PAPER – I

PHYSICS

1. The potential difference and current flowing through an instrument in an a.c. circuit are given by $V = 5\cos\omega t$ volt, $I = -2\sin\omega t$ ampere. The power dissipated in the circuit is

(a) 5 W   (b) 2 W   (c) 10 W   (d) none of these

2. Two identical balls A and B are released from the positions shown in the figure. They collide elastically on horizontal portion MN. The ratio of the maximum height attained by A and B after collision will be (neglect friction)

(a) 1 : 4   (b) 2 : 1

(c) 4 : 13   (d) 2 : 5

3. In a uniform electric field a charge of 3C experiences a force of 3000 N. The potential difference between two points 1 cm apart along the electric line of force will be

(a) 10 V   (b) 100 V   (c) 30 V   (d) 300 V

4. When a β^+-particle is emitted from a nucleus, then its neutron-proton ratio

(a) increases   (b) decreases   (c) remains same   (d) first (a) and then (b)

5. Four resistors of 4 Ω each are connected to a 2V battery as shown in the figure. The ammeter reads a current of

(a) $\dfrac{1}{8}$ A   (b) $\dfrac{3}{8}$ A

(c) $\dfrac{1}{2}$ A   (d) 2A

6. Thermocouple is an arrangement of two different metal to

(a) convert heat energy into electrical energy

(b) produce more heat

(c) convert heat energy into chemical energy

(d) convert electrical energy into heat energy

7. In a pure inductor circuit, the angle between potential and current is

(a) 0   (b) π (c) $\pi/2$ (d) 2π

8. Two longitudinal waves of wavelength 100 cm and 90 cm, each of velocity 396 m/s interfere with each other. The number of beats in one second is

(a) 41   (b) 42   (c) 34   (d) 44

9. What will be the temperature when the rms speed of gas is double of that at 300 K

(a) 300 K   (b) 600 K   (c) 900 K   (d) 1200 K

10. According to Bohr's model of hydrogen atom, the radius of stationary orbits characterized by the principal quantum number is proportional to

(a) n^{-1} (b) n^{-2} (c) n (d) n^2

11. Refractive index depends upon

(a) angle of prism   (b) wavelength of light

(c) intensity of light   (d) frequency of light

12. A potential barrier of 0.50 V exists across a *p-n* junction. If the depletion region is 5.0×10^{-7} m wide, the intensity of the electric field in this region is

(a) 1.0×10^6 V/m   (b) 1.0×10^5 V/m   (c) 2.0×10^5 V/m   (d) 2.0×10^6 V/m

13. A capacitor of capacitance C has charge Q. It is connected to an identical capacitor through a resistance. The heat produced in the resistance is

(a) $\dfrac{Q^2}{2C}$ (b) $\dfrac{Q^2}{4C}$

(c) $\dfrac{Q^2}{8C}$ (d) dependent on the value of the resistance

14. The electric potential V at any point x, y, z (all in metres) in space is given by $V = 4x^2$ volts. The electric field (in V/m) at the point (1 m, 0, 2 m) is

(a) $-8\,\hat{i}$ (b) $8\,\hat{i}$ (c) $-16\,\hat{i}$ (d) $8\sqrt{5}\,\hat{i}$

15. If a particle is projected from origin and it follows the trajectory $y = x - \dfrac{1}{2}x^2$, then the time of flight is (g = acceleration due to gravity)

(a) $\dfrac{1}{\sqrt{g}}$ (b) $\dfrac{2}{\sqrt{g}}$ (c) $\dfrac{3}{\sqrt{g}}$ (d) $\dfrac{4}{\sqrt{g}}$

16. An air bubble of radius r in water is at a depth h below the water surface at some instant. If P is atmospheric pressure, d and T are density and surface tension of water respectively, the pressure inside the bubble will be

(a) $P + hdg - \dfrac{4T}{r}$ (b) $P + hdg + \dfrac{2T}{r}$ (c) $P + hdg - \dfrac{2T}{r}$ (d) $P + hdg + \dfrac{4T}{r}$

17. When a metal wire is elongated by hanging a load Mg on it, the gravitational potential energy of mass M decreases by Mgl. The energy appears

(a) as elastic potential energy completely

(b) as thermal energy completely

(c) half as elastic potential energy and half as thermal energy

(d) as kinetic energy of the load completely

18. A satellite is launched into a circular orbit of radius R around the earth. A second satellite is launched into an orbit of radius $1.01\ R$. The time period of the second satellite is larger than that of the first one by approximately.

(a) 0.5 % (b) 1.5 % (c) 1 % (d) 3.0 %

19. If a man at the equator weight $(3/5)^{\text{th}}$ of his actual weigh, the angular speed of the earth is

(a) $\sqrt{\dfrac{2}{5}\dfrac{g}{R}}$ (b) $\sqrt{\dfrac{g}{R}}$ (c) $\sqrt{\dfrac{R}{g}}$ (d) $\sqrt{\dfrac{2}{5}\dfrac{R}{g}}$

20. A uniform rod AB of mass m and length $2a$ is falling freely without rotation under gravity with AB horizontal. Suddenly the end A is fixed when the speed of the rod is v. The angular speed with which the rod begins to rotate is

(a) $\dfrac{v}{2a}$ (b) $\dfrac{4v}{3a}$ (c) $\dfrac{v}{3a}$ (d) $\dfrac{3v}{4a}$

21. Two particles of mass m_1 and m_2 are connected by a rigid massless rod of length r to constitute a dumb-bell which is free to move in the plane. The moment of inertia of the dumb-bell about an axis perpendicular to the plane passing through the centre of mass is

(a) $\dfrac{m_1 m_2 r^2}{m_1 + m_2}$ (b) $(m_1 + m_2)r^2$ (c) $\dfrac{m_1 m_2 r^2}{m_1 - m_2}$ (d) $(m_1 - m_2)r^2$

22. Assuming the diodes are ideal, current through the battery is zero
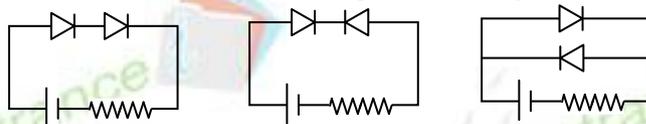
(i)　　　　(ii)　　　　(ii)

(a) in (i) and (iii) (b) in (ii) and (iii) (c) in only (ii) (d) in only (iii)

23. A particle is projected with a velocity v, so that its range on a horizontal plane is twice the greatest height attained. If g is acceleration due to gravity, then its range is

(a) $\dfrac{4v^2}{5g}$ (b) $\dfrac{4g}{5v^2}$ (c) $\dfrac{4v^3}{5g^2}$ (d) $\dfrac{4v}{5g^2}$

24. A graph AB shown in figure is a plot of the temperature of a body in degree Celsius and degree Fahrenheit. The slope of line AB is
(a) 9/5 (b) 5/9
(c) 1/9 (d) 3/9
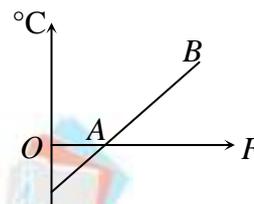
25. Which of the following statements is correct?

(a) Whenever heat is supplied to a gas, its internal energy increases

(b) Internal energy of a gas must increase when its temperature is decreased

(c) Internal energy of a gas may be increased even if heat is not supplied to the gas

(d) Internal energy of a gas is proportional to square of the velocity of the vessel in which the gas is contained.

26. According to second law of thermodynamics

(a) all heat can be converted into work

(b) the efficiency of a heat engine is always greater than unity

(c) it is not possible to transfer heat from lower to higher temperature by itself

(d) when heat changes to other forms, energy is conserved

27. A hollow and a solid sphere of same martial and identical outer surfaces are heated to the same temperature

(a) in the beginning both will emit equal amount of radiation per unit time

(b) in the beginning both will absorb unequal amount of radiation per unit time

(c) both spheres will have same rate of fall of temperature (dT/dt)

(d) both spheres will have equal temperatures at any moment

28. Two identical beakers are filled with water to the same level at 4°C. If A is heated while B is cooled, then:

(a) water level in A will rise (b) water level in B will remain constant

(c) water level in A will fall (d) water level in B will fall

29. A source of sound is moving with a velocity of 10 m/s towards an observer moving with a velocity of 10 m/s away from the source along the same straight line. If the frequency emitted by the source is 1000 Hz, the frequency received by observer will be, (velocity of sound in air = 332 m/s)

    (a) 2000 Hz   (b) 1500 Hz   (c) 1000 Hz   (d) 500 Hz

30. A mechanical wave propagates in a medium along the x-axis. The particles of the medium

    (a) may move on the x-axis   (b) does not move

    (c) must move on the y-axis   (d) must move on the x-axis

31. To prepare a print with 40 watt. lamp at 25 cm, it requires 3 seconds. If the distance is increased to 50 cm, how much time will be required to prepare the print?

    (a) 6 s   (b) 9 s   (c) 12 s   (d) 1 s

32. Two thin lenses are in contact and the foal length of the combination is 80 cm. If the focal length of one of the lenses is 20 cm, the power of the other lens is

    (a) 1.66 D   (b) 4.00 D   (c) -1.00 D   (d) -3.75 D

33. A beam of light is converging towards a point I on a screen. A plane parallel plate of glass whose thickness in the direction of beam $= t$, refractive index $= \mu$, is introduced in the path of the beam. The convergence point shifted by

    (a) $t\left(1 - \dfrac{1}{\mu}\right)$ away   (b) $t\left(1 + \dfrac{1}{\mu}\right)$ away   (c) $t\left(1 - \dfrac{1}{\mu}\right)$ nearer   (d) $t\left(1 + \dfrac{1}{\mu}\right)$ nearer

34. A balloon of mass M is descending at a constant acceleration α. When a mass m is released from the balloon it starts rising with the same acceleration α. Assuming that its volume does not change, what is the value of m?

    (a) $\dfrac{\alpha}{\alpha + g} M$ (b) $\dfrac{2\alpha}{\alpha + g} M$ (c) $\dfrac{\alpha + g}{\alpha} M$ (d) $\dfrac{\alpha + g}{2\alpha} M$

35. Equation $a = -\omega^2 y$ states the SHM of a body. Which of the following statement is correct?

    (a) The acceleration is maximum at the extreme position

    (b) Periodic time $T = 2\pi\sqrt{\omega}$

    (c) At $y = 0$, the potential energy is maximum

    (d) At $y = 0$, the kinetic energy is minimum

36. In Young's double slit experiment, the 7th maximum with wavelength λ_1 is at a distance d_1 and that with wavelength λ_2 is at a distance d_2. Then d_1/d_2 is

(a) λ_1/λ_2 (b) λ_2/λ_1 (c) λ_1^2/λ_2^2 (d) λ_2^2/λ_1^2

37. An ideal monatomic gas is taken round the cycle *ABCDA* as shown in figure. The work done by the gas during the cycle is

(a) *PV*   (b) $2PV$

(c) $\dfrac{1}{2}PV$ (d) Zero
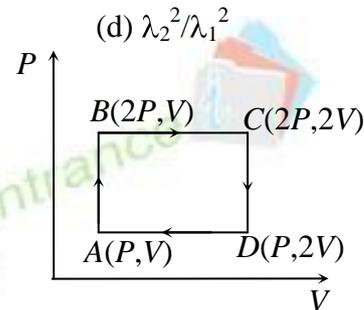
38. If $Q = \dfrac{X^n}{Y^m}$ and ΔX is maximum possible error in the measurement of *X*, ΔY is maximum possible error in the measurement of *Y*, then maximum possible error ΔQ in *Q* is

(a) $\Delta Q = \pm\left(n\dfrac{\Delta X}{X} + m\dfrac{\Delta Y}{Y} \right)$ (b) $\Delta Q = \pm\left(n\dfrac{\Delta X}{X} + m\dfrac{\Delta Y}{Y} \right)Q$

(c) $\Delta Q = \pm\left(n\dfrac{\Delta X}{X} - m\dfrac{\Delta Y}{Y} \right)Q$ (d) $\Delta Q = \pm\left(n\dfrac{\Delta X}{X} - m\dfrac{\Delta Y}{Y} \right)$

39. A monkey is climbing up a tree at a speed of 3 m/s. A dog runs towards the tree with a speed of 4 m/s. What is the magnitude of relative velocity of the dog as seen by the monkey?

(a) > 7 m/s   (b) Between 5 m/s and 7 m/s

(c) 5 m/s   (d) < 5 m/s

40. Two bodies *A* and *B* initially at rest are attracted towards each other due to gravitation. Given that *A* is much heavier than *B*, which of the following correctly describes the motion of the centre of mass of the bodies?

(a) It moves towards *A*   (b) It remains at rest

(c) It moves towards *B*

(d) it moves perpendicular to the line joining the particles.

41. If an electron is moving in a circle of radius *r*, with a frequency *n*, then magnitude of magnetic field at the centre is given by

(a) $\dfrac{\mu_0 ne}{2\pi r}$ (b) $\dfrac{\mu_0 ne}{2r}$ (c) $\dfrac{\mu_0 n^2 e}{2r}$ (d) none of these

42. The number of turns in the primary and secondary coils of a transformer are 1000 and 3000 respectively. If 80 volt AC is applied to the primary coil of the transformer, then the potential difference of the secondary coil would be

(a) 240 volt   (b) 2400 volt   (c) 24 volt   (d) 0.08 volt

43. The unit of magnetic susceptibility is

(a) Henry   (b) ampere/meter   (c) weber/meter   (d) none of these

44. In the circuit shown $V_D - V_A$ is
    (a) 4 V   (b) 2 V
    (c) 3 V   (d) none of these
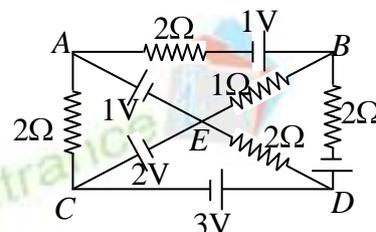
45. If the potential difference V applied to the Coolidge tube is doubled, then the cut-off wavelength of x-rays

    (a) becomes double   (b) becomes half

    (c) remains unchanged   (d) becomes quadruple

46. A radioactive element A with a half-life period of 2 hours decays giving a stable element Y. After a time t the ratio of X to Y atoms is $1 : 7$. Then t is
    (a) 6 hours   (b) 4 hours
    (c) between 4 and 6 hours (d) 14 hours

47. A particle of mass 10^{-31} kg is moving with a velocity equal to 10^5 m/s. The wavelength of the particle is equal to $(h = 6.63 \times 10^{-34})$
    (a) 0   (b) 6.6×10^{-8} m   (c) 0.66 m   (d) 1.5×10^7 m

48. The intensity of incident light falling on a photosensitive metal plate is doubled, the KE of the emitted photoelectrons is
    (a) double the earlier value   (b) unchanged
    (c) more than doubled   (d) less than doubled

49. In the series LCR circuit, the voltmeter and ammeter reading are
    (a) $V = 100$ volt, $I = 2$ amp
    (b) $V = 100$ volt, $I = 5$ amp
    (c) $V = 1000$ volt, $I = 2$ amp
    (d) $V = 300$ volt, $I = 1$ amp
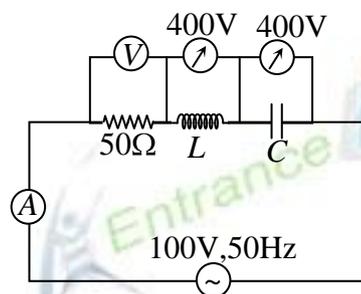
50. Two circular coils of radii R_1 and R_2, turns N_1 and N_2 are placed concentrically in the same plane. If $R_2 \ll R_1$, then the mutual inductance between them is equal to

    (a) $\dfrac{\mu_0 \pi R_2^2}{2R_1}$ (b) $\dfrac{\mu_0 \pi R_2^2 N_1 N_2}{2R_1}$ (c) $\dfrac{\mu_0 \pi R_2 N_1 N_2}{2R_1}$ (d) $\dfrac{\mu_0 \pi R_1 N_1 N_2}{2R_2}$

51. A metal disc of radius R rotates with an angular velocity ω about an axis perpendicular to its plane passing through its centre in a magnetic field induction B acting perpendicular to the plane of the disc. The induced emf between the rim and the axis of the disc is

    (a) $B\pi R^2$ (b) $\dfrac{2B\pi^2 R^2}{\omega}$ (c) $B\pi R^2 \omega$ (d) $\dfrac{BR^2 \omega}{2}$

52. The period of oscillations of a magnet is 2 s. When it is remagnetised the pole strength becomes 4 times. Its period of oscillation will become

(a) 4 s   (b) 2 s   (c) 1 s   (d) $\dfrac{1}{2}$ s

53. The angle of dip is the angle
(a) between the vertical component of earth's magnetic field and magnetic meridian
(b) between the vertical component of earth's magnetic field and geographic meridian
(c) between earth's magnetic field direction and horizontal direction
(d) between the magnetic meridian and the geographic meridian.

54. Cyclotron frequency depends upon
(a) radius   (b) velocity   (c) magnetic induction   (d) none of these

55. Two particles each of mass m and charge q are attached to the two ends of a light rod of length $2R$. The rod is rotated at constant angular speed about a perpendicular axis passing through its centre. The ratio of the magnitudes of the magnetic moment of the system and its angular momentum about the centre of the rod is

(a) $(q/2\,m)$ (b) (q/m) (c) $(2q/m)$ (d) $(q/\pi m)$

56. If electron velocity is $2\hat{i}+3\hat{j}$ and it is subjected to magnetic field of $4\hat{k}$, then its

(a) speed will change   (b) path will change
(c) both (a) and (b)   (d) none of these

57. The neutral temperature of copper-iron thermocouple is 270°C. If the temperature of cold junction is 20°C, then the temperature of inversion will be

(a) 540°C   (b) 520°C   (c) 490°C   (d) 500°C

58. A galvanometer has a resistance of 3663 ohm. A shunt S is connected across it such that (1/34) of the total current passes through the galvanometer. Then the value of shunt is

(a) 3663 Ω (b) 111 Ω (c) 107.7 Ω (d) 3555.3 Ω

59. A current of 2 amperes flows in a system of conductors as shown in figure. The potential difference $(V_A - V_B)$ will be (in volt)
(a) +2   (b) +1
(c) –1   (d) –2
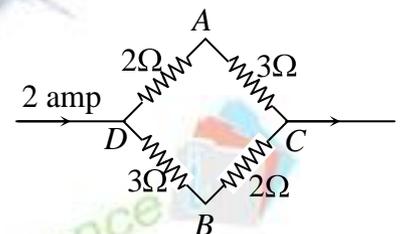
60. A cell of emf E is connected across a resistance r. The potential difference between the terminals of the cell is found to be V. The internal resistance of the cell must be

(a) $\dfrac{2(E-V)V}{r}$ (b) $\dfrac{2(E-V)r}{E}$ (c) $\dfrac{(E-V)r}{V}$ (d) $(E-V)r$

CHEMISTRY

61. Which one of the following relationship is correct?

(a) $\overline{KE} = \dfrac{2}{3}kT$

(b) $\left(P - \dfrac{an^2}{V^2}\right)(V - nb) = nRT$

(c) $\left(P - \dfrac{an^2}{V^2}\right)(V + nb) = nRT$

(d) $PV = nRT$

62. Resonance structures can be written for

(a) O_3

(b) NH_3

(c) CH_4

(d) H_2O
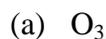
63. For a dilute solution, Raoult's law states that

(a) the lowering of vapour pressure is equal to the mole fraction of the solute.

(b) the relative lowering of vapour pressure is equal to the mole fraction of the solute.

(c) the relative lowering of vapour pressure is equal to the amount of the solute in the solution.

(d) the vapour pressure of the solution is equal to the mole fraction of the solvent.

64. The number of electrons required to balance the following equation,

$$NO_3^- + 4H^+ + e^- \longrightarrow 2H_2O + NO$$

is

(a) 5

(b) 4

(c) 3

(d) 2

65. Which of the following is not a redox reaction?

(a) $CaCO_3 \longrightarrow CaO + CO_2$

(b) $O_2 + 2H_2 \longrightarrow 2H_2O$

(c) $Na + H_2O \longrightarrow NaOH + \frac{1}{2}H_2$

(d) $MnCl_3 \longrightarrow MnCl_2 + \frac{1}{2}Cl_2$
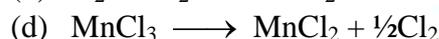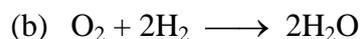
66. The rate of reaction $(A + B + C \longrightarrow$ Products$)$ is given by $r = -\dfrac{d[A]}{dt} = k[A]^{1/2}\,[B]^{1/3}\,[C]^{1/4}$ the order of reaction is

(a) 1

(b) 2

(c) 3

(d) $\dfrac{13}{12}$

67. If 4g of oxygen diffuse through a very narrow hole, how much hydrogen would have diffused under identical conditions?

(a) 16 g

(b) 1 g

(c) ¼ g

(d) 64 g

68. As long as the plant is alive the ratio ^{14}C to ^{12}C in the wood is

(a) the same as in the atmosphere.

(b) less as found in the atmosphere.

(c) more as found in the atmosphere.

(d) none of the above.

69. Which is the correct order of acidic strength of the following acids?
(a) $CH_3CH_2COOH > CH_2=CH-COOH > CH\equiv C-COOH$
(b) $CH_3CH_2COOH < CH_2=CH-COOH < CH\equiv C-COOH$
(c) $CH_3CH_2COOH < CH_2=CH-COOH > CH\equiv C-COOH$
(d) $CH_3CH_2COOH > CH_2=CHCOOH < CH\equiv C-COOH$

70. Which of the following statement regarding alkali metals is not correct?
(a) Alkali metals tarnish in air.
(b) They are kept under kerosene.
(c) All alkali metals form oxides on burning in air.
(d) The reaction of alkali metals with water increases in violence on descending the group.

71. Oxidation state of oxygen is $-\dfrac{2}{3}$ in
(a) K_2O (b) KO_2
(c) K_2O_3 (d) K_2O_2

72. The highest oxidation state of Cr is
(a) $+4$ (b) $+5$
(c) $+6$ (d) $+7$

73. How many isomers are possible for the compound C_3H_8O
(a) 2   (b) 3
(c) 4   (d) 5

74. Which of the following compounds is not chiral?
(a) $DCH_2CH_2CH_2Cl$ (b) CH_3CH_2CH-Cl with D below
(c) CH_3CHDCH_2Cl (d) $CH_3CHCl.CH_2D$

75. Which one of the following has the smallest heat of hydrogenation per mole?
(a) 1–butene   (b) trans–2–butene
(c) cis–2–butene   (d) 1,3–butadiene

76. Which compound will react with an aqueous solution of $Ag(NH_3)_2^+OH^-$?
(a) $CH_3-C\equiv C-CH_3$ (b) $CH_3CH_2C\equiv CH$
(c) CH_3-CH_3 (d) $CH_2=CH_2$

77. Aldehyde is formed when following is hydrolysed
(a) ethane   (b) ether
(c) ethyne   (d) none of these

78. In the Cannizzaro reaction given below,

$$2Ph-CHO \xrightarrow{OH^-} Ph-CH_2OH + PhCO_2^-$$

the slowest step is
(a) the attack of OH^- at the carbonyl group.
(b) the transfer of hydride to the carbonyl group.
(c) the abstraction of proton from the carboxylic acid.
(d) the deprotonation of $Ph-CH_2OH$.

79. The velocity possessed by most of the gaseous molecules is
    (a) average velocity
    (b) most probably velocity
    (c) R.M.S. velocity.
    (d) none of these

80. At constant temperature, the osmotic pressure of a solution is
    (a) directly proportional to the concentration.
    (b) inversely proportional to the concentration.
    (c) directly proportional to the square of the concentration.
    (d) directly proportional to the square root of the concentration.

81. For the manufacture of ammonia by the reaction,
    $$N_2 + 3H_2 \rightleftharpoons 2NH_3 + 21.9 \text{ kcal}$$
    the favourable conditions are
    (a) low temperature, low pressure and catalyst.
    (b) low temperature, high pressure and catalyst.
    (c) high temperature, low pressure and catalyst.
    (d) high temperature, high pressure and catalyst.

82. Which of the following is not a redox reaction?
    (a) $2Na + Cl_2 \longrightarrow 2NaCl$
    (b) $C + O_2 \longrightarrow CO_2$
    (c) $AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$
    (d) $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

83. The heat absorbed in a reaction at constant temperature and constant volume is
    (a) ΔE
    (b) ΔH
    (c) $-\Delta A$
    (d) $-\Delta G$

84. In the modern periodic table
    (a) there are eight elements in the third period.
    (b) there are eight elements in the fourth period.
    (c) the horizontal rows are termed as groups.
    (d) the vertical columns are termed as periods.

85. Which of the following is a neutral oxide?
    (a) CO
    (b) CO_2
    (c) SO_3
    (d) MgO

86. Which of the following is not the mineral of iron?
    (a) Magnetite
    (b) Magnesite
    (c) Siderite
    (d) Lemonite

87. Which of the following is Epsom salt?
    (a) $MgCl_2.6H_2O$
    (b) $MgSO_4.7H_2O$
    (c) $Mg(NO_3)_2.6H_2O$
    (d) $Mg_3(PO_4)_2$

88. The oxidation states of Cr in $K_2Cr_2O_7$ and K_2CrO_4 are respectively
    (a) $+6, +6$
    (b) $+6, +7$
    (c) $+7, +6$
    (d) $+7, +7$

89. Among the following compounds, the strongest acid is
(a) $HC\equiv CH$
(b) C_6H_6
(c) C_2H_6
(d) CH_3OH

90. Which of the following is correct order of reactivity of H atoms of alkanes?
(a) primary H > secondary H > tertiary H
(b) secondary H > primary H > tertiary H
(c) tertiary H > primary H > secondary H
(d) tertiary H > secondary H > primary H

91. Which of the following is freon−12?
(a) CCl_2F_2
(b) CCl_4
(c) CF_4
(d) C_2Cl_6

92. One can distinguish between HCOOH and CH_3COOH with
(a) $NaHCO_3$
(b) H_2SO_4
(c) Tollen's reagent
(d) I_2/OH^-

93. In hcp arrangement, the co−ordination number is
(a) 6
(b) 12
(c) 8
(d) 10

94. The rate law expression for the hypothetical reaction $2A + 3B \longrightarrow 2C$ is
$\dfrac{dx}{dt} = k[A][B]^2$. The order of reaction is
(a) 1
(b) 2
(c) 3
(d) 5

95. How many mole of MnO_4^- ion will react with 1 mol of ferrous oxalate in acidic medium?
(a) 1/5
(b) 2/5
(c) 3/5
(d) 5/3

96. In a reaction,
$$FeS_2 + KMnO_4 + H^+ \longrightarrow Fe^{+3} + SO_2 + Mn^{+2} + H_2O$$
the equivalent mass of FeS_2 would be equal to
(a) molar mass
(b) $\dfrac{molar\ mass}{10}$
(c) $\dfrac{molar\ mass}{11}$
(d) $\dfrac{molar\ mass}{13}$

97. Which of the following parameters are the same for all hydrogen−like atoms and ions in their ground states?
(a) radius of the orbit.
(b) speed of the electron.
(c) energy of the atom.
(d) orbital angular momentum of the electron.

98. The orbital angular momentum of an electron in a Bohr orbits is given as

(a) $L = n\left(\dfrac{h}{2\pi}\right)$

(b) $L = \sqrt{l(l+1)}\left(\dfrac{h}{2\pi}\right)$

(c) $L = m\left(\dfrac{h}{2\pi}\right)$

(d) $L = \left(\dfrac{h}{4\pi}\right)$

99. An element occurs in bcc structure. Its density is 8.0 g cm^{-3}. If the cell edge is 250 pm, the atomic mass of the element is

(a) 26.4 g mol^{-1}

(b) 37.6 g mol^{-1}

(c) 54.5 g mol^{-1}

(d) 86.1 g mol^{-1}

100. In the reaction $PCl_5 \rightleftharpoons PCl_3 + Cl_2$, the amounts of PCl_5, PCl_3 and Cl_2 at equilibrium are 2 mole each and the total pressure is 3 atm. The equilibrium constant K_p is

(a) 1.0 atm

(b) 2.0 atm

(c) 3.0 atm

(d) 6.0 atm

101. A sample of oleum is labeled 118%. The percentage of free SO_3 in the sample is

(a) 40

(b) 80

(c) 60

(d) 9

102. Rate constant of a first order reaction is 0.0693 min^{-1}. If we start with 20 mol L^{-1}, it is reduced to 2.5 mol L^{-1} in

(a) 10 min

(b) 20 min

(c) 30 min

(d) 40 min

103. If P° is the vapour pressure of a pure solvent and P is the vapour pressure of the solution prepared by dissolving a non–volatile solute in it. The mole fraction of the solvent X_A is given by

(a) $\dfrac{P^\circ - P}{P^\circ} = X_A$

(b) $\dfrac{P^\circ - P}{P} = X_A$

(c) $\dfrac{P}{P^\circ} = X_A$

(d) $P^\circ - P = X_A$

104. 4 moles of A are mixed with 4 moles of B, when 2 moles of C are formed at equilibrium according to the reaction

$$A + B \rightleftharpoons C + D$$

The value of equilibrium constant is

(a) 4

(b) 1

(c) 1/2

(d) 1/4

105. The difference between heats of reaction at constant pressure and constant volume of the following reaction would be

$$2C_6H_6(l) + 15O_2(g) \longrightarrow 12CO_2(g) + 6H_2O(l) \quad \text{at 25°C in kJ mol}^{-1} \text{ is}$$

(a) -7.43

(b) $+3.72$

(c) -3.72

(d) $+7.43$

106. The emf of the cell in which the following reaction,

$$Zn(s) + Ni^{2+} (0.1 \text{ M}) \longrightarrow Zn^{2+} (1.0 \text{ M}) + Ni(s)$$

occurs, is found to be 0.5105 V at 298 K. The standard emf of the cell is

(a) 0.4810 V   (b) 0.5696 V
(c) −0.5105 V   (d) 0.5400 V

107. How many faradays are needed to reduce a mole of MnO_4^- to Mn^{2+}?

(a) 4   (b) 5
(c) 3   (d) 2

108. If the concentration of a reactant 'A' is doubled and the rate of its reaction increases by a factor of 2, the order of reaction with respect to 'A' is

(a) 1   (b) zero
(c) 2   (d) 3

109. How many geometrical isomers are possible for the compound: C_6H_5–CH=CH–CH=CH–COOH?

(a) 3   (b) 4
(c) 2   (d) 1

110. Consider the following reaction,
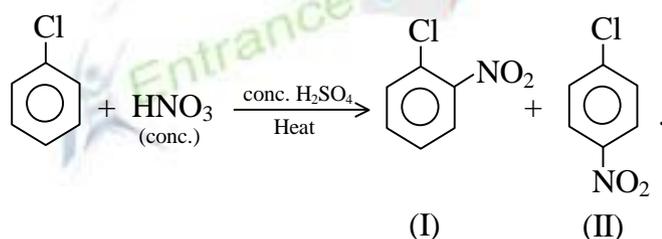
Which of the following statement is correct?

(a) It is an electrophilic addition reaction.

(b) The attacking species is NO_3^- ion.

(c) The role of conc. H_2SO_4 is to react with conc. HNO_3 to produce NO_2^+ ions.

(d) Compound I is the major product of the reaction

111. Which of the following is the strongest acid?

(a) Benzoic acid   (b) o–hydroxy benzoic acid
(c) p–hydroxy benzoic acid   (d) 2,6–dihydroxybenzoic acid

112. The reaction of CH₃CH=CH—⟨⟩—OH with HBr gives

(a) $CH_3CHBrCH_2$—⟨⟩—OH   (b) CH_3CH_2CHBr—⟨⟩—OH

(c) $CH_3CHBrCH_2$—⟨⟩—Br   (d) CH_3CH_2CHBr—⟨⟩—Br

113. To transform into , initial steps could be
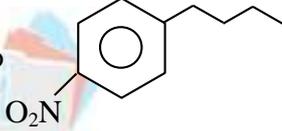
(a) Nitration followed by Friedel–Crafts alkylation.

(b) Friedel–Crafts alkylation followed by nitration.

(c) Nitration followed by Friedel–Crafts acylation.

(d) Friedel–Crafts acylation followed by Clemmensen's reduction followed by nitration.

114. The oxygen atom in phenol

(a) exhibits only inductive effect.

(b) exhibits only resonance effect.

(c) has more dominating resonance effect than inductive effect.

(d) has more dominating inductive effect than the resonance effect.

115. + $CH_3CH_2-CH_2-Cl \xrightarrow{AlCl_3}$ (X). Major product (X) formed in the reaction will be

(a)
$CH_2CH_2CH_3$

(b)
CH_3
$C-CH_3$
H

(c)
CH_3
H

(d)
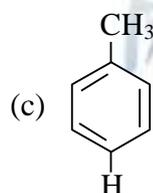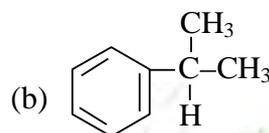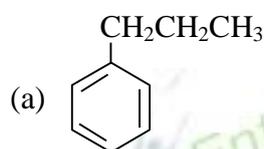
116. Which of the following is least basic in aqueous medium?

(a) $CH_3CH_2NH_2$

(b) CH_3NH_2

(c) $(Me)_3C-NH_2$

(d) $(Me)_2CH-NH_2$

117. $CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-CH_2-OH \xrightarrow[\text{(ii) } \Delta]{\text{(i) dil. } H^+}$ major product will be

(a) 2–methyl–2–butene

(b) 3–methyl–2–butene

(c) 2,2–dimethyl propene

(d) 1–methyl–1–butene

118. $\xrightarrow[\text{2. Y}]{\text{1. X}}$. X and Y would be

(a) Br_2/hv, alk. $KMnO_4$

(b) alc. KOH, NBS

(c) NBS, alc. KOH

(d) alk. $KMnO_4$, Br_2/hv

119. $\overset{14}{\text{PhCOCHO}} \xrightarrow{\text{OH}^-} (A).$

The product (A) in the given reaction is

(a) $\overset{14}{\text{PhCHOHCH(OH)O}^-}$

(b) $\overset{14}{\text{PhCHOHCOO}^-}$

(c) $\overset{14}{\text{PhCOOCH}_3}$

(d) $\overset{14}{\text{PhCHOHCH}_3}$

120. In a Cannizaro reaction, the intermediate that will be the best hydride donor is

(a)

(b)

(c)

(d)