THE GEMS TUITION

CHEMISTRY

PART-I

1. Lithium has a bcc structure. Its density is 530 kg/m^3 and its atomic weight is 6.94g mol^{-1}. Calculate the edge length of a unit cell of Lithium metal. (NA = 6.023*10^{23} mol^{-1})

   (A) 154 pm (B) 352 pm (C) 527pm (D) 264pm

2. The ionic radii of A+ and B- ions are 0.98*10^{-10} m and 1.81 * 10^{-10} m. The co-ordination number of each ion in AB is

   (A) 6 (B) 8 (C) 4 (D) 2

3. The CORRECT statement(s) for cubic close packed (ccp) three dimensional structure is(are)

(A) The number of the nearest neighbours of an atom present in the topmost layer is 12

(B) The efficiency of atom packing is 74%

(C) The number of octahedral and tetrahedral voids per atom are 1 and 2, respectively

(D) The unit cell edge length is 2J5 times the radius of the atom

4. The molarity of a NaOH solution by dissolving 4 gm of it in 250ml of water is

(A) 0.4 M (B) 0.8M (C) 0.2 M (D) 0.1 M

5. The vacant space in bcc lattice unit cell is :

(A) 23% (B) 32% (C) 26% (D) 48%

6. The correct statement regarding defects in crystalline solids is :-

(A) Frenkel defect is a dislocation defect
(B) Frenkel defect is found in hallides of alkaline metals
(C) Schottky defects have no effect on the density of crystalline solids
(D) Frenkel defects decrease the density of crystalline solids

7. The number of octahedral void(s) per atom present in a cubic close-packed structure is
(A) 4 (B) l (C) 3 (D) 2

8. If **a** is the length of the side of a cube, the distance between the body centered atom one corner atom in the cube will be –
(A) 2a/√3 (B) 4a/√3 (C) √3a/4 (D) √3a/2
9. To observe an elevation of boiling point of 0.05°C, the amount of solute (Mol-Wt-= 100) to be added to 1 00 g of water (K_b=0.5) is
(A) 2g (B) 0.5g (C) 1g (D) 0.75g
10. The ideal value of i (van't Hoff factor) for (NH4)3PO4.
(A) 5 (B) 3 (C) 4 (D) 2 (E) 1
11. Which one of the following concentration units varies with temperature?
(A) Molality (B) mole fraction (C) rnass percent (D) molarity
12. The molar boiling point constant is the ratio of the elevation in boiling point to
(E) molarity (B) Molality (C) mole fraction of solvent (D) less than that of water
13. A solution of glucose is 10%. The volume in which 1 gm mole of it is dissolved will be
(A) l dm3 (B) 1.8 dm3 (C) 200 cm3 (D) 900 cm3
14. If Z is the number of atom in the unit cell that represents the closest packing sequence … ABC ABC …, the number of tetrahedral voids in the unit cell is equal to
(A) Z (B) 2Z (C) Z/2 (D) Z/4
15. The radius of Na^+ is 95 pm and that of Cl^- is 181 pm. The coordination number of Na^+ is
(A) 8 (B) 6 (C) 4 (D) Unpredictable
16. A van der Waals gas may behave ideally when
(A) The volume is very low
(B) The temperature is very high
(C) The pressure is very low
(D) The temperature, pressure and volume all are very high
17. The measured freezing point depression for a 0.1 m aqueous CH3COOH solution is 0.19°C. The acid dissociation constant Ka at this concentration will be (Given Kf, the molal cryoscopic constant = 1.86 K kg mol–1)
(A) $4.76x10^{-5}$ (B) $4x10^{-5}$ (C) $8x10^{-5}$ (D) $2x10^{-5}$
18. The rms velocity of CO gas molecules at 27°C is approximately 1000 m/s. For N2 molecules at 600 K the rms velocity is approximately
(A) 2000 m/s (B) 1414 m/s (C)1000 m/s (D) 1500 m/s
19. A gas can be liquefied at temperature T and pressure P provided
(A) T = Tc and P < Pc (B) T < Tc and P > Pc (C) T > Tc and P > Pc (D) T > Tc and P < Pc
20. (^{32}Ge76, ^{34}Se76) and (^{14}Si30, ^{16}S32) are examples of
(A) isotopes and isobars (B) isobars and isotones (C) isotones and isotopes (D) isobars and isotopes

21. At a certain temperature the time required for the complete diffusion of 200 mL of H2 gas is 30 minutes. The time required for the complete diffusion of 50 mL of O2 gas at the same temperature will be
(A) 60 minutes (B) 30 minutes (C) 45 minutes (D) 15 minute
22. For one mole of an ideal gas the slope of V vs T curve at constant pressure of 2 atm is X lit mol^{-1}K^{-1}. The value of the ideal universal gas constant 'R' in term of X is
(A) X lit atm mol–1K–1 (B) X/2 lit a m mol–1K–1 (C) 2X lit atm mol–1K–1 (D) 2X atm lit^{-1}mol–1K^{-1}
23. As per de Broglie's formula a macroscopic particle of mass 100 gm and moving at a velocity of 100 cm s–1 will have a wavelength of
(A) 6.6×10^{-29} cm (B) 6.6×10^{-30} cm (C) 6.6×10^{-31} cm (D) 6.6×10^{-32} cm
24. The compressibility factor (Z) of one mole of a van der Waals gas of negligible 'a' value is
(A) 1 (B)1- bP/RT (C)1 +bP/RT (D)1 +RT/Pb
25. Which has the non-spherical orbital for the electron?
(A) He (B) B (C) Be (D) Li
26. If the shortest wavelength of H atom in Lyman series is x then longest wavelength in Balmer series of He^+ is
(A) 9x/5 (B) 36x/5 (C) x/5 (D) 5x/9
27. An oil drop has 8.01×10^{-19}C charge. Calculate the number of electrons in this drop
(A) 2 (B) 5 (C) 6 (D) 8
28. Magnetic moments of V, Cr, Mn, are X, Y, Z respectively, hence
(A) X=y=z (B) x<y<z (C) x<z<y (D) z<y<x
29. Alveoli are tiny sacs in the lungs whose average diameter is 510^{-10} m. Consider a oxygen molecule (5.3×10^{-26} kg) trapped within a sac. Calculate uncertainty in the velocity of oxygen molecule
(A) 1.99 m/s (B) 3.02m/s (C) 1.61 m/s (D) none
30. The energy of second orbit of hydrogen is equal to
(A) 4th orbit of He^+ (B) 4th orbit of Li^+ (C) 2nd orbit of He^+ (D) 2nd orbit of Li^+
31. Racial nodes are maximum in
(A) 4s (B) 4p (C) 3d (D)4f
32. The osmotic pressure of 0.1 M sodium chloride solution at 27^0C is
(A) 4.0Atm (B) 2.46atm (C) 4.92 atm (D) 1.23 atm
33. The temperature at which molarity of pure water is equal to is equal to its molality is
(A) 273 K (B) 298K (C) 277 K (D) none
34. The value of n for the valence shell of Palladium is (atomic number 46)
(A) 2 (B) 5 (C) 3 (D) 4
35. The correct set of four quantum number for the valence electrons of Rubidium (37) is
(A) 5, 1, 1 ,+1/2 (B) 5 ,0 ,1 ,+1/2 (C) 5, 0, 0, +1/2
(D) 5 ,1 ,0, +1/2

36. An ion Mn^{a+} has the magnetic moment = 4.9 bm. What is the value of a?
    (A) 1 (B) 3 (C) 2 (D) 5
37. A body of mass x kg is moving with velocity of 100m/sec. its De Broglie wavelength is 6.62×10^{-35} m. Hence x is?
    (A) 0.25 kg (B) 0.15 kg (C) 0.2 kg (D) 0.1 kg
38. If P^0 and P are the vapour pressure of the pure solvent and solution and n_1 and n_2 are the moles of solute and solvent respectively in the solution then the correct relation between P and P^0 is
    (A) $P^0= p[n_1/(n_1+n_2)]$
    (B) $P^0 = P[n_2/(n_1+n_2)]$
    (C) $P=P^0 [n_1/(n_1+n_2)]$
    (D) $P=P^0 [n_1/(n_1+n_2)]$
39. Sodium metal crystallizes in a body centred cubic lattice with a unit cell edge of 4.29 A^0 .the radius of sodium atom is approximately
    (A) 1.86 A^0 (B) 3.22 A^0 (C) 5.72 A^0 (D) 0.93 A^0
40. The temperature of an ideal gas is increased from 120K to 480 K. if at 120K, the root mean square speed of gas molecules is v, then at 480K, it will be
    (A) 4v (B) 2v (C) v/2 (D)v/4
41. What is the maximum number of orbitals that can be identified with the following? N=3, *l*= 1, m=0
    (A) 1 (B) 2 (C) 3 (D) 4
42. Which of the following behaves as ideal solution?
    (A) Benzene +toluene
    (B) Hexane+butane
    (C) Ethyl bromide+ ethyl chloride
    (D) None of these
43. In a simple cubic crystal the radius ratio should be
    (A) $\geq$ 0.732 (B) $\leq$ 0.732 (C) $\leq$0.424 (D) $\leq$0.225
44. Van der waals real gas, act as an ideal gas, at which condition?
    (A) High temperature, low pressure
    (B) low temperature, high pressure
    (C) High temperature, high pressure
    (D) low temperature, low pressure
45. Which of the following is iso-electronic with Na+?
    (A) O^{-2} (B) N_2 (C) Cl^- (D) none of these

PART-II

46. 29.2% (w/w) HCI stock solution has a density of 1.25 g ml^{-1} . The molecular weight of

HCI is 36.5 g mol^{-1}. The volume (mL) of stock solution required to prepare a 200 mL solution of 0.4 M HCI is

(A) 8 (B) 12 (C) 9 (D) 10

47. The Henry's law constant for the solubility of N2 gas in water at 298 K is 1.0 x 10^5 atm. The mole fraction of N2 in air is 0.8. The number of moles of N2 from air dissolved in 10 moles of water at 298 K and 5 atm pressure is

(A) 4.0 x 10^{-4} (B) 4.0 x 10^{-5} (C) 5.0× 10^{-4} (D) 4.0 x 10^{-6}

48. A solution contains 28% phosphoric acid by mass. This means that

(A) the density of this solution is 2.8 g/mL
(B) 1 mL of this solution contains 28 g of phosphoric acid
(C) 100 g of this solution contains 28 g of phosphoric acid
(D) 1 L of this solution has a mass of 28g
(E) 1 L of this solution contains 28 mL of phosphoric acid

49. In a solid AB having the NaCl structure, 'A' atom occupies the corners of the face cubic unit cell. If all the face centred atoms along one of the axis are removed then the resultant stoichiometry of the solid is?

(A) AB_2 (B) A_2B (C) AB (D) A_3B_4

50. The ratio of masses of oxygen and nitrogen in a particular gaseous mixture is 1:4. The ratio of their molecule is :

(A) 1:8 (B) 3:16 (C) 1:4 (D) 7:32

PHYSICS

PART-I

51. Nature of the image formed by a convex mirror is

(A) Real, inverted, diminished
(B) Real, inverted, enlarged
(C) Virtual, erect, diminished
(D) Virtual, erect, enlarged

52. Formula to find the refractive index of a medium is

(A) N= speed of light in the medium /speed of light in air
(B) N=1/ speed of light in air
(C) N= speed of light in the air/ speed of light in the medium
(D) N=1/ speed of light in the medium

53. When a ray of light passes from a denser medium to a rarer medium , which angle is greater?

(A) Angle of incidence

(B) Angle of refraction
(C) Both
(D) None

54. A ray of light travels from a medium of refractive index n_1 to a medium of refractive index n_2. If angle of incidence is 'i' and the angle of refraction is 'r'. Then refractive index is equal to
(A) n_1
(B) n_2
(C) n_{21}
(D) n_{12}

55. Speed of light in water is
(A) 3.0×10^8
(B) 2.3×10^8
(C) 2.0×10^8
(D) 1.2×10^8

56. Critical angle of water when refracted angle is 90^0 and refractive index for water and air is 1.33 and 1 respectively is
(A) 48.8^0
(B) 49.1^0
(C) 50^0
(D) 51^0

57. An alternating current has e.m.f V=300 Sin(500πt). The current is flowing through 150 Ω résistance. The R.M.S value of current is
(A) 14.14A (B) 1.414A C) 0.141A D) 3.0A

58. An alternating current is expressed as V= 200 Sin(2πt/T-φ). What is the frequency of that A.C current.
(A) 50Hz (B) 75Hz (C) 100Hz (D) 150 Hz

59. An alternating current has peak voltage V_o = 100 volt and frequency(f)= 60 Hz. After 1/360 sec the value of alternating voltage will be
(A) 122.49 (B) 122 (C) 122.87 (D)122.02

60. In an alternating current frequency is 50 Hz. How many times the A.C current will be zero within 2 seconds.
(A) 50 (B) 100 (C) 200 (D) 300

61. What will the time required for a 60 Hz alternating current to reach its peak value starting from zero.
(A) 1/60 sec (B) 1/120 sec (C) 1/180 sec (D) 1/240 sec

62. $I=I_o$ Sin wt and $V=V_o$ Cos $(wt+\pi/3)$. What is the phase difference between current and voltage?
    (A) $7\pi/3$ (B) $5\pi/6$ (C) 2π (D) Π
63. Mirror used for focusing light is
    (A) Concave (B) convex (C) plane mirror (D) none
64. A stick in the water is broken due to
    (A) Reflection of light
    (B) Refraction of light
    (C) Total internal reflection
    (D) None of these
65. An object of size 2.0 cm is placed perpendicular to the principal axis of a concave mirror. The distance of the object from the mirror equals to the radius of curvature. The size of the image will be _____.
    (A) (B) 1.5 cm (C) 1.0 cm (D) 2.0 cm
66. A ray of light strikes a glass plate at an angle of 60^0. If the reflected and refracted rays are perpendicular to each other then the refractive index of the glass is
    (A) $\sqrt{3}/2$ (B) 3/2 (C) ½ (D) $\sqrt{3}$
67. Light travels through a glass plate of thickness t and having refractive index μ. If e velocity of light c be the velocity of light in vaccum, time taken by the light to travel through this thickness of glass is
    (A) t/ μc (B) tc /μ (C) μt/c (D) μ/tc
68. The image formed by plane mirror is
    (A) Real and erect
    (B) Virtual and erect
    (C) Real and inverted
    (D) Virtual and inverted
69. The focus of a concave mirror is
    (A) Real (B) virtual (C) undefined (D) at the pole
70. The relation between the focal length and radius of curvature of a mirror is _____.
    (A) f/2 +1 =f
    (B) R+2 =f
    (C) f= R/2
    (D) f = 2R
71. For a plane mirror, magnification (m)=_____
    (A) 0 (B) 1 (C) $\pm$ 1 (D) ≤ 0
72. If the angle of incidence, $\theta_i = 0°$, the angle of reflection, θ_r = _____.
    0^0 (B) 90^0 (C) 180^0 (D) 45^0
73. If light travels from one medium to the other of which the refractive index is different, then which of the following will change?
    (A) Frequency, wavelength, and velocity

(B) Frequency and wavelength

(C) Frequency and velocity

(D) Wavelength and velocity

74. The mirage in desert is caused because

(A) The refractive index of atmosphere does not change with height

(B) There is effect of height on refractive index

(C) Light is reflected by the particles

(D) None of the above

75. An object is placed 40cm away from a concave mirror of focal length 20 cm. The image formed is

(A) Real, inverted and same in size

(B) Real, inverted and smaller

(C) Virtual, erect and larger

(D) Virtual erect and smaller

PART-II

76. To get three images of a single object, one should have two plane mirrors at an angle of

(A) 30^0 (B) 60^0 (C) 90^0 (D) 120^0

77. A boy of length 10m, to see his own complete image, requires a mirror of length at least equal to

(A) 10/4 (B) 10/3 (C) 10/2 (D) 10

78. An object placed 2m from a plane mirror is shifted by 0.5 m away from the mirror. What is the distance between the object and its image?

(A) 2m (B) 1.5 m (C) 5m (D) 3m

79. Light from a point source in air falls on a spherical glass surface (n= 1.5 and radius of curvature = 20 cm). the distance of the light source from the glass surface is 100cm. at what position the image is formed?

(A) +100cm (B) -100cm (C) +53cm (D) -53cm

80. What focal length should the reading spectacles have for a person for whom the least distance of distinct vision is 50 cm?

(A) +50 cm (B) -59 cm (C) +48cm (D) – 45cm