Chemistry

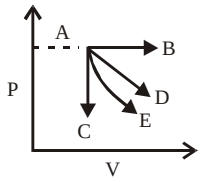
VOLUME - 3

Physical Chemistry

Quantum Success Mantraa: SCQ-NCERT Based

Choose the appropriate answer:

1. Human body is an example of ?
   (1) Open system (2) Closed system
   (3) Isolated system
   (4) Not a thermodynamic system
2. For which of the process in the following figure $q = \Delta E$



   (1) $A \rightarrow B$ (2) $A \rightarrow C$
   (3) $A \rightarrow D$ (4) $A \rightarrow E$
3. A system is provided 50 J of heat work done by the system is 10J. The change in internal energy is
   (1) 60 J (2) 20 J
   (3) 40 J (4) 50 J
4. In an irreversible process taking place at constant T and P and in which only P–V work is being done, the change in free energy (dG) and change in entropy (dS) satisfy the criteria
   (1) $(dS)_{V,U} = 0, (dG)_{T,P} = 0$
   (2) $(dS)_{V,U} = 0, (dG)_{T,P} = +ve$
   (3) $(dS)_{V,U} = -ve, (dG)_{T,P} = -ve$
   (4) $(dS)_{V,U} = +ve, (dG)_{T,P} = -ve$
5. When ice melts, the external work done is ?
   (1) positive (2) negative
   (3) zero (4) equal to latent heat
6. The law of conservation of energy states that:
   (1) The internal energy of a system is constant
   (2) The heat content of a system is constant
   (3) Energy is neither created nor destroyed
   (4) There is an equivalence between energy and mass
7. Internal energy of an ideal gas depends on:
   (1) Pressure (2) Temperature
   (3) Volume (4) None
8. The change in the internal energy of a system in an adiabatic process, is
   (1) equal in magnitude to work done but opposite in sign
   (2) equal to work both in magnitude as well as in sign
   (3) greater than the work done
   (4) less than the work done
9. In an isothermal reversible cyclic process, the total change in internal energy:
   (1) is always positive (2) is always negative
   (3) is always zero (4) can have any value
10. If an endothermic reaction is non-spontaneous at freezing point of water and becomes feasible at its boiling point, then
   (1) ΔH is –ve, ΔS is +ve
   (2) ΔH and ΔS both are is +ve
   (3) ΔH and ΔS both are is –ve
   (4) ΔH is +ve, ΔS is –ve
11. The temperature at which the gas neither heats nor cools on expansion or where Joule-Thomson coefficient is zero, is called:
   (1) Critical temp. (2) Elevated temp.
   (3) Inversion temp. (4) Reduced temp.
12. The work done when one mole of an ideal gas expand freely into vacuum
   (1) $-P\Delta V$ (2) $P\Delta V$
   (3) ΔG (4) zero
13. Which statement(s) is/are correct?
   (1) $\left(\frac{dH}{dT}\right)_P - \left(\frac{dU}{dT}\right)_V = R$
   (2) $\left(\frac{dH}{dT}\right)_P > \left(\frac{dU}{dT}\right)_V$
   (3) $\left(\frac{dU}{dV}\right)_T$ for ideal gas is zero
   (4) All of the above
14. If a chemical change is brought about by one or more methods in one or more steps, then the amount of heat absorbed or evolved during the complete change is the same, whichever method was followed. This rule is known as:
   (1) Le Chatelier's principle (2) Hess's law

(3) Joule Thomson effect (4) None of these

15. The temperature of the system increases during an
(1) Isothermal expansion
(2) Adiabatic compression
(3) Adiabatic expansion
(4) Isothermal compression

16. Which statements are correct?

(1) $2.303 \log\frac{P_2}{P_1} = \frac{\Delta H_{vap.}}{R}\frac{[T_2 - T_1]}{T_1T_2}$ is Clausius-Clapeyron equation

(2) $\frac{\Delta H_{vap.}}{\text{Boiling point}} = 88\,J\,mol^{-1}K^{-1}$ is called Trouton's rule

(3) Entropy is a measure of unavailable energy, i.e., unavailable energy = entropy $\times$ temperature

(4) All of the above

17. The ΔH_f^o for $CO_2(g)$, $CO(g)$ and $H_2O(g)$ are –393.5, –110.5 and –241.8 kJ mol^{-1} respectively. The standard enthalpy change (in kJ) for the reaction $CO_2(g) + H_2(g) \longrightarrow CO(g) + H_2O(g)$ is
(1) 524.1 (2) 41.2
(3) –262.5 (4) –41.2

18. If $\frac{1}{2}X_2O(s) \longrightarrow X(s) + \frac{1}{4}O_2(g); \Delta H = 90\,kJ$, then heat change during reaction of metal 'X' with one mole of O_2 to form oxide to maximum extent is
(1) 360 kJ (2) –360 kJ
(3) –180 kJ (4) +180 kJ

19. Which of the following expressions defines the physical significance of free energy change :
(1) $-\Delta G = W_{(non\ exp)}$ (2) $-\Delta G = -W_{(non\ exp)}$
(3) $\Delta G = -W_{(exp)}$ (4) $\Delta G = W_{(exp)}$

20. According to third law of thermodynamics, the entropy at 0°K is zero for
(1) elements in their stable form
(2) perfectly crystalline solids
(3) substances at 1 atm and 25°C
(4) N_2O

21. An ideal gas expands from 10 litre to 20 litre against a constant pressure of 1.5 atmosphere. Work done is_____ cal.
(1) 248.42 (2) 363.53
(3) 187.35 (4) zero

22. The heat of combustion of ethanol determined in a bomb calorimeter is –670.48 K. cals $mole^{-1}$ at 25°C. What is ΔE at 25°C for the reaction?
(1) –335.24 K.Cals (2) –669.29 K.Cals
(3) –670.48 K.Cals (4) + 670.48 K.Cals

23. The standard heat of combustion of carbon is –94.0 k.cals. Hence the heat of formation of CO_2 will be?
(1) + 94.0K.cal (2) –94.0 K.cal
(3) –26.0 K.cal (4) –46.0 K.cal

24. The standard enthalpies of formation for $CO_2(g)$, $H_2O(l)$ and $CH_3OH(l)$ are –393.5 kJ/mol, –285.8 kJ/mol and –238.7 kJ/mol respectively. Calculate $\Delta H°$ for the combustion of 454 grams of methanol $CH_3OH(l)$
(1) –440.2 kJ (2) –726.4 kJ
(3) -6.26×10^3 kJ (4) -10.3×10^3 kJ

25. A hypothetical reaction, A $\rightarrow$ 2B, proceed via following sequence of steps
$A \rightarrow C;\ \Delta H = q_1$,
$C \rightarrow D;\ \Delta H = q_2$
$1/2D \rightarrow B;\ \Delta H = q_3$
The heat of reaction is:
(1) $q_1 - q_3 + 2q_3$ (2) $q_1 + q_2 - 2q_3$
(3) $q_1 + q_2 + 2q_3$ (4) $q_1 + 2q_2 - 2q_3$

26. For a cyclic process change in internal energy is equal to
(1) w (2) q
(3) ΔH (4) Zero

27. $NH_3(g) + 3Cl_2(g) \rightleftharpoons NCl_3(g) + 3HCl(g);\ -\Delta H_1$
$N_2(g) + 3H_2(g) = 2NH_3(g);\ -\Delta H_2$
$H_2(g) + Cl_2(g) = 2HCl(g);\ -\Delta H_3$
The heat of formation of $NCl_3(g)$ in the terms of ΔH_1, ΔH_2 and ΔH_3 is
(1) $\Delta H_f = -\Delta H_1 - \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$
(2) $\Delta H_f = \Delta H_1 + \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$
(3) $\Delta H_f = \Delta H_1 - \frac{\Delta H_2}{2} - \frac{3}{2}\Delta H_3$
(4) None of these

28. If heat of neutralisation is –13.7 k.cal and $H_f^o H_2O = -68$ k.cal, then enthalpy of OH^- would be
(1) 54.3 k.cal (2) –54.3 k.cal
(3) 71.3 k.cal (4) –71.3 k.cal

29. If $S(s) + O_2(g) \rightarrow SO_2(g);\ \Delta H = -298.2$ kJ

(1) $SO_2(g) + 1/2O_2(g) \rightarrow SO_3(g)$; $\Delta H = -98.7$ kJ

(2) $SO_3(g) + H_2O(l) \rightarrow H_2SO_4$; $\Delta H = -130.2$ kJ

(3) $H_2(g) + 1/2O_2(g) \rightarrow H_2O(l)$; $\Delta H = -287.3$kJ

(4) The enthalpy of formation of H_2SO_4 at 298 K will be:

(1) –814.4 kJ (2) +320.5 kJ

(3) –650.3 kJ (4) –433.7 kJ

30. Given that $3C + 2Fe_2O_3 = 4Fe + 3CO_2$; $\Delta H = +110.8$ kcal and $C(s) + O_2(g) = CO_2(g)$, $\Delta H = -94.05$ kcal

Heat of formation of Fe_2O_3 is

(1) 16.75 K cals (2) –16.75 K cals

(3) –196.5 Kcals (4) –393 K cals

31. The heats of combustion of rhombic and monoclinic sulphur are 70960 and 71030 calories respectively. What will be the heat of conversion of rhombic sulphur to monoclinic

(1) 70960 calories (2) 71030 calories

(3) –70 calories (4) +70 calories

32. The bond dissociation energy of C – H bond in CH_4 from the equation $C(g) + 4H(g) \rightarrow CH_4(g)$; $\Delta H = -397.8$ k cal is

(1) + 397.8 k cal (2) +198.9 k cal

(3) +99.45 k cal (4) –99.45 k cal

33. For a reversible process, the total change in entropy of the universe is equal to

(1) ΔS (system) + ΔS (surroundings)

(2) ΔS (system) – ΔS (surroundings)

(3) zero

(4) negative

34. On combustion, carbon forms two oxides CO and CO_2. Heat of formation of CO_2 is 94.3 K.cals and that of CO is 26.0 K.cals. Heat of combustion of carbon is ?

(1) –26.0 K.Cal (2) –94.3 K.Cal

(3) –68.3 K.Cal (4) +94.3 K.Cal

35. $NH_3(g) + HCl(g) = NH_4Cl(g) + 42,100$ Cal

$NH_4Cl(g) + aq = NH_4Cl(aq) - 3900$ Cal

Heat of reaction, when gaseous NH_3 and gaseous HCl are converted into a dilute aqueous solution NH_4Cl, is

(1) 38200 cal are evolved

(2) 38200 cal are absorbed

(3) 46000 cal are evolved

(4) 46000 cal are absorbed

36. Heat of neutralization of NaOH and HCl is –57.3 kJ mol^{-1}. The heat of ionization of water will be

(1) –57.3 kJ mol^{-1} (2) –114.6 kJ mol^{-1}

(3) +57.3 kJ mol^{-1} (4) +114.6 kJ mol^{-1}

37. At 0°C, ice and water are in equilibrium and $\Delta H = 6$ KJ/mole $\Delta S =$ _____ JK^{-1} $mole^{-1}$

(1) 0 (2) –11

(3) 22 (4) 27.5

38. Enthalpy of vaporization of liquid water is 9720 calories per mole. Its normal boiling point is 100°C. The entropy change is :

(1) $\frac{9720}{373}$ cal $degree^{-1}mole^{-1}$

(2) $\frac{373}{9720}$ cal $degree^{-1}mole^{-1}$

(3) $\frac{9720}{273}$ cal $degree^{-1}mole^{-1}$

(4) $9720\left(\frac{1}{270}-\frac{1}{373}\right)$ cal $degree^{-1}mole^{-1}$

39. Heat of neutralization is least when

(1) NaOH is neutralised by CH_3COOH

(2) NaOH is neutralised by HCl

(3) NH_4OH is neutralised by CH_3COOH

(4) NH_4OH is neutralised by HNO_3

40. If ΔH is change in enthalpy and ΔE, the change in internal energy accompanying a gaseous reaction, then

(1) ΔH is always greater than ΔE

(2) $\Delta H < \Delta E$ only if the number of moles of the products is greater than the number of moles of the reactants

(3) ΔH is always less than ΔE

(4) $\Delta H < \Delta E$ only if the number of moles of products less than the number of moles of the reactants

41. For the reaction, $A \rightarrow B$, ΔH and ΔS are positive. The most favourable conditions for the reaction is ?

(1) Low temperature (2) High temperature

(3) High concentration (4) Very low temperature

42. In which of the following reactions does the heat change represent the heat of formation of water ?

(1) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$; $\Delta H = -116$ kcal

(2) $H_2(g) + {}^1/_2\, O_2(g) \rightarrow H_2O(l)$; $\Delta H = -58$ kcal

(3) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$; $\Delta H = -13.7$ kcal

(4) $C_2H_2(g) + 5/2\ O_2(g) \rightarrow 2CO_2(g) + H_2O(l)$;

$\Delta H = -310$ kcal

43. Which of the following is true for the reaction $H_2O(l) \rightleftharpoons H_2O(g)$ at 100°C and 1 atmosphere?
(1) $\Delta S = 0$ (2) $\Delta H = 0$
(3) $\Delta H = \Delta E$ (4) $\Delta H = T\Delta S$

44. In which of the following neutralization reaction, the heat of neutralisation will be highest
(1) NH_4OH and H_2SO_4
(2) HCl and NaOH
(3) CH_3COOH and KOH
(4) CH_3COOH and NH_4OH

45. The value of ΔH^o for the reaction $Cu^+(g) + I^-(g) \longrightarrow CuI(g)$ is 745 kJ mol^{-1} and the electron affinity of I(g) is –295 kJ mol^{-1}, then the value of ΔH^o for the formation of one mole of CuI(g) from Cu(g) and I(g) is
(1) –446 kJ mol^{-1} (2) 450 kJ mol^{-1}
(3) 594 kJ mol^{-1} (4) 4 kJ mol^{-1}

46. The heat of combustion of yellow P and red P are –9.91 kJ mol^{-1} and –8.78 kJ mol^{-1} respectively. The heat of transition of yellow P $\rightarrow$ red P is
(1) –18.69 kJ (2) +1.13 kJ
(3) +18.69 kJ (4) –1.13 kJ

47. In a reversible isothermal process, the change in internal energy is
(1) zero (2) positive
(3) negative (4) None of these

48. For a diatomic molecule Ab, the electronegativity difference between A and B = 0.2028 $\sqrt{\Delta}$ [where Δ = Bond energy of AB – Geometric mean of the bond energies of A_2 and B_2]. The electronegativies of fluorine and chlorine are 4.0 and 3.0 respectively and the bond energies are of F – F : 38 k.cal mol^{-1} and Cl – Cl : 58 k.cal mol^{-1}. the bond energy of Cl – F is
(1) ~ 71 k.cal/mol (2) ~ 61 k.cal/mol
(3) ~ 48 k.cal/mol (4) ~ 75 k.cal/mol

49. The total entropy change for a system and its surroundings increases, if the process is
(1) reversible (2) irreversible
(3) exothermic (4) endothermic

50. During an adiabatic process, the pressure of gas is found to be proportional to the cube of its absolute temperature. The ratio of C_p/C_v for the gas is
(1) $\frac{3}{2}$ (2) $\frac{7}{5}$
(3) $\frac{5}{3}$ (4) $\frac{4}{3}$

51. At constant T and P, which one of the following statements is correct for the reaction ?
$S_8(s) + 8O_2(g) \rightarrow 8\,SO_2(g)$
(1) $\Delta H < \Delta E$
(2) $\Delta H = \Delta E$
(3) $\Delta H > \Delta E$
(4) ΔH is independent of the physical state of the reactants

52. The difference between heats of reaction at constant pressure and constant volume for the reaction $2C_6H_6(l) + 15\,O_2(g) \rightarrow 12\,CO_2(g) + 6H_2O(l)$ at 25°C in kJ is
(1) –7.43 (2) +3.72
(3) –3.72 (4) +7.43

53. Calculate the work involved when 1 mol of an ideal gas is expanded reversibly from 20.0 dm^3 to 40.0 dm^3 at a constant temperature of 300 K
(1) 7.78 kJ (2) –1.73 kJ
(3) 11.73 kJ (4) –4.73 kJ

54. The free energy change $\Delta G = 0$, when
(1) the system is in equilibrium
(2) catalyst is added
(3) reactants are initially mixed thoroughly
(4) the reactants are completely consumed

55. The enthalpy of dissolution of $BaCl_2$ (s) and $BaCl_2.2H_2O$ (s) are –20.6 and 8.8 kJ mol^{-1} respectively. The enthalpy of hydration for $BaCl_2$ (s) + $2H_2O \rightarrow BaCl_2.2H_2O$(s) is
(1) 29.4 kJ (2) –29.4 kJ
(3) –11.8 kJ (4) 38.2 kJ

56. A chemical reaction will be spontaneous if it is accompanied by a decrease of
(1) entropy of the system
(2) enthalpy of the system
(3) internal energy of the system
(4) free energy of the system

57. Which of the following is a closed system?
(1) Jet engine
(2) Tea placed in a steel kettle
(3) Pressure cooker

(4) Rocket engine during propulsion

58. The ionisation energy of solid NaCl is 180 k.cal per mol. The dissolution of the solid in water in the form of ions is endothermic to the extent of 1 k.cal per mol. If the solvation energies of Na^+ and Cl^- ions are in the ratio 6 : 5, what is the enthalpy of hydration of sodium ion?

(1) –85.6 k.cal/mol (2) –97.5 k.cal/mol
(3) 82.6 k.cal/mol (4) +100 k.cal/mol

59. Given that $C(s) + O_2(g) \rightarrow CO_2(g)$, $\Delta H° = -xKJ$
$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$, $\Delta H° = -y$ kJ
the enthalpy of formation of carbon monoxide ____ will be

(1) $\frac{2x - y}{2}$ (2) $\frac{y - 2x}{2}$
(3) 2x – y (4) y = 2x

60. Which relation is correct ?

(1) $\Delta G = \Delta H - T\Delta S$ (2) $\Delta G = \Delta H + T\Delta S$
(3) $\Delta G = T\Delta S - \Delta S$ (4) $\Delta G = \Delta H - SdT$

61. A solution of 200 mL of 1 M KOH is added to 200 mL of 1 M HCl and the mixture is well shaken. This rise in temperature T_1 is noted. The experiment is repeated by using 100 mL of each solution and increase in temperature T_2 is again noted. Which of the following is correct?

(1) $T_1 = T_2$
(2) T_2 is twice as large as T_1
(3) T_1 is twice as large as T_2
(4) T_1 is four times as large T_2

62. Identify the correct statement regarding entropy?

(1) At absolute zero of temperature, entropy of a perfectly crystalline substance is taken to be zero
(2) At absolute zero of temperature, the entropy of a perfectly crystalline substance is positive
(3) Absolute entropy of a substance cannot be determined
(4) At 0°C, the entropy of a perfectly crystalline substance is taken to be zero

63. Heat of neutralisation of strong acid against strong base is constant and is equal to

(1) –13.7 kcal (2) –57 kJ
(3) -5.7×10^4 J (4) All of these

64. $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$, $\Delta H = -44$ k cal
$2Na(s) + 2HCl(g) \rightarrow 2NaCl(s) + H_2(g)$, $\Delta H = -152$ kcal
For the reaction, $Na(s) + {}^1/_2\, Cl_2(g) \rightarrow NaCl(s)$, ΔH = ?

(1) –180 kcal (2) –196 kcal
(3) –98 kcal (4) 54 kcal

65. Which of the following has a positive enthalpy of formation

(1) $NH_{3(g)}$ (2) $CoCl_{2(l)}$
(3) $S_2Cl_{2(g)}$ (4) N_3H

66. If the internal energy of an ideal gas decreases by the same amount as the work done by the system, the process is

(1) cyclic (2) isothermal
(3) adiabatic (4) isolated

67. It requires 5 minutes to evaporate 50 mL of water from an electric source which delivers 400 W. The enthalpy of vapourization of water is

(1) 40 kJ mol^{-1} (2) 43 kJ mol^{-1}
(3) 16 kJ mol^{-1} (4) 180 kJ mol^{-1}

68. The mathematical expression for the standard enthalpy of sublimation is given by

(1) $\Delta H°$ (sublimation) = $\Delta H°$ (fusion) $-2\,\Delta H°$ (vapourization)
(2) $\Delta H°$ (sublimation) = $\Delta H°$ (fusion) $-\Delta H°$ (vapourization)
(3) $\Delta H°$ (sublimation) = $\Delta H°$ (fusion) $+\Delta H°$ (vapourization)
(4) $\Delta H°$ (sublimation) = $\Delta H°$ (combustion) $+\Delta H°$ (dissociation)

69. For the reaction $CO(g) + \frac{1}{2}O_2(g) \rightarrow CO_2(g)$; $\Delta H° = -67650$ cal at 25°C. Calculate $\Delta H°$ at 100°C, given that the required molar heat capacities are as follows $C_p(CO, g) = 6.97$ cal/degree Celsius
$C_p(CO_2, g) = 8.97$ cal/degree Celcius
$C_p(O_2, g) = 7.00$ cal/degree Celsius

(1) –54.6 cal (2) –67650.4 cal
(3) –67684.4 cal (4) –67762.5 cal

70. The molar enthalpy of fusion of water is 6.01 kJ mol^{-1}. The entropy change of 1 mol of water at its melting point will be

(1) 22 J mol^{-1} (2) 109 J mol^{-1}
(3) 44 J mol^{-1} (4) 11 J mol^{-1}

71. The molar enthalpies of combustion of isobutane and n-butane are –2870 kJmol^{-1} and –2878 kJmol^{-1} respectively at 298 K and 1 atm. Calculate $\Delta H°$

for the conversion of 1 mol of n-butane to 1 mol of isobutane.

(2) -8 kJ mol^{-1} (2) $+8$ kJ mol^{-1}

(3) -5748 kJ mol^{-1} (4) $+5748$ kJ mol^{-1}

72. In which of the following reaction $\Delta H = \Delta E$?

(1) $H_2(g) + I_2(g) \rightarrow 2HI(g)$

(2) $KI(aq) + I_2(s) \rightarrow KI_3(aq)$

(3) $6NaOH(aq) + 3Cl_2(g) \rightarrow 5\,NaCl(aq) + NaClO_3(aq) + 3H_2O(l)$

(4) $N_2O_4(g) \rightarrow 2NO_2(g)$

73. The plots of $\frac{1}{X_A}$ Vs. $\frac{1}{Y_A}$ (where X_A and Y_A are the mole fraction of liquid A in liquid and vapour phase respectively) is linear with slope and intercepts respectively

(1) $\frac{P_A^0}{P_B^0}$ and $\frac{\left(P_A^0 - P_B^0\right)}{P_B^0}$ (2) $\frac{P_A^0}{P_B^0}$ and $\frac{\left(P_B^0 - P_A^0\right)}{P_B^0}$

(3) $\frac{P_B^0}{P_A^0}$ and $\frac{\left(P_A^0 - P_B^0\right)}{P_B^0}$ (4) $\frac{P_B^0}{P_A^0}$ and $\frac{\left(P_B^0 - P_A^0\right)}{P_B^0}$

74. The highest temperature at which vapour pressure of a liquid can be measured is ?

(1) B.P. of liquid

(2) Critical temperature

(3) Critical solution temperature

(4) Inversion temperature

75. The pair of compounds which an can not exist in solution is ?

(1) $NaHCO_3$ & NaOH (2) Na_2CO_3 & $NaHCO_3$

(3) Na_2CO_3 and NaOH (4) $NaHCO_3$ and NaCl

76. Which of the following shows a negative deviation from Raoult's law

(1) Benzene-methanol (2) Acetone-ethanol

(3) Acetone-chloroform (4) Acetone-benzene

77. The azeotropic mixture of water (b.p. 100°C) and HCl (b.p. 85°C) boils at 108.5°C. When this mixture is distilled it is possible to obtain :

(1) Pure HCl

(2) Pure water

(3) Pure water as well as pure HCl

(4) Neither HCl nor H_2O in their pure states

78. At 40°C, the vapour pressure (in torr) of methyl alcohol (A) and ethyl alcohol (B) solution is represented by $P = 120\,X_A + 138$; where X_A is mole fraction of methyl alcohol. The value of lim $X_A \longrightarrow \frac{P_B^0}{X_B}$ and lim $X_B \longrightarrow \frac{P_A^0}{X_A}$ are

(1) 138, 258 (2) 258, 138

(3) 120, 138 (4) 138, 125

79. The enthalpy change for a given reaction at 298 K is $-x$ Jmol^{-1}. If the reaction occurs spontaneously at 298 K, the entropy change at that temperature

(1) can be negative but numerically larger than x/298

(2) can be negative but numerically smaller than x/298

(3) cannot be negative (4) cannot be positive

80. the vapour pressure of a solution of a non-volatile electrolyte (A) in a solvent (B) is 95% of the vapour pressure of the solvent at the same temperature. If $M_B = 0.3\,M_A$, where M_B and M_A are molecular weights of B and A respectively, the weight ratio of the solvent and solute are

(1) 0.15 (2) 5.7

(3) 0.2 (4) 4.0

81. Osmotic pressure of 40% (wt./vol.) urea solution is 1.64 atm. and that of 3.42% (wt./vol.) cane sugar is 2.46 atm. When equal volumes of the above two solutions are mixed, the osmotic pressure of the resulting solution is

(1) 1.64 atm. (2) 2.46 atm.

(3) 4.10 atm. (4) 2.05 atm.

82. Blood has been found to be isotonic with ?

(1) Normal saline solution

(2) Saturated NaCl solution

(3) Saturated KCl solution

(4) Saturated solution of 1 : 1 mixture of NaCl and KCl

83. At 298 K, the enthalpy changes of cleave of successive O – H bonds of water molecules are

$H_2O(g) \rightarrow H(g) + OH(g)$; $\Delta H = 498$ kJ mol^{-1}

$OH(g) \rightarrow H(g) + O(g)$; $\Delta H = 428$ kJ mol^{-1}

From the above data, the value of ΔH_{O-H} bond is

(1) 498 kJ mol^{-1} (2) 428 kJ mol^{-1}

(3) 463 kJ mol^{-1} (4) 70 kJ mol^{-1}

84. The vapour pressure of pure benzene and toluene are 160 and 60 torr respectively. The mole fractions of toluene in vapour phase in benzene and toluene is?

(1) 0.50 (2) 0.16

(3) 0.27 (4) 0.73

85. The vapour pressure of water at room temperature is 23.8 mm (Hg). The vapour pressure of an aqueous solution of sucrose with mole fraction 0.1 is equal to:
(1) 2.39 mm Hg (2) 2.42 mm Hg
(3) 21.42 mm. Hg (4) 21.44 mm. Hg

86. A 5% solution of glucose (molar mass 180) is isotonic with a 2.5% solution of substance X at the same temperature. The molar mass of X is:
(1) 90 (2) 45
(3) 180 (4) 360

87. Molecular weight of acetic acid in benzene is 120. The value of van't Hoff factor (i) is
(1) 1 (2) 0.5
(3) 2 (4) 2.5

88. Which of the following solutions will have the maximum lowering of vapour pressure at 300 K?
(1) 1 M NaCl (2) 1 M $CaCl_2$
(3) 1 M Phenol (4) 1 M sucrose

89. The relationship between boiling points of very dilute solutions of $BaCl_2(t_1)$ and $KCl(t_2)$ having the same molarity is ?
(1) $t_1 = t_2$ (2) $t_2 > t_1$
(3) $t_2 < t_1$ (4) $t_2 \approx t_1$

90. 1% solution of $Ca(NO_3)_2$ has freezing point:
(1) 0°C (2) less than 0°C
(3) Greater than 0°C (4) None of these

91. The observed osmotic pressure of a solution of NaCl is 2000/76 atmospheres, while the calculated osmotic pressure is 14.64 atmospheres. The degree of dissociation of the dissolved salt (NaCl) will be approximately :
(1) 1/5 (2) 2/5
(3) 3/5 (4) 4/5

92. Out of molality (m), molarity (M), formality (F) and mole fraction (x), those which are independent of temperature are
(1) M, m (2) F, x
(3) m, x (4) M, x

93. A pressure cooker reduces cooking time because
(1) The heat is more evenly distributed
(2) B.P. of water inside the cooker is increased
(3) B.P. of water inside the cooker is lowered
(4) The high temperature tenderises the food

94. The freezing point of 0.05 molal solution of a non-electrolyte in water is
(1) –1.86°C (2) –0.93°C
(3) –0.093°C (4) 0.03°C

95. On mixing 20 ml of acetone with 40 ml of chloroform, the total volume of the solution is
(1) < 60 ml (2) > 60 ml
(3) = 60 ml (4) Unpredictable

96. Isopiestic solutions are
(1) Whose vapour pressure are equal
(2) Whose osmotic pressure are equal
(3) Whose osmotic pressure are lesser than the other
(4) Whose osmotic pressure are higher than the other

97. Molarity and molality of a solution of caustic soda are respectively 11.12 M and 94.12 m. The density of the solution is
(1) 0.556 g ml^{-1} (2) 5.56 g ml^{-1}
(3) 55.6 g ml^{-1} (4) None of these

98. The solubility of iodine in water is 0.8 g per litre. If the partition coefficient of iodine between CCl_4 and water is 82, what is the solubility of iodine in CCl_4?
(1) 65.6 g L^{-1} (2) 32.8 g L^{-1}
(3) 131.2 gL^{-1} (4) None of these

99. Dry air was successively passed through a solution of 5 g solute in 80 g water and then through pure water. The loss in weight of solution was 2.5 g and that of pure water was 0.04 g. What is the mol. mass of the solute ?
(1) 160 amu (2) 73.86 amu
(3) 200 amu (4) 71.43 amu

100. What is the amount of ice that will separate out on cooling solution containing 50 g ethylene glycol in 200 g water to - 9.3°C (K_f for water is 1.86 K Kg mol^{-1})
(1) 200 g (2) 38.7 g
(3) 161.2 g (4) 50 g

101. The van't Hoff factor for 0.1 M $Ba(NO_3)_2$ solution is 2.74. The degree of dissociation is
(1) 91.3% (2) 87%
(3) 100 % (4) 74%

102. An X molal solution of a compound in benzene has mole fraction of solute equal to 0.2. The value of X is
(1) 14 (2) 3.2
(3) 1.4 (4) 2

103. Van't Hoff's factor for a dilute solution of sodium argento cyanide is
(1) 2 (2) 0.25
(3) 0.50 (4) 3.0

104. How many moles of oxygen are contained in one

litre of air under standard conditions if it contains 21% (by volume) oxygen ?

(1) 0.186 mole (2) 0.21 mole
(3) 2.10 mole (4) 0.0093 mole

105. What weight of sodium hydroxide is required to neutralise 100 mL of 0.1 N HCl ?

(1) 4.0 g (2) 0.04 g
(3) 0.4 g (4) 2.0 g

106. A molal solution of sodium chloride has a density of 1.21 g ml^{-1}. The molarity of this solution is?

(1) 4.15 (2) 1.143
(3) 2.95 (4) 3.15

107. The molarity of pure water is ?

(1) 55.6 (2) 50
(3) 100 (4) 18

108. If 250 ml. of 0.25 M NaCl solutionis diluted with water to a volume of 500 ml, the new concentration of the solution is ?

(1) 0.167 M (2) 0.125 M
(3) 0.0833 M (4) 0.0167 M

109. Among the following aqueous solutions, the order of their increasing boiling points :

(i) 10^{-4} M NaCl (ii) 10^{-3} M Urea
(iii) 10^{-3} M $MgCl_2$ (iv) 10^{-2} M NaCl
(1) (i) < (ii) < (iii) < (iv) (2) (ii) < (i) = (iii) < (iv)
(3) (ii) < (i) < (iii) < (iv) (4) (iv) < (iii) < (i) = (ii)

110. On the basis of relative strengths of intermolecular forces, predict the correct order of decreasing boiling points of the compounds:

(1) $CH_3OH > H_2 > CH_4$ (2) $CH_3OH > CH_4 > H_2$
(3) $CH_4 > CH_3OH > H_2$ (4) $H_2 > CH_4 > CH_3OH$

111. The factor $\Delta T_f/k_f$ for non electrolyte solute is equal to

(1) molarity (2) formality
(3) normality (4) molality

112. The vapour pressures of ethanol and methanol are 42.0 mm and 88.5 mm Hg respectively. An ideal solution is formed at the same temperature by mixing 46.0 g of ethanol with 16.0 g of methanol. The mole fraction of methanol in the vapour is

(1) 0.467 (2) 0.502
(3) 0.513 (4) 0.556

113. Among the following molecules, in which does bromine show the maximum oxidation number?

(1) $Hg_2(BrO_3)_2$ (2) BrCl
(3) $KBrO_4$ (4) Br_2

114. A compound contains atoms A, B and C; the oxidation number of A = +2, that of B = +5 and that of C = –2. A possible formula of the compound is

(1) ABC_2 (2) $A_2(BC_3)_2$
(3) $A_3(BC_4)_2$ (4) $A_3(B_4C)_2$

115. A solution containing 8.6 g urea in one litre was found to be isotonic with a 5% (wt./vol.) solution of an organic non-volatile solute. The molecular weight of latter is

(1) 348.0 (2) 34.89
(3) 3489 (4) 861.2

116. The equivalent weights of $KMnO_4$ in an acidic, a slightly alkaline or neutral and a strong alkaline medium are respectively (M = molecular weight)

(1) M/5, M/2, M (2) M/5, M/3, M/2
(3) M/5, M/3, M (4) M/3, M, M/5

117. The equivalent weight of $Na_2S_2O_3$ in the reaction

$2Na_2S_2O_3 + I_2 \rightarrow Na_2S_4O_6 + 2NaI$ is

(1) M (2) M/8
(3) M/0.5 (4) M/2

118. What will be the value of the equivalent weight of $KBrO_3$ in the following ionic equation?

$2BrO_3^- + 12H^+ + 10e \rightarrow Br_2 + 6H_2O$

(1) M/4 (2) M/6
(3) M/10 (4) M/5

119. In the redox reaction

$xMnO + yPbO_2 + zHNO_3 \rightarrow HMnO_4 + Pb(NO_3)_2 + H_2O$

(1) x = 2, y = 5, z = 10 (2) x = 2, y = 7, z = 8
(3) x = 2, y = 5, z = 8 (4) x = 2, y = 5, z = 5

120. In order to prevent rancidification of food material which of the following is added ?

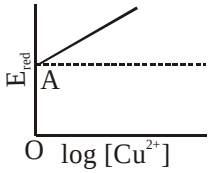
(1) reducing agent (2) oxidising agent
(3) antioxidant (4) none of these

121. For which cell e.m.f. is independent of the concentrations of electrolytes used?

(1) $Fe|FeO(s)|KOH(aq)|NiO(s)|Ni_2O_3(s)|Ni$
(2) Pt (H_2) | HCl | Pt (Cl_2)
(3) Zn | Zn $(NO_3)_2$ || $CuSO_4$ | Cu
(4) Hg, $HgCl_2$ | KCl || $AgNO_3$ | Ag

122. $Cu^{2+} + 2e \longrightarrow Cu; \log[Cu^{2+}]$ Vs. E_{red} graph is of the type as shown in figure where OA = 0.34 V

then electrode potential of the half cell of $Cu\,|\,Cu^{2+}\,(0.1M)$ will be



(1) $-0.34+\frac{0.0591}{2}$ V (2) 0.34 + 0.0591 V

(3) 0.34 V (4) None of these

123. The resistance of 0.0025 M solution of K_2SO_4 is 326 ohm. The specific conductance of the solution is

(1) 4.997×10^{-4} (2) 5.997×10^{-7}

(3) 6.997×10^{-4} (4) unpredictable

124. The conductivity of four electrolytes P, Q, R, S in $ohm^{-1}\ cm^{-1}$ are as follows P(5×10^{-5}); Q(1×10^{-10}); R(7×10^{-8}); S (9.2×10^{-3}). The one which offers highest resistance to the passage of electric current is

(1) P (2) S

(3) R (4) Q

125. The molar ionic conductance at infinite dilution of Ag^+ is 61.92×10^{-4} S mol^{-1} m^2 at 25°C. The ionic mobility of Ag^+ will be

(1) 6.4×10^{-8} (2) 6.192

(3) 6.192×10^{-4} (4) 3.2×10^{-4}

126. Which of the following relation corresponds to Faraday's first law of electrolysis ?

(1) m = Zct (2) $E = mc^2$

(3) $E = h\nu$ (4) $\Delta G° = -n FE°$

127. The potential at which a solution containing 1 M $CuSO_4$, 1 M $NiSO_4$ and 2M H_2SO_4 be electrolysed so as to deposit only copper and no nickel so that 1×10^{-9} M Cu^{2+} is left, is [$E°_{Cu^{2+}/Cu} = 0.34$ V]

(1) 0.04 V (2) 0.4 V

(3) 0.07 V (4) 0.007 V

128. Sodium metal cannot be produced by the electrolysis of an aqueous solution of sodium chloride because

(1) Sodium reacts with water

(2) Sodium reacts Cl^- ions in the solution

(3) Solution ions are more stable than sodium atom

(4) Reduction of water is preferred to reduction of Na^+ ions

129. The hydrogen electrode can exhibit electrode potential > 0 if

(1) H_2 is bubbled through the solution at 2 atm. pressure

(2) concentration of H^+ ion in solution is increased

(3) concentration of H^+ ions in solution is decreased

(4) concentration H^+ ions is decreased and simultaneously pressure of H_2 gas is increased.

130. Which reagents will not liberate Br_2 ?

(1) $KBrO_3 + I_2$ (2) KBr + HBr

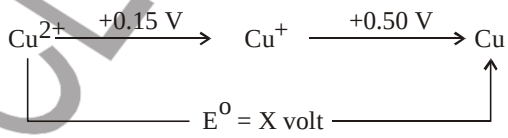
(3) $KBr + Cl_2$ (4) Both (1) and (2)

131. Two hydrogen electrodes are constituted using buffer solutions of CH_3COONa and CH_3COOH in the ratio of x : y and y : x respectively and have electrode potentials E_1 and E_2 volts, at 25°C. The pKa value of acetic acid is

(1) $\frac{E_1+E_2}{0.118}$ (2) $\frac{E_2-E_1}{0.118}$

(3) $-\frac{E_2+E_1}{0.118}$ (4) $-\frac{E_1-E_2}{0.118}$

132. In the diagram below the value of X is



(1) 0.325 V (2) 0.65 V

(3) –0.35 V (4) –0.65 V

133. A cell is constituted as follows

Pt, $H_{2(1\ atm)}$ | HA_1 | HA_2 | $H_{2(1\ atm)}$, Pt

The pH of two acids solutions HA_1 and HA_2 are 5 and 3 respectively. The emf of the cell is

(1) 0.059 V (2) 0.0295 V

(3) 0.118 V (4) –0.118 V

134. The depolarizer used in dry cell batteries is

(1) NH_4Cl (2) Manganese dioxide

(3) Potassium hydroxide (4) Sodium triphosphide

135. In lead storage battery, the anode reaction is

(1) $Pb^{2+} + 2e^- \rightarrow Pb$

(2) $Pb + H_2SO_4 \rightarrow PbSO_4 + 2H^+ + 2e^-$

(3) $PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$

(4) None of these

136. Which of the following reaction is redox reaction ?

(1) $NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$

(2) $KCN + AgCN \rightarrow K\,[Ag(CN)_2]$

(3) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

(4) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$

137. The number of electrons involved in the reduction

of nitrate ion to hydrazine is

(1) 8 (2) 7

(3) 5 (4) 4

138. A 100 watt, 110 volt lamp is connected in series with an electrolytic cell containing cadmium sulphate solution. What mass of cadmium will be deposited by the current flowing for 10 hours? (Given, Atomic mass of Cd = 112.4)

(1) 19 g (2) 91 g

(3) 17 g (4) 26 g

139. The standard reduction potential of Pb and Zn electrodes are –0.126 and –0.763 volts respectively. The e.m.f. of the cell Zn/Zn^{+2} (0.1 M) $||Pb^{+2}$ (1 M)/ Pb is

(1) 0.637 V (2) < 0.637 V

(3) > 0.637 V (4) 0.889 V

140. Standard electrode potential are

Fe^{+2}/Fe ($E° = -0.44$ V), Fe^{+3}/Fe^{+2} ($E° = 0.77$ V)

Fe^{+2}, Fe^{+3} and Fe blocks are kept together, then

(1) Fe^{+3} increases

(2) Fe^{+3} decreases

(3) Fe^{+2}/Fe^{+3} remains unchanged

(4) Fe^{+2} decreases

141. Standard electrode potential data are useful for understanding the suitability of an oxidant in a redox titration. Some half cell reactions and their standard potentials are given below;

$$MnO_4^-(aq) + 8H^+(aq) + 5\bar{e} \longrightarrow Mn^{2+}(aq) + 4H_2O(l); E° = 1.51\,V$$

$$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6\bar{e} \longrightarrow 2Cr^{3+}(aq) + 7H_2O(l); E° = 1.38\,V$$

$$Fe^{3+}(aq) + \bar{e} \longrightarrow Fe^{2+}(aq); E° = 0.77\,V$$

$$Cl_2(g) + 2\bar{e} \longrightarrow 2Cl^-(aq); E° = 1.40\,V$$

Identify the only incorrect statement regarding the quantitative estimation of aqueous $Fe(NO_3)_2$

(1) MnO_4^- can be used in aqueous HCl

(2) $Cr_2O_7^{2-}$ can be used in aqueous HCl

(3) MnO_4^- can be used in aqueous H_2SO_4

(4) $Cr_2O_7^{2-}$ can be used in aqueous H_2SO_4

142. The reduction potential of hydrogen half cell will be negative if

(1) $p(H_2) = 1$ atm and $[H^+] = 1$ M

(2) $p(H_2) = 2$ atm and $[H^+] = 2$M

(3) $p(H_2) = 2$ atm and $[H^+] = 1$M

(4) $p(H_2) = 1$ atm and $[H^+] = 2$ M

143. A solution containing one mole per litre each of $Cu(NO_3)_2$, $AgNO_3$, $Hg_2(NO_3)_2$ and $Mg(NO_3)_2$ is being electrolysed by using inert electrodes. The values of standard electrode potentials in volt (reduction potentials) are,

$Ag|Ag^+ = 0.80, 2Hg|Hg_2^{2+} = 0.79,$

$Cu|Cu^{2+} = +0.34$ and $Mg|Mg^{2+} = -2.37$

With increasing voltage, the sequence of deposition of metals on the cathode will be

(1) Ag, Hg, Cu, Mg (2) Mg, Cu, Hg, Ag

(3) Ag, Hg, Cu (4) Cu, Hg, Ag

144. What is the current required to deposit 0.50 g of platinum from a solution containing $[PtCl_6]^{-2}$ ion in 5 hours ? [At. wt. of Pt = 195]

(1) 19.5 Ampere (2) 0.055 Ampere

(3) 0.077 Ampere (4) 0.088 Ampere

145. If equal volumes of 1M $KMnO_4$ and 1M $K_2Cr_2O_7$ solutions are used to oxidise Fe^{+2} to Fe^{+3} in acidic medium then Fe^{+2} will be oxidised

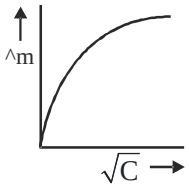
(1) more by $K_2Cr_2O_7$

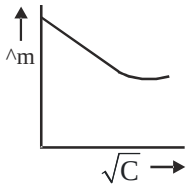
(2) more by $KMnO_4$

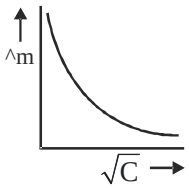
(3) equal in both the cases

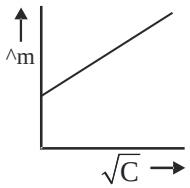
(4) the data is insufficient to predict the answer

146. Which one of the following graph represents correctly the variation of molar conductivity for a strong electrolyte?

(1) 

(2) 

(3) 

(4) 

147. The specific conductivity of a saturated solution of silver chloride is 2.30×10^{-6} S cm^{-1} at 25°C. What will be the solubility of silver chloride at 25°C if molar conductivities at infinite dilution for Ag^+ and Cl^- ions

are 61.9 and 76.3 S cm^2 mol^{-1} respectively

(1) 1.66×10^{-5} M (2) 2.382×10^{-3} M

(3) 2.33×10^{-5} M (4) None of these

148. Which of the followings act both as an oxidising agent as well as a reducing agent ?

(a) H_2O_2 (b) H_2S

(c) SO_2 (d) HNO_2

(1) (b), (c) & (d) (2) (a), (b) & (c)

(3) (a), (c) & (d) (4) All of these

149. To reduce Ag+ ion of 3.12 g silver sulphate, the amount of copper required is ? (Atomic weights : Cu = 63.5; Ag = 107.9; S = 32.1, O = 16)

(1) 63.5 g (2) 6.35 g

(3) 635 g (4) 0.635 g

150. Salts of X (atomic mass 15), Y (atomic mass 27) and Z (atomic mass 48) were electrolysed under similar conditions using the same amount of current. It was found that when 4.5 g of X was deposited, the masses of Y and Z deposited were 2.7 g and 9.6 g. The valencies of X, Y and Z are respectively

(1) 3, 1 and 3 (2) 3, 1 and 2

(3) 1, 3 and 2 (4) 2, 3 and 2

151. E°_{red} of different half cells are given below :

$E^o_{Cu^{2+}/Cu} = 0.34$ V; $E^o_{Zn^{+2}/Zn} = -0.76$ V,

$E^\circ_{Ag^+/Ag} = 0.80$ V; $E^o_{Mg^{+2}/Mg} = -2.37$ V

In which cell is ΔG° most negative ?

(1) Zn $|Zn^{+2}$ (1 M) $\|$ Ag^+ (1 M) | Ag

(2) Cu | Cu^{+2} (1 M)$\|$ Ag^+ (1 M) | Ag

(3) Ag | Ag^+ (1M) $\|$ Mg^{+2} (1M) | Mg

(4) Zn | Zn^{+2} (1M) $\|$ Mg^{+2} (1M) | Mg

152. How much will the reduction potential of a hydrogen electrode change when its solution initially at pH = 0 is neutralised to pH = 7.

(1) Increase by 0.059 V (2) Decrease by 0.059 V

(3) Increase by 0.41 V (4) Decrease by 0.41 V

153. In which of the following compounds, iron has the lowest oxidation number ?

(1) $Fe(CO)_5$ (2) Ferrocene

(3) $K_4[Fe(CN)_6]$ (4) Mohr salt

154. The oxidation number of C in HCN and HNC respectively are :

(1) +2, +4 (2) +4, +4

(3) –2, –2 (4) +2, +2

155. The standard reduction potential values of the elements, A, B and C are +0.34 V, –3.05 V and +2.86 V respectively. The order of their oxidising power will be :

(1) B > A > C (2) A < B < C

(3) B < A < C (4) C < B < A

156. The cost of electricity required to deposit 1 g of Mg is Rs. 5.00. How much would it cost to deposit 10 g of Al (Al = 27, Mg = 24)

(1) Rs. 10.00 (2) Rs. 27.00

(3) Rs. 44.44 (4) Rs. 66.67

157. The value of log K_c for the reaction Cu(s) + $2Ag^+$ (aq) $\rightarrow$ Cu^{2+} (aq). + 2Ag(s) is [$E^o_{Cell} = 0.46$ V]

(1) 15.6 (2) 1.56

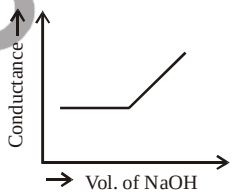
(3) 156 (4) None of these

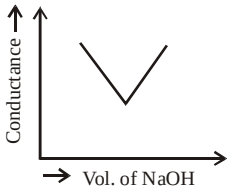
158. Thermodynamic efficiency of the fuel cells is given by

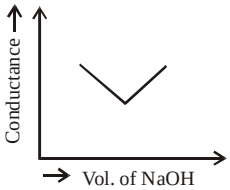
(1) $\frac{\Delta G^\circ}{\Delta H^\circ} \times 100\%$ (2) $\frac{\Delta G^\circ - \Delta H^\circ}{\Delta G^\circ} \times 100\%$

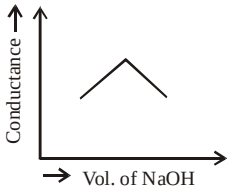
(3) $\frac{\Delta H^\circ}{\Delta G^\circ} \times 100\%$ (4) $\frac{\Delta H^\circ - \Delta G^\circ}{\Delta H^\circ} \times 100\%$

159. CH_3COOH is neutralized by NaOH. Conductometric titration curve will be of the type

(1) 

(2) 

(3) 

(4) 

160. The oxidation state of oxygen in O_2PtF_6 is

(1) zero (2) $+\frac{1}{2}$

(3) +1 (4) $-\frac{1}{2}$

161. When a lead storage battery is discharged

(1) SO_2 is evolved

(2) lead sulphate is consumed

(3) lead is formed

(4) sulphuric acid is consumed

162. When a copper wire is placed in a solution of $AgNO_3$, the solution acquires blue colour. This is due to the formation of

(1) Cu^{+2} ions

(2) Cu^+ ions

(3) Soluble complex of copper with $AgNO_3$

(4) Cu^- ion by the reduction of Cu

163. Of the following metals that cannot be obtained by the electrolysis of the aqueous solution of their salts are
(1) Ag and Mg (2) Ag and Al
(3) Mg and Al (4) Cu and Cr

164. A dilute aqueous solution of Na_2SO_4 is electrolysed using platinum electrodes. The products at the anode and cathode are
(1) O_2, H_2 (2) $S_2O_8^{2-}$, Na
(3) O_2, Na (4) $S_2O_8^{2-}$, H_2

165. The oxidation number of sulphur in S_8, S_2F_2, H_2S respectively, are
(1) 0, +1 and –2 (2) +2, + 1 and –2
(3) 0, +1 and +2 (4) –2, +1 and –2

166. Amongst the following, identify the species with an atom in +6 oxidation state
(1) MnO_4^- (2) $Cr(CN)_6^{3-}$
(3) NiF_7^{2-} (4) CrO_2Cl_2

167. The correct order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl is
(1) LiCl > NaCl > KCl (2) KCl > NaCl > LiCl
(3) NaCl > KCl > LiCl (4) LiCl > KCl > NaCl

168. The reaction,
$3\,ClO^-(aq) \rightarrow ClO_3(aq) + 2\,Cl^-(aq)$ is an example of
(1) Oxidation reaction (2) Reduction reaction
(3) Disproportionation (4) Decomposition reaction

169. Saturated solution of KNO_3 is used to make 'salt bridge' because
(1) Velocity of K^+ is greater than that of NO_3^-
(2) Velocity of NO_3^- is greater than that of K^+
(3) Velocities of both K^+ and NO_3^- are nearly the same
(4) KNO_3 is highly soluble in water

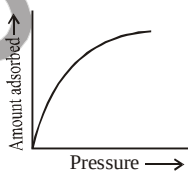
170. Lead storage battery commonly used, has
(1) 38% H_2SO_4 solution (2) 38% HNO_3 solution
(3) 38% H_3PO_3 solution (4) 38% NaOH solution

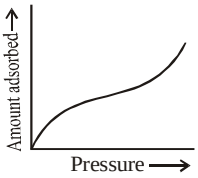
171. The resistance of 1 N solution of acetic acid is 250 ohm, when measured and its cell constant 1.15 cm^{-1}. The equivalent conductance (in $ohm^{-1}\,cm^2\,equiv^{-1}$) of 1 N acetic acid is
(1) 4.6 (2) 9.2
(3) 18.4 (4) 0.023

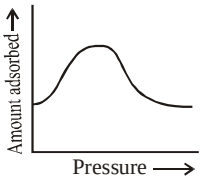
172. Beryllium is placed above magnesium in the II group. Beryllium dust, therefore, when added to $MgCl_2$ solution will:
(1) Have no effect
(2) Precipitate Mg metal
(3) Precipitate MgO
(4) Lead to dissolution of Be metal

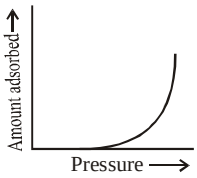
173. For the adsorption of a gas on a solid, the plot of log(x/m) verses log p is linear with slope equal to
(1) k (2) log k
(3) n (4) $\frac{1}{n}$

174. Which of the following gas is adsorbed most by activated charcoal ?
(1) CO_2 (2) N_2
(3) CH_4 (4) Ar

175. Which of the following curves do not correspond to adsorption isotherms?
(1) 

(2) 

(3) 

(4) 

176. Indicate the correct statement
(1) In chemisorption, there is no disruption of bonding in an absorbed molecule
(2) The rate of decomposition of the substance adsorbed on a surface depends on the surface coverage
(3) In heterogeneous catalytic reaction no surface reaction occurs
(4) Increase in surface area of catalyst reduces the surface phase reactions

177. The density of Cu is 8.94 g/ml. What are the number of F required to plate an area of 100 cm^3 to a thickness of 10^{-2} cm using $CuSO_4$ solution?
(1) 0.28 F (2) 0.56 F
(3) 0.14 F (4) 14 F

178. Separations of colloidal particles from those of

molecular dimension by means of electric current is known as

(1) Electroosmosis (2) Electrophoresis

(3) Electrodialysis (4) Electrolysis

179. The Brownian movement is due to

(1) enthalpy change during the formation of colloids

(2) attractive forces between the colloidal particles and the molecules of dispersion medium

(3) the impact of molecules of the dispersion medium on the colloidal particles

(4) the movement of positively charged colloidal particle to negatively charged particle

180. The critical micelle concentration (CMC) is

(1) the concentration at which micellization starts

(2) the concentration at which the true solution is formed

(3) the concentration at which one molar electrolyte is present per 1000 g of the solution

(4) the concentration at which $\Delta H = 0$

181. Fog is a colloidal solution of

(1) liquid particles dispersed in gas

(2) gaseous particles dispersed in a liquid

(3) solid particles dispersed in a liquid

(4) solid particles dispersed in gas

182. During Micelle formation

(1) $\Delta H = +ve, \Delta S = +ve$ (2) $\Delta H = -ve, \Delta S = -ve$

(3) $\Delta H = -ve, \Delta S = +ve$ (4) $\Delta H = +ve, \Delta S = -ve$

183. Which of the following statements is incorrect?

(1) Emulsions are prepared by shaking two liquid components, say oil and water and adding some emulsifying agent

(2) Water-in-oil emulsions are formed when the emulsifying agent at the interface is chiefly in the water phase

(3) Water-in-oil emulsions are formed when the emulsifying agent at the interface is chiefly in the oil phase

(4) Gems and gels mixed together to give emulsion

184. The coagulating power of an effective ion carrying the charge opposite to the sol particles is given by

(1) Brownian movement

(2) Gold number

(3) Tyndall effect

(4) Hardy-Schulz law

185. Hardy-Schulz law states that

(1) larger the size of the coagulating ions greater its coagulating power, having opposite sign of solution

(2) solution must have zero gold number

(3) disperse phase and dispersion medium must be of the same sign

(4) micelles coagulates in presence of surfactants

186. A freshly prepared $Fe(OH)_3$ precipitate is peptized by adding $FeCl_3$ solution. The charge on the colloidal particles is due to preferential adsorption of

(1) Br^- ion (2) Fe^{3+} ion

(3) OH^- ion (4) Ba^{2+} ion

187. Which of the following electrolytes is least effective in causing flocculation of ferric hydroxide sol?

(1) $K_3[Fe(CN)_6]$ (2) K_2CrO_4

(3) KBr (4) K_2SO_4

188. The Rubin number which was proposed by Ostwald as an alternative to the Gold number in order to measure the protective efficiency of a lyophilic colloid may be defined as the

(1) Mass in milligram of a colloid per 100 mL of standard sol of dye Congo–Rubin from red to violet when 0.16 g eq. KCl is added to it

(2) Mass in gram of a colloid per 100 mL of solution which just prevents the colour change of standard sol of dye Congo–Rubin from red to violet when 0.1 M KCl is added to it

(3) Mass in gram of a colloid per 100 mL of solution which just prevents the colour changed of standard sol of dye Congo–Rubin from red to violet when 0.2 M KCl is added to it

(4) Mass in gram of a colloid per 100 mL of solution which just prevents the colour change of standard sol of dye Congo–Rubin from red to violet when 1 M KCl is added to it

189. Which of the following is the most effective in the coagulation of gold sol ?

(1) $NaNO_3$ (2) $MgCl_2$

(3) Na_3PO_4 (4) $K_4[Fe(CN)_6]$

190. Which of the following forms cationic micelles above certain concentrations?

(1) Sodium dodecyl sulphate

(2) Urea

(3) Sodium acetate
(4) Cetyl trimethyl ammonium bromide

191. The ability of an ion to bring about coagulation of a given colloid depends on
(1) its size
(2) the magnitude of its charge
(3) the sign of the charge alone
(4) both magnitude and sign of its charge

192. An arsenious sulphide sol carries a negative charge. The maximum precipitating power for this sol is possessed by
(1) K_2SO_4 (2) $CaCl_2$
(3) Na_3PO_4 (4) $AlCl_3$

193. Cloud is a colloidal system in which the dispersion phase and dispersed medium are
(1) gas, liquid (2) liquid, gas
(3) solid, liquid (4) liquid, solid

194. A current of 9.65 A is passed for 3 hours between nickel electrodes in 0.5L of a 2M solution of $Ni(NO_3)_2$. The molarity of the solution after electrolysis would be
(1) 0.46 M (2) 0.625 M
(3) 0.92 M (4) 2 M

195. Which solution will have the highest b.p.?
(1) 1M $C_6H_{12}O_6$ solution (2) 1M NaCl solution
(3) 1M $BaCl_2$ solution (4) 1M $(NH_2)_2CO$ solution

196. Which among the following statement is false?
(1) increase of pressure increases the amount of adsorption
(2) Increase in temperature may decrease the amount of adsorption
(3) The adsorption may be monolayered or multilayered
(4) Particle size of the adsorbent will not affect the amount of adsorption

197. Colloid of which of the following can be prepared by electrical dispersion as well as reduction method?
(1) Sulphur
(2) Ferric hydroxide
(3) Arsenious sulphide
(4) Gold

198. The colloidal system in which the disperse phase and dispersion medium are both liquids is known as
(1) An emulsion (2) An aerosol
(3) Gel (4) A foam

199. When 1 mole of a solute is dissolved in 1kg of H_2O boiling point of solution was found to be 100.5°C. K_b for H_2O is
(1) 0.5 (2) 100
(3) 100.5 (4) 93.5

200. An aqueous solution contains 5% and 10% of urea and glucose respectively by wt. If K_f for water is 1.86, the freezing point of the solution is
(1) 3.03 K (2) –3.03°C
(3) +3.03°C (4) –3.03 K

SUBJECTIVE QUESTIONS

1. Calculate the vapour pressure of a solution at 100 °C containing 3 g of cane sugar in 33 g of water. (At.wt. C = 12, H = 1, O = 16)
2. Determine the entropy change when 2 mole of an ideal gas at 27 °C is expanded reversibly from 2 L to 20 L.
3. A heat engine operating between 227 °C and 27°C absorbs 1 k.cal of heat from the 227 °C reservoier per cycle. Calculate the efficiency of the cycle.
4. The standard emf for the cell reaction

   $2Cu^{+}(aq) \longrightarrow Cu(s) + Cu^{2+}(aq)$ is +0.36 V at 298 K. Determine the equilibrium constant for the reaction.
5. The standard emf of the following cell

   $Cd(s)|CdCl_2(aq)(0.1M)\,||\,AgCl(s)\,|\,Ag(s)$

   with the following cell reaction

   $Cd(s) + 2AgCl(s) \longrightarrow 2Ag(s) + Cd^{2+}(aq) + 2Cl^{-}(aq)$

   is 0.695 V at 0°C and 0.6753 V at 25°C. Calculate the enthalpy change for the reaction at 25 °C.
6. Calculate the osmotic pressure of 10% solution of cane sugar at 15 °C.
7. A 0.001 molal solution of the complex of the molecular formula $[Pt(NH_3)_4Cl_4]$ in water had a freezing point depression of 0.0054°C. If the K_f for water is 1.80, determine the correct formula of the above molecule.
8. A solution of 4.5 g of a pure non-electrolyte in 100 g of water was found to freeze at –0.465 °C. Determine the molecular weight of the solute.
9. The standard reduction potentials for two reactions are given below.

   $AgCl(s) + \bar{e} \longrightarrow Ag(s) + Cl^{-}(aq), E^{o} = 0.22\,V$

   $Ag(aq) + \bar{e} \longrightarrow Ag(s); \qquad E^{o} = 0.80\,V$

   Calculate the solubility product of AgCl under standard conditions of temperature.
10. One mole of an non-ideal gas undergoes a change of state (2.0 atm, 3.0 L, 95 K $\longrightarrow$ 4.0 atm, 5.0 L, 245 K) with a change in internal energy, $\Delta U = 30.0\,L$ atm. Determine the enthalpy (ΔH) of the process in L atm.
11. The standard emf for the cell reaction

    $Zn + Cu^{2+} \longrightarrow Cu + Zn^{2+}$ is 1.1 V at 25°C. Determine the emf for the cell reaction at 25 °C, when 0.1 M Cu^{2+} and 0.1 M Zn^{2+} solutions are used.
12. A 0.025 M solution of a monobasic acid has freezing point of –0.06°C. Find the value of K_a of this acid. K_f of water = 1.86 $kgmol^{-1}$ (density of solution = 1gml^{-1})
13. Give $Fe^{3+} + e^{-} \rightleftharpoons Fe^{2+}$; E° = 0.77 V; $Fe^{2+} + 2e^{-} \longrightarrow Fe$; E° = –0.44V.

    What will be the value of E° for half cell $Fe^{3+} + 3e^{-} \rightleftharpoons Fe$
14. Find the potential of hydrogen electrode at pH = 10 at 25°C.
15. KNO_3 is used in salt bridge as an electrolyte. Can $NaNO_3$ be used instead of KNO_3? Give reasons for your answer.
16. One mole of an ideal gas is allowed to expand reversibly and adibatically from a temperature of 27 °C. If the

work done during the process is 3 kJ, what will be final temperature? [Given $C_v = 20\ J\ K^{-1}$]

17. Enthalpy of vapourization for water is 186.5 kJ mol^{-1}. What is the entropy change during vapourisation and also predict the reaction is spontaneous or not.?
18. One gm sample of NH_4NO_3 is decomposed in a bomb calorimeter. The temperature of the calorimeter increases by 6.12 K. The heat capacity of the system is 1.23 KJ/g/deg. What is the molar heat of the decomposition for NH_4NO_3?
19. What is the electric work done in reducing 13.25g of aluminium chloride to aluminium.
20. Phenol associates in bengene to a certain extent to form a dimer. A solution containing 20×10^{-3} kg of phenol in 1.0 kg of benzene has its freezing point depressed by 0.69 K. Calculate the fraction of phenol that has dimerized.

ANSWERS

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UNIT - 3