -0.40 V
c) -0.76 V
d) 0.40 V

Q-11: The Nernst equation for the reaction, $A^{2+} + 2e^- \rightarrow B$ in terms of the free energy change is

a) $\Delta G=\Delta G^{o}+ 2.303RT \log([B]/[A])$
b) $\Delta G=\Delta G^{o}- 2.303RT \log([B]/[A])$
c) $-\Delta G=-\Delta G^{o}+ 2.303RT \log([B]/[A])$
d) $\Delta G=-\Delta G^{o}+ 2.303RT \log([B]/[A])$

Q-12: The standard Gibbs free energy change for the reaction shown below is -2.7kJ/mol

$Sn(s) + Pb^{2+} \rightarrow Sn^{2+} + Pb(s)$

Given that $E^{0}(Pb^{2+}/Pb)$ is -0.126 V the value of $E^{0}(Sn^{2+}/Sn)$ in V is _____(upto two decimal places)

Q-13: A column of 0.05M NaOH solution with a diameter of 1 cm and a length of 50 cm has an electrical resistance of 5.55×10^{3} ohm. Determine the resistivity, conductivity, and molar conductivity.

Q-14: Why is it not possible to measure the potential of a single electrode?

Q-15: Explain the distinction between primary and secondary batteries.

Q-16: For the following reaction,
$2MnO_4^- + 5H_2C_2O_4 + 6H^+ \rightarrow 2Mn^{2+} + 8H_2O + 10CO_2$

$E^{0}(MnO_4^-/Mn^{2+})$= +1.51 V and $E^{0}(CO_2/H_2C_2O_4)$ = -0.49 V. Calculate the equilibrium constant at 298 K.

Q-17: The electrical conductivity of a metal

a) Increases with increasing temperature
b) Decreases with increasing temperature
c) Is independent of temperature
d) Shows oscillatory behaviour with temperature

Q-18: The mean ionic activity coefficient of 0.001 molal $ZnSO_4$(aq) at 298 K according to the Debye-Huckel limiting law is(Debye Huckel constant is 0.509 $molal^{-½}$)
Q-19: When an Al-NaCl solution is electrolyzed, how does the pH change?
Q-20: The H_2 -O_2 fuel cell was used in the Apollo space programmes.

(a) Explain why fuel cells are preferred in space missions.
(b) Discuss the values that influenced the decision to use fuel cells.
(c) Can fuel cells be used in automobiles?
(d) How can we increase efficiency of fuel cells ?