Degloor College, Degloor

B. Sc. III year **Physical Chemistry SEM-VI** **MCQ**

1. The entropy of a pure crystal is zero at absolute zero. This is statement of

(a) first law of thermodynamics (b) second law of thermodynamics

(c) third law of thermodynamics (d) none of these

Answer. (c)

2. The Gibbs free energy function (G) is defined as

(a) $G = H + T S$ (b) $G = H - T S$

(c) $G = T S - H$ (d) none of these

Answer. (b)

3. The change in free energy is a measure of :

(a) net work done (b) net change is entropy

(c) net change in enthalpy (d) net change in internal energy

Answer. (a)

4. The Helmholtz work function (A) is defined as

(a) $A = E - T S$ (b) $A = E + T S$

(c) $A = T S - E$ (d) none of these

Answer. (a)

5. The change in free energy of a system is given by

(a) $\Delta G = \Delta A + P \Delta V$ (b) $\Delta G = \Delta H - T \Delta S$

(c) $\Delta G = \Delta E + P \Delta V - T \Delta S$ (d) all of these

Answer. (d)

6. Which out of the following is not a state function?

(a) free energy (b) work function

(c) entropy (d) work done

Answer. (d)

7. The variation of free energy with temperatures at constant pressure is given by the relation :

(a) $dG_P = -SdT_P$ (b) $\left(\frac{dG}{dT}\right)_P = -S$

(c) neither of these (d) both (a) and (b)

Answer. (d)

8. The variation of free energy with pressure at constant temperature is given by

(a) $(dG)_T = V\,(dP)_T$ (b) $dG_P = -SdT_P$

(c) $\left(\frac{dG}{dT}\right)_P = -S$ (d) none of these

Answer. (a)

9. The change in free energy in an isothermal process for n moles of the gas is given by

(a) $\Delta G = 2.303 \times n\,RT \log \frac{P_2}{P_1}$ (b) $\Delta G = 2.303 \times RT \log \frac{V_1}{V_2}$

(c) $\Delta G = 2.303 \times RT \log \frac{P_2}{V_1}$ (d) none of these

Answer. (a)

10. The Gibb's Helmholtz equation is applicable to

(a) all processes, chemical or physical

(b) all process, chemical or physical but in a closed system

(c) all chemical processes in a closed system

(d) all physical processes in a closed system

Answer. (b)

11. For a spontaneous process

(a) $\Delta G > 0$ (b) $\Delta G < 0$

(c) $\Delta G = 0$ (d) none of these

Answer. (b)

12. A process is in the equilibrium state when

(a) $\Delta G > 0$ (b) $\Delta G < 0$

(c) $\Delta G = 0$ (d) none of these

Answer. (c)

13. Which of the following equation is used to calculate the heats of reaction when ΔG at two temperature are given?

(a) Gibbs Helmholtz equation (b) Clapeyron equation

(c) Kirchoff's equation (d) none of these

Answer. (a)

14. The equation $\frac{dP}{dT} = \frac{\Delta H}{T(V_2 - V_1)}$ is called

(a) Gibb's Helmholtz equation (b) Kirchoff's equation

(c) Clapeyron equation (d) Clausius Clapeyron equation

Answer. (c)

15. The Clausius Clapeyron equation helps to calculate

(a) latent heat of vaporization

(b) boiling point or freezing point

(c) vapour pressure at one temperature, if at another temperature is given

(d) all of the above

Answer. (d)

16. The decrease in the work function A in any process at constant temperature gives the -------- that can be obtained from the system during any change.

(a) minimum work (b) maximum work

(c) useful work (d) net work

Answer. (b)

17. The equation for van't Hoff isotherm is

(a) $-\Delta G = 2.303\ RT \log K_P$ (b) $\Delta G = 2.303\ RT \log K_P$

(c) $-\Delta G = 2.303\ RT^2 \log K_P$ (d) $\Delta G = 2.303\ RT^2 \log K_P$

Answer. (a)

18. The equation $\frac{\Delta H}{RT^2} = \frac{d(\ln Kp)}{dT}$ is known as

(a) van't Hoff equation (b) van't Hoff isochore

(c) Gibbs equation (d) Gibbs Duhem equation

Answer. (b)

19. Each substance in a given state has a tendency to escape from that state and this escaping tendency is called

(a) spontaneity (b) Gibbs free energy

(c) fugacity (d) activity

Answer. (c)

20. When water is cooled to ice, its entropy

(a) increases (b) decreases

(c) remains the same (d) becomes zero

Answer. (b)

21. Which of the following sets of conditions makes a process spontaneous at all temperatures?

(a) $\Delta H = 0; \Delta S > 0$ (b) $\Delta H = 0; \Delta S < 0$

(c) $\Delta H > 0; \Delta S > 0$ (d) $\Delta H < 0; \Delta S < 0$

Answer. (c)

22. The increase in entropy is maximum in

(a) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$ (b) $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$

(c) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ (d) $H_2(g) + I_2(g) \rightarrow 2HI(g)$

Answer. (a)

23. Which of the following is Gibb's Helmholtz equation interms of free energy and enthalpy?

(a) $\Delta G = \Delta H + T\left(\frac{\partial \Delta G}{\partial T}\right)_p$ (b) $\Delta G = \Delta S + T\left(\frac{\partial \Delta G}{\partial T}\right)_p$

(c) $\Delta G = \Delta A + T\left(\frac{\partial \Delta G}{\partial T}\right)_p$ (d) None of these

Answer. (a)

24. Which of the following is Gibb's Helmholtz equation interms of workfunction and energy?

(a) $\Delta G = \Delta E + T\left(\frac{\partial \Delta A}{\partial T}\right)_V$ (b) $\Delta A = \Delta E + T\left(\frac{\partial \Delta A}{\partial T}\right)_V$

(c) $\Delta A = \Delta H + T\left(\frac{\partial \Delta A}{\partial T}\right)_V$ (d) None of these

Answer. (b)

25. Which of the following is chemical potential of an ideal gas equation?

(a) $\mu = \mu^o + RT \ln P$ (b) $\mu = \mu^o - RT \ln P$

(c) Both a & b (d) None of these

Answer. (a)

26. Which of the following equation is Gibb's Duhem equation?

(a) $\Sigma n_i d\mu_i = 0$ (b) $\Sigma \mu_i dn_i = 0$

(c) Both a & b (d) None of these

Answer. (a)

27. Which of the following equation is Van't Hoff' isochore equation?

(a) $\log \frac{Kp_2}{Kp_1} = \frac{\Delta H}{2.303R}\left(\frac{T_1 - T_2}{T_1 T_2}\right)$ (b) $\log \frac{Kp_1}{Kp_2} = \frac{\Delta H}{2.303R}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$

(c) $\log \frac{Kp_2}{Kp_1} = \frac{\Delta H}{2.303R}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$ (d) None of these

Answer. (c)

28. Which of the following equation is Clausius Clapeyron equation?

(a) $\log \frac{P_2}{P_1} = \frac{\Delta H}{2.303R}\left(\frac{T_1 - T_2}{T_1 T_2}\right)$ (b) $\log \frac{P_2}{P_1} = \frac{\Delta H}{2.303R}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$

(c) $\log \frac{Kp_2}{Kp_1} = \frac{\Delta H}{2.303R}\left(\frac{T_2 - T_1}{T_1 T_2}\right)$ (d) None of these

Answer. (b)

29. In the reaction, $Zn(s) + 2HCl \rightarrow ZnCl_2(aq) + H_2(g)$

(a) zinc is oxidized

(b) the oxidation number of chlorine remains unchanged

(c) the oxidation number of hydrogen changes from +1 to 0.

(d) all are correct

Answer. (d)

30. Electrolytic cells are electrochemical cells in which ------ reactions are forced to occur by the input of electrical energy.

(a) spontaneous (b) non-spontaneous

(c) exothermic (d) endothermic

Answer. (b)

31. In any electrochemical cell, the cathode is always .

(a) a nonmetal

(b) attached to a battery

(c) the electrode at which some species gain electrons

(d) the electrode at which some species lose electrons

Answer. (c)

32. In an electrolytic cell, the charge on the electrode that gives electrons to the species in solution is ------ ; the chemical change that occurs at this electrode is called ------.

(a) positive; oxidation (b) positive, reduction

(c) negative, oxidation (d) negative, reduction

Answer. (d)

33. In a galvanic cell the following reaction takes place:

$2H_2O \rightarrow O_2(g) + 4H^+ + 4e^-$ It occurs at the

(a) cathode (b) anode

(c) cathode and anode (d) none of these

Answer. (b)

34. The site of oxidation in an electrochemical cell is

(a) the anode (b) the cathode

(c) the electrode (d) the salt bridge

Answer. (a)

35. Which statement below is not true for the reaction? $Fe^{3+} + e^- \rightarrow Fe^{2+}$

(a) Fe^{3+} is being reduced

(b) the oxidation state of Fe has changed

(c) Fe^{3+} could be referred to as an oxidizing agent in this reaction

(d) both Fe^{3+} and Fe^{2+} are called anions

Answer. (d)

36. $Zn \rightarrow Zn^{2+} + 2e^-$, $E^\circ = + 0.76$ V , $Cr^{3+} + 3e^- \rightarrow Cr$, $E^\circ = - 0.74$ V

The anode in this cell is

(a) Zn (b) Cr

(c) Zn^{2+} (d) Cr^{3+}

Answer. (a)

37. Which of the following statements is correct concerning the reaction:

$Fe^{2+} + 2H^+ + NO_3^- \rightarrow Fe^{3+} + NO_2 + H_2O$

(a) Fe^{3+} is oxidized and H^+ is reduced

(b) Fe^{2+} is oxidized and nitrogen is reduced

(c) Fe^{2+} and H^+ are oxidized

(d) Oxygen is oxidized

Answer. (b)

38. Which of the following is a half-reaction?

(a) $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$ (b) $H^+ + OH^- \rightarrow H_2O$

(c) $Ag^+ + e^- \rightarrow Ag$ (d) $Ag^+ + Cl^- \rightarrow AgCl$

Answer. (c)

39. Which of the following statements associated with electrochemical cells is incorrect?

(a) the function of a salt bridge in an electrochemical cell is to complete the circuit

(b) cell potential is the potential difference in a voltaic cell

(c) a Bronsted-Lowry acid-base reaction can be the basis of the net reaction in a chemical cell

(d) a half-reaction corresponds to one electrode in a voltaic cell

Answer. (c)

40. Write the cell diagram for the reaction below

$Cl_2(g) + 2Ag(s) \rightarrow 2Ag^+(aq) + 2Cl^-(aq)$

(a) $Ag \mid Ag^+(aq) \mid Cl^2(g), Cl^-(aq) \mid Pt$ (b) $Ag \mid Ag^+(aq), Cl^-(aq) \mid Cl^2(g) \mid Pt$

(c) $Pt, Cl^2(g) \mid Cl^-(aq) \parallel Ag^+(aq) \mid Ag$ (d) $Ag \mid Ag^+(aq) \parallel Cl^2(g), Cl^-(aq) \mid Pt$

Answer. (d)

41. Write the balanced equation for the voltaic cell made from Ag^+/Ag and Cu^{2+}/Cu and calculate E°cell.

(a) $2\ Ag^+(aq) + Cu(s) \rightarrow 2\ Ag(s) + Cu^+$, E° = 1.260 V

(b) $2\ Ag^+(aq) + Cu(s) \rightarrow Ag(s) + 2\ Cu^+$, E° = 1.140 V

(c) $2\ Ag^+(aq) + Cu(s) \rightarrow 2\ Ag(s) + Cu^{2+}$, E°cell = 0.460 V

(d) $2\ Ag^+(aq) + Cu(s) \rightarrow 2\ Ag(s) + Cu^+$, E° = 1.140 V

Answer. (c)

42. Which of the following statements associated with batteries is incorrect?

(a) in a dry cell, the reaction $Zn \rightarrow Zn^{2+}$ continues to occur even when the battery is not being used

(b) secondary batteries are rechargeable

(c) the cell reaction in a primary battery is not reversible

(d) electrodes with greater surface area give a greater potential

Answer. (d)

43. When this redox reaction $PbO + [Co(NH_3)_6]^{3+} \rightarrow PbO_2 + [Co(NH_3)_6]^{2+}$

is balanced in BASIC solution, there are

(a) reactants include $2OH^-$. Products include $2H_2O$

(b) reactants include $2OH^-$. Products include $2Co(NH\ )^{2+}$

(c) reactants include $2H_2O$. Products include $2OH^-$

(d) products include $2OH^-$ and $1Co(NH_3)_6^{2+}$

Answer. (b)

44. Given the nickel-cadmium battery reaction :

$$2NiOOH + Cd + 2H_2O \underset{\text{Charge}}{\overset{\text{Discharge}}{\rightleftharpoons}} 2Ni(OH)_2 + Cd(OH)_2$$

What occurs during discharge in the nickel-cadmium battery?

(a) Ni^{3+} is reduced to Ni^{2+} (b) Ni^{2+} is reduced to Ni^{3+}

(c) Ni^{3+} is oxidized to Ni^{2+} (d) Ni^{2+} is oxidized to Ni^{3+}

Answer. (a)

45. What is indicated when a chemical cell's voltage (E°) has dropped to zero?

(a) the concentration of the reactants has increased

(b) the concentration of the products has decreased

(c) the cell reaction has reached equilibrium

(d) the cell reaction has completely stopped

Answer. (c)

46. Given the redox reaction :

$2Cr(s) + 3Cu^{2+}(aq) \rightarrow 3Cr^{3+}(aq) + 3Cu(s)$ Which reaction occurs at the cathode in an electrochemical cell?

(a) reduction of $Cu^{2+}(aq)$ (b) reduction of Cu(s)

(c) oxidation of $Cr^{3+}(aq)$ (d) oxidation of Cr(s)

Answer. (a)

47. Which metal is used as a coating on steel to limit corrosion?

(a) Na (b) Ca

(c) K (d) Zn

Answer. (d)

48. Given the cell reaction: The cell is best described as

$2H_2O(l) \rightarrow 2H2(g) + O2(g)$

(a) an electrolytic cell in which an exothermic reaction occurs

(b) an electrolytic cell in which an endothermic reaction occurs

(c) a galvanic cell in which an exothermic reaction occurs

(d) a galvanic cell in which an endothermic reaction occurs

Answer. (b)

49. Given the reaction: $Pb(s) + Cu2+(aq) \rightarrow Pb^{2+}(aq) + Cu(s)$

What is the reducing agent?

(a) $Pb^{2+}(aq)$ (b) $Cu^{2+}(aq)$

(c) Pb(s) (d) Cu(s)

Answer. (c)

50. Given the reaction: $4HCl(aq) + MnO_2(s) \rightarrow MnCl_2(aq) + 2H_2O(l) + Cl_2(g)$

The manganese is

(a) reduced and its oxidation number changes from +4 to +2

(b) reduced and its oxidation number changes from +2 to +4

(c) oxidized and its oxidation number changes from +4 to +2

(d) oxidized and its oxidation number changes from +2 to +4

Answer. (a)

51. What occurs when an atom is oxidized in a chemical reaction?

(a) a loss of electrons and a decrease in oxidation number

(b) a loss of electrons and an increase in oxidation number

(c) a gain of electrons and a decrease in oxidation number

(d) a gain of electrons and an increase in oxidation number

Answer. (b)

52. Standard cell potential is

(a) measured at a temperature of 25°C

(b) measured when ion concentrations of aqueous reactants are 1.00 M

(c) measured under the conditions of 1.00 atm for gaseous reactants

(d) All of these

Answer. (d)

53. The standard reduction potentials in volts for Pb^{2+} and Ag^{+} are –0.13 and +0.80, respectively. Calculate. E° in volts for a cell in which the overall reaction is

$Pb + 2Ag^+ \rightarrow Pb^{2+} + 2Ag$

(a) 1.73 (b) 0.67

(c) 0.93 (d) 1.47

Answer. (c)

54. Given the following information, $Fe^{3+}(aq) + H_2(g) \rightarrow 2H^+ + Fe^{2+}$, E°cell = 0.77 Determine E° for the reaction : $e^- + Fe^{3+}(aq) \rightarrow Fe^{2+}(aq)$

(a) 1.54 (b) 0.77

(c) 0.39 (d) – 0.77

Answer. (b)

55. Breathalyzers determine alcohol content via the redox reaction:

$Cr_2O_7^{2-} + C_2H_5OH \rightarrow Cr^{3+} + C_2H_4O_2$

Which substance is a reductant (reducing agent) and which is an oxidant (oxidizing agent)?

(a) C_2H_5OH, reductant; no oxidant (b) C_2H_5OH, reductant; $Cr_2O_7^{2-}$, oxidant

(c) C_2H_5OH, oxidant; Cr^{3+}, reductant (d) C_2H_5OH, reductant; Cr^{3+}, oxidant

Answer. (b)

56. Predict the products in the electrolysis of aqueous potassium bromide.

(a) hydrogen and bromine (b) potassium metal and oxygen

(c) oxygen and bromine (d) potassium metal and bromine

Answer. (a)

57. Which of the following statements associated with corrosion is incorrect?

(a) iron corrodes more readily than aluminium because iron is more active than aluminium

(b) cathodic protection prevents corrosion by using a sacrificial anode

(c) a corroding metal has both anodic and cathodic areas

(d) corrosion involves both oxidation and reduction

Answer. (a)

58. Which of the following shows a metal being oxidized?

(a) $2Na + 2H_2O \rightarrow 2NaOH + H_2$ (b) $Cu \rightarrow Cu^{2+} + 2e^-$

(c) $Cu^{2+} + 2e^+ \rightarrow Cu$ (d) Both (a) and (b)

Answer. (d)

59. It is possible to generate an electrical potential by inserting two strips of different metals into an acidic citrus fruit such as a lemon. Among other functions, the lemon serves as a salt bridge. Which shorthand notation would best describe a lemon into which has been inserted a strip of zinc and a strip of copper, with the two metal strips connected by a wire?

(a) $Zn(s) \mid Zn^{2+}(aq) \| O_2(g) \mid H_2O(l) \mid Cu(s)$ (b) $Zn(s) \mid Zn^{2+}(aq) \| H^+(aq) \mid H_2(g) \mid Cu(s)$

(c) $Cu(s) \mid Cu^{2+}(aq) \| O_2(g) \mid H_2O(l) \mid Zn(s)$ (d) $Zn(s) \mid Zn^{2+}(aq) \| Cu^{2+}(aq) \mid Cu(s)$

Answer. (a)

60. Write the net equation for the redox reaction that occurs in the voltaic cell with a $Cu(s) – Cu^{2+}(aq)$ electrode and a $Ag(s) – Ag^+(aq)$ electrode.

(a) $Cu^{2+}(aq) + 2Ag(s) \rightarrow Cu(s) + 2Ag^+(aq)$

(b) $Cu(s) + Cu^{2+}(aq) \rightarrow 2Ag^+(aq) + Ag(s)$

(c) $Cu(s) + 2Ag^+(aq) \rightarrow Cu^{2+}(aq) + 2Ag(s)$

(d) $2Ag^+(aq) + Ag(s) \rightarrow Cu(s) + Cu^{2+}(aq)$

Answer. (c)

61. Which of these statements about a galvanic cell are not true?

i. the cathode carries a positive sign

ii. the anions migrate toward the cathode

iii. the electrons are released through the anode

iv. reduction occurs at the anode

(a) i and iii (b) i and ii

(c) ii and iii (d) ii and iv

Answer. (d)

62. The half–reaction that occurs at the cathode during the electrolysis of molten sodium iodide is

(a) $2I^- \rightarrow I^2 + 2e^-$ (b) $I_2 + 2e^- \rightarrow 2I^-$

(c) $Na^+ + e^- \rightarrow Na$ (d) $Na \rightarrow Na^+ + e^-$

Answer. (c)

63. For a voltaic cell using Ag^+ (1 M)/Ag and Cu^{2+}(1M)/Cu half cells, which of the following statements is false?

(a) electrons will flow through the external circuit from the copper electrode to the silver electrode

(b) reduction occurs at the silver electrode as the cell operates

(c) the mass of the copper electrode will decrease as the cell operates

(d) the concentration of Ag^+ will increase as the cell operates

Answer. (d)

64. In the lead storage battery

(a) a reversible reaction can occur to recharge the battery

(b) lead is oxidized to create a flow of electrons

(c) lead forms the cathode when it is being reduced

(d) all of the above

Answer. (d)

65. The advantages of fuel cells include

(a) they can be recharged by the addition of more material to be oxidized and/or reduced

(b) they can be made to produce little or no harmful pollutants

(c) they can be made to run very quietly

(d) all of the above

Answer. (d)

66. For the reaction $2In(s) + 6H^+(aq) \rightarrow 2In^{3+}(aq) + 3H_2(g)$, $E° = + 0.34$ V

Determine the value of E° red for the half-reaction $In^{3+}(aq) + 3e^- \rightarrow In(s)$

(a) – 0.17 (b) – 0.34

(c) 0.17 (d) 0.34

Answer. (b)

67. From a consideration of the following two half-reactions

Half Reaction E° (Volts) $Mn^{2+} + 2e^- \rightarrow Mn$ –1.18

$AuCl^{4-} + 3e^- \rightarrow Au + 4Cl^-$ 1.00

What is the standard cell potential for the reaction

$3Mn + 2AuCl^{4-} \rightarrow 3Mn^{2+} + 2Au + 8Cl^-$

(a) – 2.18 V (b) – 0.18 V

(c) 0.18 V (d) 2.18 V

Answer. (d)

68. Determine the values of E° cell and $\Delta G°$ for the reaction below.

$O_2(g) + 4I^-(aq) + 4H^+(aq) \rightarrow 2H_2O(A) + 2I_2(s)$

(a) E°cell = 0.159 V and $\Delta G°$ = – 2.68 × 105 J

(b) E°cell = 0.694 V and $\Delta G°$ = – 2.68 × 105 J

(c) E°cell = 0.694 V and $\Delta G°$ = + 2.68 × 105 J

(d) E°cell = 1.764 V and $\Delta G°$ = – 6.81 × 105 J

Answer. (b)

69. The standard reduction potentials of Cu^{2+} and Ag^{+} in V are + 0.34 and + 0.80, respectively. Determine the value of E in volts for the following cell at 25°C

Cu | Cu^{2+} (1.00 M) || Ag^{+} (0.0010 M) | Ag

(a) 0.37 V (b) 0.55 V

(c) – 0.28 V (d) 0.28 V

Answer. (d)

70 What is the potential of a half cell consisting of a platinum wire dipped into a solution 0.01M in Sn^{2+} and 0.001M in Sn^{4+} at 25°C?

(a) E°oxid. + 0.059 (b) E^{o} red . 0.059

(c) E^{o}red. 0.059 (d) E° oxid. = – 0.059

Answer. (b)

71. A galvanic cell can be represented as

Pt(s) | Sn^{2+} (aq, 1 M), Sn^{4+} (aq, 1 M) || Fe^{2+} (aq, 1 M) Fe^{3+} (aq, 1 M) | Pt(s) What reaction is occurring at the anode?

(a) Pt $\rightarrow Pt^{2+} + 2e^{-}$ (b) $Sn^{2+} \rightarrow Sn^{4+} + 2e^{-}$

(c) Pt $\rightarrow Sn^{2+} + 2e^{-}$ (d) $Fe^{2+} \rightarrow Fe^{3+} + 1e^{-}$

Answer. (d)

72. What is the cell voltage of Zn | Zn^{2+} (0.1 M) || Ag+ (0.1 M) | Ag?

The standard reduction potential for $Zn^{2+} + 2e^{-} \rightarrow$ Zn is – 0.76 V and for

$Ag^{+} + e^{-} \rightarrow$ Ag is +0.80 V.

(a) – 0.76 V (b) + 0.80 V

(c) + 1.53 V (d) +1.59 V

Answer. (c)

73. Calculate the voltage (E) of a cell with E° = 1.1 volts, if the copper half-cell is at standard conditions but the zinc ion concentration is only 0.001 molar. Temperature is 25°C. The overall reaction is $Zn + Cu^{+2} \rightarrow Cu + Zn^{+2}$

(a) 0.39 volt (b) 1.43 volt

(c) 6.19 volt (d) 1.19 volt

Answer. (d)

74. Suppose that an alkaline dry cell was manufactured using cadmium metal rather than zinc. What effect would this have on the cell emf ?

(a) no change (b) the voltage would increase by 0.360 V

(c) the voltage would decrease by 0.360 V (d) it would not work

Answer. (c)

75. Given $Zn \rightarrow Zn^{+2} + 2e^{-}$ with E° = + 0.763, calculate E for a Zn electrode in which Zn^{+2} = 0.025 M.

(a) 1.00 V (b) 0.621 V

(c) 0.810 V (d) 0.124 V

Answer. (c)

76. A strip of zinc is dipped in a solution of copper sulfate. Select the correct occurring half–reaction.

(a) $Co^{++} + 2e^{-} \rightarrow Co$, reduction (b) $Cu + 2e^{-} \rightarrow Cu^{++}$, reduction

(c) $Cu \rightarrow Cu^{++} + 2e^{-}$, reduction (d) $Zn \rightarrow Zn^{++} + 2e^{-}$, oxidation

Answer. (d)

77. A concentration cell is constructed by placing identical Zn electrodes in two Zn^{2+} solutions. If the concentrations of the two Zn^{2+} solutions are 0.10 M and 0.00010 M, respectively, what is the potential of the cell?

(a) + 0.763 V (b) + 0.089 V

(c) + 0.053 V (d) + 0.24 V

Answer. (b)

78. Calculate the potential (in volts) for the following voltaic cell at 25°C:

Cr/Cr^{3+} (0.10 M) || Cu^{2+} (0.0010 M) /Cu

(a) 1.25 V (b) 1.33 V

(c) 1.41 V (d) 1.57 V

Answer. (b)

79. Calculate the cell potential for the voltaic cell that results when the following two half-cells are connected at 25°C:

(1) a platinum electrode inserted into a solution of 0.10 M Co^{3+} and 0.0010 M Co^{2+}

(2) a copper electrode inserted into a solution of 0.010 M Cu^{2+} ions

(a) 1.56 V (b) 1.30 V

(c) 1.48 V (d) 1.66 V

Answer. (d)

80. Calculate the potential (in volts) for the following voltaic cell at 25° C:

Ag/Ag^{+} (0.01 M) || MnO^{4-} (0.1 M); H^{+} (1 M); Mn^{2+} (0.001 M)/Pt

(a) + 0.57 V (b) 0.71 V

(c) + 0.85 V (d) + 0.91 V

Answer. (c)

81. What is the equilibrium constant for the following at 25°C?

$3Mn^{2+} + 2Cr \rightarrow 3Mn + 2Cr^{3+}$

(a) 5.1×10^{44} (b) 1.3×10^{21}

(c) 2.5×10^{-45} (d) 8.0×10^{-23}

Answer. (c)

82. A voltaic cell has an E° value of –1.00 V. The reaction .

(a) is spontaneous (b) has a positive $\Delta G°$

(c) has a negative $\Delta G°$ (d) has K = 1

Answer. (b)

83. Which of the following is FALSE regarding the salt bridge used in voltaic cells? The salt bridge .

(a) allows for the two half-cells to be kept separated

(b) maintains the electrical neutrality in each half cell

(c) allows mixing of the two electrode solutions

(d) is made of a medium through which ions can slowly pass

Answer. (c)

84. Which of the following can we use to measure pH?

(a) a glass electrode (b) a concentration cell

(c) a hydrogen electrode (d) all of these

Answer. (d)

85. Based on the following information, which will be the most effective oxidizing agent?

$Na^{+} + e^{-} \rightarrow Na$ E° = – 2.71

$O_2 + 4e^- + 2H_2O \rightarrow 4OH^-$ E° = + 0.40

$Cl_2 + 2e^- \rightarrow 2Cl^-$ E° = + 1.36

(a) Na (b) Na^+

(c) O_2 (d) Cl_2

Answer. (d)

86. What is ΔG° at 298 K for the reaction

$Hg(A) + 2Fe^{3+}(aq) \rightarrow Hg^{2+}(aq) + 2Fe^{2+}(aq)$?

(a) + 314 kJ (b) –16 kJ

(c) – 314 kJ (d) 16 kJ

Answer. (d)

87. The salt bridge in the electrochemical cell serves to

(a) increase the rate at which equilibrium is attained

(b) increase the voltage of the cell

(c) maintain electrical neutrality

(d) increase the oxidation/reduction rate

Answer. (c)

88. Complete and balance the following equation. (All stoichiometric coefficients must be integers) MnO4–(aq) + Cl–(aq) □ Mn2+(aq) + Cl2(g) (acidic solution)

How many hydrogen ions are needed and on which side of the equation must they appear?

(a) 16, on the left (b) 8, on the left

(c) 16, on the right (d) 4, on the left

Answer. (a)

89. Complete and balance the following equation. (All stoichiometric coefficients must be integers) $HClO(aq) + Br_2(g) \rightarrow BrO^{3-}(aq) + Cl_2(g)$ (acidic solution)

How many hydrogen ions are needed and on what side of the equation must they appear?

(a) 0 hydrogen ions are needed (b) 10, on the right

(c) 12, on the right (d) 2, on the left

Answer. (a)

90. What is ΔG° at 298 K for the reaction:

$2VO^{2+}(aq) + 4H^+(aq) + Cd(s) \rightarrow 2VO^{2+}(aq) + 2H_2O(A) + Cd^{2+}(aq)$?

(a) – 271 kJ (b) 1.403 J

(c) – 135 kJ (d) –115 kJ

Answer. (a)

91. From a consideration of the following two half-reactions at 298 K,

Half Reaction E° (Volts)

$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$ – 0.126

$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$ – 0.447

What is the equilibrium constant for the following equation?

$Pb^{2+}(aq) + Fe(s) \rightarrow Pb(s) + Fe^{2+}(aq)$ Keq = $e^- \Delta G/RT$ Faraday constant:

1 F = 96,485 C/mol. R = 8.314 J mol^{-1} K^{-1}

(a) 3.7×10^{-6} (b) 2.7×10^{5}

(c) 7.2×10^{10} (d) 2.4×10^{19}

Answer. (c)

92. From a consideration of the following two half-reactions

Half Reaction E°(Volts)

$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$ 1.36

$Br_2(A) + 2e^- \rightarrow 2Br^-(aq)$ 1.07

what is the standard free energy change at 25°C for the following reaction?

$Cl_2(g) + 2Br^-(aq) \rightarrow Br_2(A) + 2Cl^-(aq)$

Faraday constant: 1 F = 96,485 C/mol. R = 8.314 J mol^{-1} K^{-1}

(a) – 112 kJ/mol (b) – 56 kJ/mol

(c) – 28 kJ/mol (d) 470 kJ/mol

Answer. (b)

93. The tendency of magnetic lines of force to pass through the medium relative to the tendency of the same lines of force to pass through the air or vacuum is called as ----------

(a) Magnetic moment (b) magnetic susceptibility

(c) magnetic permeability (d) None of these

Answer. (c)

94..If magnetic permeability (μ) is less than one (μ < 1) then the medium is said to be

(a) paramagnetic (b) ferromagnetic

(c) dimagnetic (d) None of these

Answer. (c)

95. If magnetic permeability (μ) is lgreater than one (μ>1) then the medium is said to be

(a) paramagnetic (b) ferromagnetic

(c) dimagnetic (d) None of these

Answer. (a)

89. Ferromagnetic substances are

(a) Fe (b) Co

(c) Ni (d) All of these

Answer. (d)

90. The product of pole strength of the magnetic substance and its length is called as ----------

(a) Magnetic moment (b) magnetic susceptibility

(c) magnetic permeability (d) None of these

Answer. (a)

91. Magnetic susceptibility is given by

(a $K = \frac{I}{H}$ (b) $K = \frac{H}{I}$

(c) $F = \frac{m_1 m_2}{\mu r^2}$ (d) None of these

Answer. (a)

92. Specific susceptibility is given by

(a $K = \frac{I}{H}$ (b) $K = \frac{H}{I}$

(c) $x = \frac{K}{\rho}$ (d) None of these

Answer. (c)

93. The measure of how substance is susceptible (get affected) by magnetic lines of force is called

(a) Magnetic moment (b) magnetic susceptibility

(c) magnetic permeability (d) None of these

Answer. (a)

94. Molar susceptibility is given by

(a) $x_m = \frac{K}{\rho}$ (b) $K = \frac{K M}{\rho}$

(c) $x = \frac{K I}{\rho}$ (d) None of these

Answer. (b)

95. The unit of magnetic susceptibility is given by

(a) B. M. Oerstead^{-1} cm^{-3} (b) B. M. Oerstead^{-1} cm

(c) B. M. Oerstead^{-3} cm^{-1} (d) None of these

Answer. (a)

96. The unit of specific susceptibility is given by

(a) B. M. Oerstead^{-1} cm^{-3} (b) B. M. Oerstead^{-1} gm^{-1}

(c) B. M. Oerstead^{-3} gm (d) None of these

Answer. (b)

97. The substances which are attracted by the magnet when placed in magnetic field from weaker to stronger part of the field is called as---------

(a) paramagnetic substances (b) ferromagnetic substances

(c) dimagnetic substances (d) None of these

Answer. (a)

98. The substances which are repelled by the magnet when placed in magnetic field from stronger to weaker part of the field is called as---------

(a) paramagnetic substances (b) ferromagnetic substances

(c) dimagnetic substances (d) None of these

Answer. (c)

99. The substances which are attracted by the magnet when placed in magnetic field and can also be permanently magnetised is called as---------

(a) paramagnetic substances (b) ferromagnetic substances

(c) dimagnetic substances (d) None of these

Answer. (b)

100. The magnetic susceptibility of a paramagnetic material is ---------

(a) Negative (b) Positive

(c) both a and b (d) None of these

Answer. (b)

101. The magnetic susceptibility of a dimagnetic material is ---------

(a) Negative (b) Positive

(c) both a and b (d) None of these

Answer. (a)

102. The ferromagnetic substances obey's ---------

(a) Joule's law (b) Curie's law

(c) both a and b (d) None of these

Answer. (b)

103. The paramagnetic substances obey's ---------

(a) Joule's law (b) Curie's law

(c) both a and b (d) None of these

Answer. (b)

104. The temperature of paramagnetic substance is increased then the magnetic susceptibility ---------

(a) Increases (b) Decreases

(c) Remains constant (d) None of these

Answer. (b)

105. The magnetic susceptibility of dimagnetic substances -------- with the temperature

(a) Increases (b) Decreases

(c) Does not change (d) None of these

Answer. (c)

106. The magnetic susceptibility of ferromagnetic substances -------- with the temperature

(a) Increases (b) Decreases

(c) Does not change (d) None of these

Answer. (b)

107. The dimagnetic substance is -------- in the magnetic field

(a) Attracted (b) rotated

(c) Repelled (d) None of these

Answer. (c)

108. The substances which retain their magnetic property when removed from the magnetic field are called as ----------

(a) paramagnetic substances (b) ferromagnetic substances

(c) dimagnetic substances (d) None of these

Answer. (b)

109. The paramagnetism is due to the presence of ----------

(a) Paired electrons (b) Unpaired electrons

(c) both a and b (d) None of these

Answer. (b)

110. Iron, cobalt and nickel are the examples of ----------

(a) paramagnetic substances (b) dimagnetic substances

(c) ferromagnetic substances (d) None of these

Answer. (c)

111. Aluminioum, manganese, Platinum and oxygen are the examples of ----------

(a) paramagnetic substances (b) dimagnetic substances

(c) ferromagnetic substances (d) None of these

Answer. (a)

112. The ferromagnetism is due to the presence of ----------

(a) Paired electrons

(b) Unpaired electrons

(c) both a and b

(d) None of these

Answer. (b)