M.Sc.(Industrial Chemistry)

1. V_2O_5 is used as a catalyst in the manufacture of
(A) Ammonia (B) Sulphuric Acid
(C) Polypropylene (D) Nylon-6

2. Which of the following processes is used to manufacture petroleum coke?
(A) Visbreaking (B) Delayed Coking
(C) Hydrocracking (D) Fluid catalytic cracking

3. In petroleum refining, the process used for conversion of hydrocarbons to aromatics is
(A) Catalytic cracking (B) Catalytic reforming
(C) Hydrotreating (D) Alkylation

4. Which of the following is a gas at atmospheric conditions?
(A) Methyl chloride (B) Methylene chloride
(C) Chloroform (D) Carbon tetrachloride

5. Phthalic anhydride is produced by the oxidation of
(A) Naphthalene (B) Benzene (C) Tolune (D) Aniline

6. Vinyl acetate is represented by the formula
(A) CH_2=CHCOOH (B) CH_2=CHOH
(C) CH_2=COOCH=CH_2 (D) CH_3COOCH=CH_2

7. Which of the following is a thermosetting plastic?
(A) Polyethylene (B) Teflon (C) Polypropylene (D) Bakelite

8. Natural rubber is mainly
(A) Polybutadiene (B) Polychloroprene
(C) Polystyrene (D) Polyisoprene

9. High excess air in combustion of fuels results in
(A) Increased fuel combustion (B) Incomplete combustion
(C) Smoky flame (D) Decreased combustion

10. Phosphoric acid is produced in wet process from phosphate rock and
(A) H_2SO_4 (B) NH_3 (C) HNO_3 (D) HCl

11. Liquefied petroleum gas (LPG) is mainly a mixture of
(A) Propane and butane (B) Methane and ethane
(C) High boiling olefins (D) High boiling naphthenes

12. Aniline point is a property of the
(A) Diesel (B) LPG (C) Naphtha (D) Gasoline

13. Chemical formula of BHC, which is an insecticide is

(A) $C_6H_6Cl_6$ (B) C_6Cl_6 (C) C_6H_5Cl (D) $C_6H_4Cl_2$

14. $CaSO_4.\frac{1}{2}.H_2O$ is known as

(A) Blue vitriol (B) Plaster of paris
(C) Gypsum (D) Zeolite

15. Digestion of wood base materials (for manufacture of pulp) is done to

(A) Removes lignin (B) Produce long fibres
(C) Prevent deterioration on storage (D) To reduce yield

16. The inlet pressure in a constant rate filtration

(A) Increases continuously (B) Decreases gradually
(C) Remains constant (D) First increases then decreases

17. What is the unit of kinematic viscosity in SI units?

(A) m^2/s (B) $N/m^2.s$ (C) kg.s/m (D) kg/m.s

18. Which is not a variable head meter?

(A) Venturimeter (B) Pitot tube (C) Rotameter (D) Orificemeter

19. The number of kg vaporized per kg of steam fed to the evaporator is defined as

(A) Capacity (B) Rate of evaporation
(C) Economy (D) Rate of condensation

20. Boiling point elevation of an ideal solution

(A) Increases rapidly with temperature rise
(B) Decreases rapidly with temperature rise
(C) Is independent of pressure
(D) Both (A) and (B)

21. The dipole moment of a hydrogen halide H-Xis 1.8Dand the bond length is 1.5 Å. The percentage ionic character of H-X will be

(A) 25 % (B) 50 % (C) 75 % (D) 80 %

22. Which of the following diatomic molecules would be stabilized by the removal of an electron?

(A) C_2 (B) CN (C) N_2 (D) O_2

23. Which of the following represents a set of hard acid and soft base respectively?

(A) Mg^+, O_2^{2-} (B) Mg^{2+}, SR^- (C) BF_3, F^- (D) BF_3, H_2O

24. Which of the following belongs to the C_{3v} point group?

(A) SO_3 (B) BBr_3 (C) NH_3 (D) $AlCl_3$

25. Carbon atom in $C_2(CN)_4$ are

(A) sp hybridized (B) sp^2 hybridised
(C) sp and sp^2 hybridised (D) sp, sp^2 and sp^3 hybridised

26. If you heat a 5 L balloon from a temperature of 25^0C to 50^0C, its new volume will be:
(A) 10 L (B) 2.5L (C) 5.42L (D) 4.61L

27. For the reaction 2HI (g) $\rightarrow H_2(g) + I_2(g)$, K_p= 0.0198 at 721 K. In a particular experiment, the partial pressures of $[H_2]$ and $[I_2]$ at equilibrium are 0.710 and 0.888 atm, respectively. The partial pressure of HI is
(A) 7.87 atm (B) 1.98 atm (C) 5.64 atm (D) 0.125 atm

28. 50 ml of 0.2 M KOH is added to 40 ml of 0.5 M HCOOH. The pH of the resulting solution is: (Ka = 1.8 x 10^{-4} and log 18 = 1.26)
(A) 3.74 (B) 5.64 (C) 7.57 (D) 3.42

29. Consider the following redox equation:

$12H^+_{(aq)} + 2IO_3^-{}_{(aq)} + 10Fe^{2+}_{(aq)} \rightarrow 10Fe^{3+}_{(aq)} + I_{2(s)} + 6H_2O_{(l)}$

The reducing agent is

(A) I_2 (B) H^+ (C) Fe^{2+} (D) IO_3^-

30. Carbenol is the trivial name for :
(A) $(CH_3)_3COH$ (B) C_2H_5OH (C) CH_3OH (D) $CH_3CH_2CHOHCH_3$

31. In a certain reaction ΔH = -136 kJ and Ea reverse = 236 kJ. Which of the following is true of its forward reaction?
(A) The reaction is exothermic and Ea = -100 kJ
(B) The reaction is exothermic and Ea = 100 kJ
(C) The reaction is endothermic and Ea = 372 kJ
(D) The reaction is endothermic and Ea = 232 kJ

32. A compound formed by elements A and B crystallizes in cubic structure, in which atoms of A are at the corners while that of B are at the face centre. The formula of the compound is –
(A) AB_3 (B) AB (C) A_3B (D) A_3B_2

33. The correct arrangement of NH_3, N_2H_4, NH_2OH and CH_3NH_2 in the order of increasing base strength is
(A) $NH_3 < N_2H_4 < NH_2OH < CH_3NH_2$ (B) $NH_2OH < N_2H_4 < NH_3 < CH_3NH_2$
(C) $CH_3NH_2 < NH_3 < N_2H_4 < NH_2OH$ (D) $N_2H_4 < NH_2OH < CH_3NH_2 < NH_3$

34. The calculated ground state magnetic moment of Sm^{3+} at room temperature is
(A) 0.84 BM (B) 5.97 BM (C) 3.25 BM (D) 7.9 BM

35. Which is thermodynamically unstable and also kinetically labile?
(A) $[Co(H_2O)_6]^{3+}$ (B) $[Co(H_2O)_6]^{2+}$ (C) $[Co(NH_3)_6]^{3+}$ (D) $[Co(NH_3)_6]^{2+}$

36. Which of the following conditions is necessary for a reaction to be spontaneous?

(A) $\Delta S_{sur} > 0$ (B) $\Delta S_{sys} > 0$ (C) $\Delta S_{sur} + \Delta S_{sys} > 0$ (D) $\Delta S_{sur} + \Delta S_{sys} < 0$

37. Calculate the equilibrium constant at 25°C for the reaction

$2\ NO(g) + O_2(g) \rightleftharpoons 2\ NO_2(g)$ given that $\Delta_r G° = -69.8\ kJ\ mol^{-1}$.

(A) 1.7×10^{12} (B) 28.2 (C) 1.03 (D) 5.91×10^{-13}

38. A typical compound undergoes Cannizaro's reaction and aldol condensation it is:

(A) $(CH_3)_2CHCHO$ (B) HCHO

(C) C_6H_5CHO (D) CH_3CHO

39. Which of the following will be strongly acidic ?

(A) When pOH = 4.5 (B) When pH = 14

(C) When pOH = 7 (D) When pH = 0

40. Correct relation between K_p, K_c, and K_x when number of moles of product is equal to number of moles of reactant :

(A) $K_p > K_c = K_x$ (B) $K_p = K_c = K_x$

(C) $K_p < K_c = K_x$ (D) $K_p = K_c \neq K_x$

41. Which of the following Maxwell's equations remain unchanged under all circumstances?

(A) $\vec{\nabla} \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}$ (B) $\vec{\nabla} \times \vec{H} = \vec{J} + \frac{\partial \vec{D}}{\partial t}$ (C) $\vec{\nabla} . \vec{D} = 0$ (D) $\vec{\nabla} . \vec{B} = 0$

42. In an ac circuit,

(A) The current always leads the voltage

(B) The current always lags behind the voltage

(C) The current and voltage are always in phase

(D) The phase relationship between current and voltage varies, depending on the circuit.

43. A metal bar radiates energy at 50 W at 200°C. The same bar at 250°C will radiate energy at

(A) 40 W (B) 75 W (C) 55 W (D) 1000 W

44. The electron's mass will be double of its rest mass at a speed of

(A) 0.75 c (B) 0.43 c (C) 0.5 c (D) 0.87 c

45. The Miller indices of a plane parallel to x and z axes are

(A) (1 1 0) (B) (1 0 1) (C) (0 1 0) (D) (1 1 1)

46. In a X-ray tube, the increase in the applied potential difference results in the

(A) Increase in the frequency of emitted X-rays

(B) Increase in the wavelength of emitted X-rays.

(C) Increase in the intensity of the emitted X-rays

(D) Increase in the speed of emitted X-rays

47. In case of a magnetic material, the neighboring dipoles will have negligible interaction if the material is

(A) Diamagnetic (B) Paramagnetic (C) Ferromagneic (D) Ferrimagnetic

48. According to Maxwell's law of distribution of molecules, the root mean square velocity of gas molecules is

(A) Greater than the mean velocity
(B) Greater than the most probable velocity
(C) Equal to the mean velocity
(D) Equal to the most probable velocity

49. According to Debye's theory of specific heat of soilds, the specific heat at high temperatures (T) is proportional to

(A) T (B) T^0 (independent of temperature)
(C) T^2 (D) T^3

50. An electron is confined to move in an infinite potential well that is 10 nm wide. The ground state energy of such an electron is given by

(A) 377 MeV (B) 1508 MeV (C) 3.77 MeV (D) 15 MeV

51. The direction of Hall voltage is

(A) Perpendicular to the applied electric field
(B) Perpendicular to the applied magnetic field
(C) Perpendicular to both the applied electric and magnetic field
(D) Is independent of the directions of the applied fields.

52. When a light wave is reflected at the surface of an optically denser medium, it suffers a phase change of

(A) π (B) $\pi/2$ (C) $\pi/4$ (D) 2π

53. If the number of lines on a diffraction grating is increased then

(A) The principal and secondary maxima will become sharp and intense.
(B) The principal and secondary maxima will become less sharp and less intense.
(C) The principal maxima will become intense and sharp while secondary maxima will become weaker.
(D) The principal maxima will become weaker while secondary maxima will become intense and sharp.

54. The wavelength of radiation given out by a laser with energy of 3 eV is

(A) 414 nm (B) 41.4 nm (C) 6.63×10^{-26} m (D) 663 nm

55. A spring having spring constant ''k'', mass ''m'' and frequency of oscillation ''ω'' is cut in half and the same mass is suspended from one of its halves. The frequency of oscillation becomes

(A) ω (B) 2ω (C) $\omega/2$ (D) $\omega/\sqrt{2}$

56. Electromagnetic waves are produced by

(A) An accelerated charge
(B) A moving but unaccelerated charge
(C) A static charge
(D) A chargeless particle

57. The de-broglie wavelength of wave associated with an electron accelerated through 150 volts is
(A) 0.1 nm (B) 1 nm (C) 2.02 nm (D) 0.22 nm

58. If the Fermi energy of a metal is 1.4 eV, the Fermi temperature of the metal is approximately
(A) 1.6 x 10^3 K (B) 1.6 x 10^4 K (C) 1.6 x 10^5 K (D) 1.6 x 10^6 K

59. The number of independent variables for a free particle in a 3-D space is
(A) N (B) 2N (C) 3N (D) Zero

60. The characteristic impedance of a perfect conductor to the electromagnetic wave is:
(A) Zero (B) One (C) Infinity (D) Negative

61. The general solution of the ordinary differential equation $2\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + y = 0$ is
(A) $y = [C_1 \cos\left(\frac{x}{2}\right) + C_2 \sin(\frac{x}{2})]$
(B) $y = e^{\frac{x}{2}}[C_1 \cos\left(\frac{x}{2}\right) + C_2 \sin(\frac{x}{2})]$
(C) $y = [C_1 \cos(x) + C_2 \sin(x)]$
(D) $y = e^{\frac{-x}{2}}[C_1 \cos\left(\frac{x}{2}\right) + C_2 \sin(\frac{x}{2})]$

62. The general solution of the differential equation $(D^3 + 4D)y = \sin(2x)$ where $D = \frac{d}{dx}$, is given by
(A) $y = c_1 + C_2 \cos(2x) + c_3 \sin(2x) - \frac{x}{8} \sin(2x)$
(B) $y = C_2 \cos(2x) + c_3 \sin(2x) + \frac{x}{8} \sin(2x)$
(C) $y = \cos(2x) + \sin(2x)$
(D) $y = c_1 e^x + c_2\, e^{2x} + \cos(2x)$

63. Find the Laplace transform of $(t) = e^t \cos(t)$.
(A) $\frac{s}{s^2+1}$ (B) $\frac{s-1}{(s-1)^2-4}$ (C) $\frac{s+1}{(s+1)^2+1}$ (D) $\frac{s-1}{(s-1)^2+1}$

64. Let $z = y\, f(\frac{y}{x})$, then the partial differential equation representing this surface is given by
(A) $z = p\, x + qy$ (B) $z = p\, x - qy$ (C) $z = p\, x^2 + qy^2$ (D) $z = p^2\, x + q^2 y$

65. Find the value of $\lim_{x\to\infty} \frac{2\, x^{5/3} - x^{1/3} + 7}{x^{8/5} + 3x + \sqrt{x}}$
(A) 2 (B)1 (C) ∞ (D) 0

66. Find the area of the region between the x-axis and the graph of the $f(x) = x^3 - x^2 - 2x$, $-1 \leq x \leq 2$.

(A) 12 (B) 37/12 (C) 10 (D) 43/12

67. The region between the curves $x = \frac{2}{y}$, $1 \leq y \leq 4$, and the y-axis is revolved about the y-axis to generate a solid. Find its volume.

(A) 20 (B) 2π (C) π (D) 3π

68. Find all real values of x for which the given series is convergent:

$$1 + x + x^2 + x^3 + x^4 + \cdots \ldots \ldots \ldots$$

(A) All real values of x (B) $|x| < 1$

(C) $|x| \leq 1$ (D) $|x| > 1$

69. The value of $\lim_{n\to\infty} \frac{\ln n}{n^{1/n}}$ is

(A) Divergent (B) 1 (C) 0 (D) -1

70. Find the angle between $\vec{A} = 3\hat{\imath} - 2\,\hat{\jmath} + \hat{k}$ and $\vec{B} = 2\,\hat{\jmath} + 4\,\hat{k}$.

(A) 30^o (B) 90^o (C) $\pi/4$ (D) 20^o

71. Find the value of $\int_0^2 \int_0^{\sqrt{4-y^2}} (x^2 + y^2) dx\, dy$

(A) π (B) 3π (C) 2π (D) $-\pi$

72. Find the rank of the matrix $A = \begin{bmatrix} 3 & 2 & -1 \\ 4 & 2 & 6 \\ 7 & 4 & 5 \end{bmatrix}$

(A) 1 (B) 3 (C) 0 (D) 2

73. Find the values of λ and μ for which the system of equations has a unique solution

$$3x + 2y + z = 6, \quad 3x + 4y + 3z = \mu, \quad 6x + 10\,y + \lambda\, z = \mu$$

(A) $\lambda = 8, \mu = 9$

(B) $\lambda \neq 8$, μ is any real number

(C) $\mu \neq 36$, λ is any real number

(D) $\lambda = 8$, $\mu = 4$

74. Find the eigen values of the matrix $B = \begin{bmatrix} 1 & 2 & -2 \\ 1 & 2 & 1 \\ -1 & -1 & 0 \end{bmatrix}$

(A) 1, -1,3 (B) 1,1,4 (C) 2,3,4 (D) 1,5,7

75. Compute A^{-2} given that $A = \begin{bmatrix} 1 & 1 \\ 2 & 4 \end{bmatrix}$.

(A) $\begin{bmatrix} 9/4 & 5/4 \\ 3/4 & 2/3 \end{bmatrix}$ (B) $\begin{bmatrix} 9 & 4 \\ 3 & 2 \end{bmatrix}$ (C) $\begin{bmatrix} 9/2 & -5/4 \\ -5/2 & 3/4 \end{bmatrix}$ (D) $\begin{bmatrix} -1 & -1 \\ 2 & -4 \end{bmatrix}$

x-x-x