PAPER – I

PHYSICS

1. A train is moving towards a hill with a speed 108 km/hr. The engine of the train blows a whistle of frequency 600 Hz. Speed of sound in air being 330 m/sec, frequency of the reflected sound heard by a passenger sitting in the train will be

(a) 950 Hz (b) 840 Hz (c) 720 Hz (d) 680 Hz

2. Mass of a spherical object (10±1)g. Its radius is $\left(\frac{3}{\pi}\right)^{\frac{1}{3}}$ cm with a percentage error of 2%. Density of the object can be expressed as

(a) (2.5 ± 0.6) g/cm^3 (b) (2.5 ± 0.8)g/cm^3 (c) (2.5 ± 0.4)g/cm^3 (d) (2.5 ± 0.3)g/cm^3

3. A person swims from bank A of a river to the other bank B in shortest time. In doing so, he takes 5 minutes and travels an actual distance 1 km. Now he swims from bank B to A along shortest path and travels an actual distance 800m. Speed of water (river) is

(a) 2.5 m/sec (b) 2.0 m/sec (c) 1.5 m/sec (d) 3.0 m/sec

4. Stationary waves, represented by $y = 25\sin(50t)\cos(0.02x)$, are formed due to superposition of progressive waves of equal wavelength travelling in opposite directions with equal speeds. In the given equation t is in sec, y and x in metre. Speed of the progressive wave is

(a) 1250 m/sec (b) 1000 m/sec (c) 2500 m/sec (d) 330 m/sec

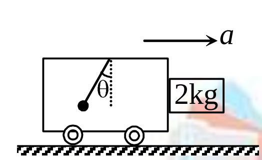
5. Two tuning forks X and Y are sounded together producing 10 beats per second, X is in resonance with 30 cm long air column closed at one end and Y is in resonance with 59 cm long air column open at both ends. Frequencies of forks X and Y are

(a) 500 Hz, 510 Hz (b) 590 Hz, 600 Hz (c) 256 Hz, 266 Hz (d) 410 Hz, 400 Hz

6. Two mutually perpendicular simple harmonic motions are impressed upon a particle such that x and y coordinates are given by $x = 4\sin\omega t$ and $y = 4\sin(\omega t - \pi/2)$. The particle describes

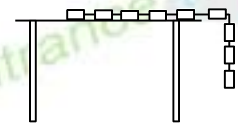
(a) circle (b) parabola (c) ellipse (d) straight line

7. A simple pendulum is suspended from the ceiling of a trolley. As shown, the trolley is moving towards right with a block of mass 2 kg in contact with its vertical side and with such an acceleration that the block is just prevented from falling under gravity. Coefficient of friction between the surfaces of trolley and the block being $\frac{1}{2}$, inclination of the pendulum to the vertical will be



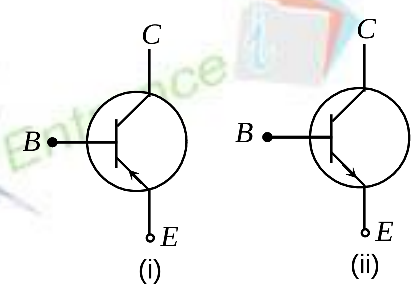
(a) $\sin^{-1}\left(\frac{1}{2}\right)$ (b) $\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$ (c) $\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$ (d) $\tan^{-1} 2$

8. A uniform chain of mass *M* and length *L* is placed such that a part of its lies horizontally on a table and the other part hangs along the vertical as shown in figure. Coefficient of limiting friction being μ=0.25, what maximum percent of total length could hang vertically without sliding the remaining part?



(a) 20% (b) 30% (c) 25% (d) 50%

9. The following represent standard symbols for transistors, choose correct statement



(a) both represent p-n-p transistors

(b) both represent n-p-n transistors

(c) (i) represent p-n-p transistor while (ii) represent the n-p-n transistor

(d) (i) represent n-p-n transistor while (i) represent the p-n-p transistor

10. Two persons *A* and *B*, each of mass 60 kg, are standing together inside a trolley of mass 240 kg which is initially at rest on a frictionless surface. *B* now beings to walk along the length of the trolley and, after some time. A find *B* to be at a distance 10m. Distance travlled by *B* as observed by a person *C* standing on ground (outside the trolley) is approximately

(a) 8 m (b) 6 m (c) 5 m (d) 10 m

11. A shell is fired from a gun with an initial velocity *v* at an angle θ with horizontal. At the highest point of trajectory, the shell explodes into two fragments *X* and *Y* of equal masses. Given that the speed of fragment *X*, immediately after the explosion, is zero, how far from the gun does the fragment *Y* strike the ground?

(a) $\frac{v^2 \sin 2\theta}{g}$ (b) $\frac{3}{2}\frac{v^2 \sin 2\theta}{g}$ (c) $\frac{5}{2}\frac{v^2 \sin 2\theta}{g}$ (d) $\frac{2v^2 \sin 2\theta}{g}$

12. A solid sphere, starting from rest, rolls down (without slipping) an inclined plane of length *s* and inclination θ. Its speed when it reaches the bottom of the plane is

(a) $\sqrt{2gs\sin\theta}$ (b) $\sqrt{\frac{4}{3}gs\sin\theta}$ (c) $\sqrt{\frac{16}{9}gs\sin\theta}$ (d) $\sqrt{\frac{10}{7}gs\sin\theta}$

13. A stone of mass 10 kg tied at one end of a 10 m long string, is whirled in a vertical circle. It crosses the highest point at a speed 10 m/s. Tension in the string at the lowest point is (g =10 m/s^2)

(a) 800 newton (b) zero (c) 575 newton (d) 600 newton

14. A missile of mass m is fired vertically upward from the surface of earth at such an initial speed that it attains a maximum height (above the surface) equal to R, R being the radius of earth. What is the mechanical energy of the missile when it is at height $h = \frac{R}{3}$.

(a) $-\frac{2}{3}mgR$ (b) $-mgR$ (c) $-\frac{mgR}{2}$ (d) $-\frac{5}{6}mgR$

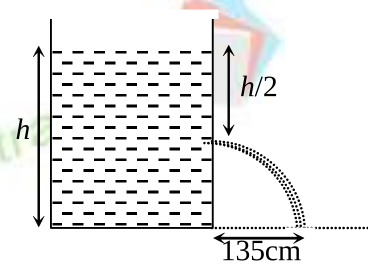
15. Imagine that earth is rotating at such an angular speed that a body becomes weightless at the equator. If weight of the same body at north-pole is 100 kg wt, its weight at a placed of latitude 60^0 will be

(a) 75 kg wt (b) 100 kg wt (c) zero (d) 67.5 kg wt

16. A uniform solid cube of side 10 cm and made of a material of density 0.6 g/cc is floating in water. An additional mass 300 g is placed on top of the cube. What volume of the cube now lies outside water?

(a) 400 cc (b) 300 cc (c) 200 cc (d) 100 cc

17. Water is filled in a vessel upto a height h. If a hole is made in the vessel at a depth $\frac{h}{2}$ below the free surface, water rushing out of the hole is found to strike the base level at a horizontal distance 135 cm as shown. Determine the volume of water coming out per unit time if there is a square hole of side 3cm at a depth $\frac{h}{3}$ below the free surface ($g = 10$ m/s^2)



(a) 2700 cc/sec (b) 3000 cc/sec (c) 3100 cc/sec (d) 280 cc/sec

18. A spherical object is taken to the bottom of a 50 m deep lake. Volume of the object is found to change by 0.01%. Bulk modulus of the object is (g = 10 m/s^2)

(a) 5×10^8 N/m^2 (b) 5×10^9 N/m^2 (c) 0.5×10^8 N/m^2 (d) 0.5×10^{11} N/m^2

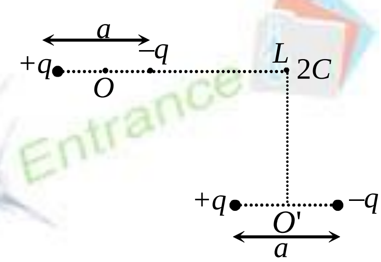
19. A soap bubble (surface tension of soap being 35 dyne/cm) has radius $\sqrt{\frac{3}{\pi}}$ cm. Work done in increasing the radius of the bubble by 100 per cent is

(a) 3.24×10^{-2} J (b) 2.52×10^{-1} J (c) 1.98×10^{-3} J (d) 3.76×10^{-3} J

20. Two free charged particles A and B with charges $+q$ and $-q$ respectively, and the mass of A being double of B, are released from a separation a in air. They move under the action mutual attractive force. Kinetic energy of A at the moment when separation between the two is $a/2$ will be

(a) $9\times10^9\times\dfrac{q^2}{a}$ (b) $4.5\times10^9\times\dfrac{q^2}{a}$ (c) $3\times10^9\times\dfrac{q^2}{a}$ (d) $2.25\times10^9\times\dfrac{q^2}{a}$

21. A charge $2C$ is placed at L which is a point on the axial line of electric dipole A and also on the equatorial line of dipole B, as shown. Given that $OL = O'L >> a$ and the electric field strength at L due to dipole A is 30 N/C, net force experienced by $2C$ charge is

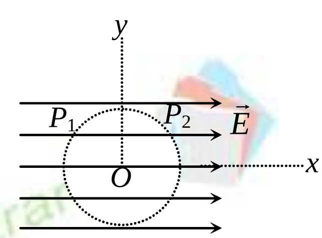


(a) zero (b) 45 newton (c) 30 newton (d) 15 newton

22. A charge q is kept at the centre of a cube of side $10\sqrt{3}$ m. Electric flux through any face of the cube is found to be $\dfrac{10^6}{8.85}$ (SI unit). If a charge 1 millicoulomb is placed at any corner of the cube, it will experience a force

(a) 0.12 newton (b) 0.24 newton (c) 0.36 newton (d) 0.48 netwon

23. In a region of uniform electric field of strength 10 N/C, consider a circle of radius 5m centred at O (origin) as shown in the figure. P_1 and P_2 are two points on the circumference of the circle with coordinates (x_1, 3) and (x_2, 3) respectively. Potential difference $V_{P_2} - V_{P_1}$ is



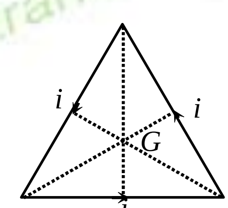
(a) +50 V (b) –50 V (c) –75 V (d) –80 V

24. Two cells each of emf 4V and internal resistance 2Ω are connected in series with an external resistance R. Value of R is so chosen that maximum power is transferred to the external load. This maximum power is equal to

(a) 3 W (b) 4 W (c) 5 W (d) 6.8 W

25. A current of $2A$ is flowing in the sides of an equilateral triangle of side 2m. Magnetic flux density at the centroid of triangle is

[$\dfrac{\mu_0}{4\pi} = 10^{-7}\ \text{wbA}^{-1}\text{m}^{-1}$, assume the triangle to be in the plane of paper]



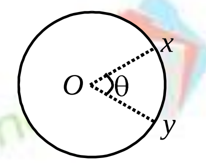
(a) 1.8×10^{-6} T perpendicular to plane of paper and directed outward

(b) 3.6×10^{-6} T perpendicular to plane of paper and directed inward

(c) 4.8×10^{-8} T perpendicular to plane of paper and directed outward

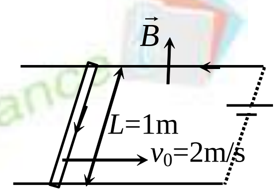
(d) 4.2×10^{-7} T perpendicular to plane of paper and directed outward

26. X and Y are two points on the circumference of a uniform conducting ring of radius a and resistance R as shown in the figure. θ is the angle subtended at the centre by one of the arcs XY. A battery of emf E and negligible internal resistance is connected between X and Y . Find magnetic flux density at the centre due to the current in the ring



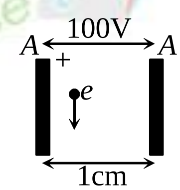
(a) $\frac{\mu_0 E}{2aR}$ (b) $\frac{\mu_0 E}{4aR}$ (c) $\frac{\mu_0 E}{2\pi aR}$ (d) zero

27. A constant current 2A flows through a metal rod of length 1m and mass 0.5 kg which slides on frictionless rails in a horizontal plane. Initial speed of the rod is 2 m/sec and a uniform magnetic field 0.5T is acting vertically upwards as shown. Distance moved by the rod before coming to rest is



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

28. A potential difference 100V is applied between the plates of a parallel plate air capacitor and a uniform magnetic field is also applied in the region between the plates. As shown, separation between the plates being 1 cm. An electron is projected parallel to the plates at a distances 0.4 cm from the plate A with an initial velocity 10^5m/sec. Acceleration of the electron is found to be zero. What is the magnitude and direction of magnetic field in the region between the plates? (electric field and the motion of electron are in the plane of paper)



(a) 0.2 T outward (b) 0.1 T outward (c) 0.3 T outward (d) 0.2 T inward

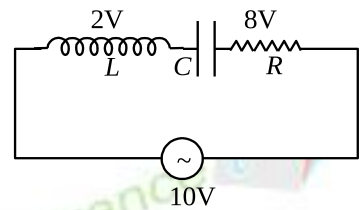
29. At a place where horizontal component of earth's magnetic field is 2×10^{-4} T and angle of dip 30^0, a metal rod 50 cm long with its length along the north-south is moved at constant speed $20\sqrt{3}$ cm/sec towards west, emf induced in the rod will be

(a) 20 μV (b) 15 μV (c) 10 μV (d) 12.5 μV

30. Dimension formula of self inductance is

(a) $[ML^2T^{-1}A^{-2}]$ (b) $[ML^2T^{-2}A^{-1}]$ (c) $[MLT^{-2}A^{-2}]$ (d) $[ML^2T^{-2}A^{-2}]$

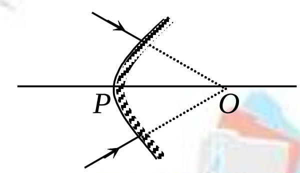
31. In the given circuit, voltage across C is



(a) 10 V (b) 2 V

(c) 0 V (d) 8 V

32. As shown in the figure, a beam of light, converging towards O, is incident on a convex mirror of radius of curvature 60cm. If PO = 50 cm, image will be



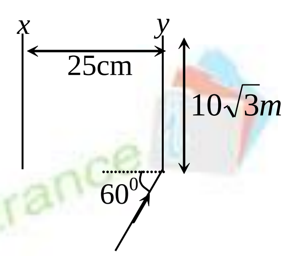
(a) real, enlarged and at a distance 75 cm from P in front in front of the mirror

(b) virtual, enlarged and at a distance 70 cm from P behind the mirror

(c) real, diminished and at a distance 70cm from P in front of the mirror

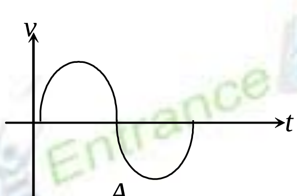
(d) virtual, diminished and at a distance 75 cm from P behind the mirror

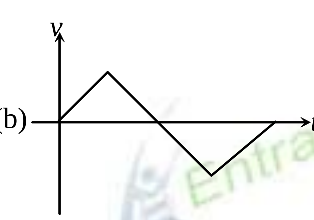
33. Two plane mirrors X and Y are kept parallel to each other at a separation 25 cm, as shown. A ray of light is incident on the mirror Y at an angle 60^0 at its end/edge. Length of each mirror being $10\sqrt{3}$ m, number of times the ray is reflected, including the initial one, before it emerges is

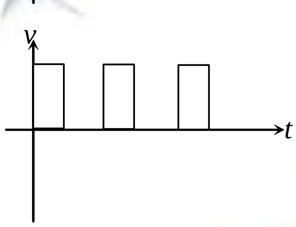


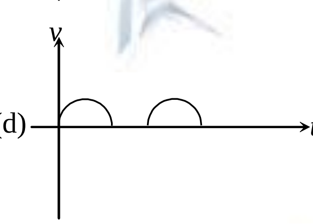
(a) 41 (b) 26 (c) 31 (d) 39

34. Which of the following represents the digital signal?

(a) 

(b) 

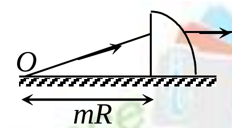
(c) 

(d) 

35. Refractive indices of crown glass for violet and red colours are, respectively, 1.52 and 1.48 and those of flint glass are 1.77 and 1.73 respectively. A prism of angle 9^0 is made of crown glass and white light is incident on this prism at a small angle. Another flint glass prism is combined with the crown glass prism so that there is no deviation of incident light. Net dispersion of the combined system is

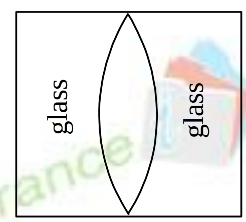
(a) 0.36^0 (b) 0.24^0 (c) 0.12^0 (d) 0.08^0

36. A quarter cylinder of radius R and made of a glass of refractive index 1.4 is kept on a table. A point object O is placed at a distance mR from it as shown. Determine m so that a ray from P emerges parallel to the table



(a) $\frac{25}{14}$ (b) $\frac{35}{18}$ (c) $\frac{21}{12}$ (d) 2

37. Two plano-concave lenses made of glass of refractive index $\frac{3}{2}$ have radii of curvature of their curved surfaces as 20 cm and 40 cm. They are kept in contact with their curved surfaces facing each other as shown in the figure. The space between them is filled with water $\left(\mu = \frac{4}{3}\right)$. System behaves as a



(a) convergent lens of focal length 75 cm (b) divergent lens of focal length 80 cm
(c) convergent lens of focal length 40 cm (d) divergent lens of focal length 75 cm

38. A convex lens of focal length 50 cm and a concave lens of focal length 10 cm are placed with their optic centres on the same axis and with a distance d between them. For what value of d will a parallel beam of light incident on the convex lens leave the concave lens as a parallel beam?

(a) 50 cm (b) 10 cm (c) 30 cm (d) 40 cm

39. Magnifying power of an Astronomical Telescope for distant objects is 8. If the objective and the eye lenses are at a separation 45 cm and the final image is formed at infinity, focal lengths of objective and the eye lenses are

(a) 40 cm, 5 cm (b) 30 cm, 3.75 cm (c) 36 cm, 4.5 cm (d) 35 cm , 10 cm

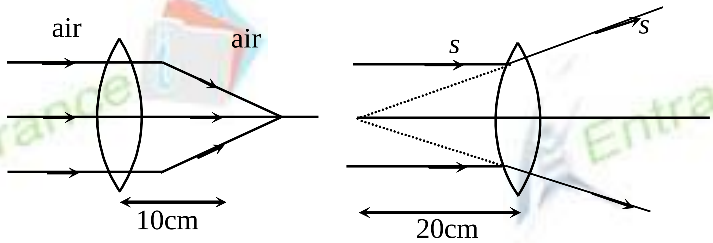
40. The thickness of a plate which will produce a change in optical path equal to half the wavelength λ of the light passing through it normally is (The refractive index of the plate is μ)

(a) $\frac{\lambda}{4(\mu-1)}$ (b) $\frac{\lambda}{2(\mu-1)}$ (c) $\frac{\lambda}{(\mu-1)}$ (d) $\frac{\lambda}{2(\mu+1)}$

41. A lens of unknown nature (convex/concave) and of focal length 20 cm forms an erect image 4 times the size of an object. Determine the nature of lens and also the distance of object from the lens.

(a) convex, 15 cm (b) convex, 40 cm (c) concave, 15 cm (d) concave, 40 cm

42. A lens made of material of refractive index 3/2 when placed in air behaves as shown in the figure (i) and when placed in a surrounding of refractive index μ_s, it behaves as shown in figure (ii), μ_s is



(a) 1.75 (b) 1.6 (c) 2.0 (d) 1.45

43. In a Young's double slit experiment, light consisting of two wavelengths 7000Å and 6000Å is used to obtain interference fringes. If the distance between the two slits is 1 mm and the distance between the plane slits and screen is 100cm, what is the minimum distance from central maximum where bright fringes due to both the wavelength coincide?

(a) 0.54 cm (b) 0.62 cm (c) 0.42 cm (d) 0.28 cm

44. Photons of energy 5eV fall on the surface of a metal X resulting in emission of photoelectrons having maximum kinetic energy E(eV) and de Broglie wavelength λ. Y is another metal on the surface of which photons of energy 6eV are incident and result in emission of photoelectrons of maximum kinetic energy (E –2) eV and de Broglie wavelength $\sqrt{3}\lambda$. Work functions of metals X and Y are in the ratio

(a) 3 : 2 (b) 2 : 5 (c) 1 : 3 (d) 3 : 5

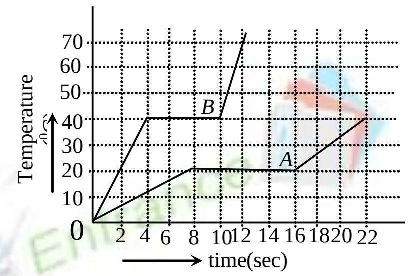
45. Half-life of a radioactive substance for α-decay is 40 years and for β-decay 20 years. What fraction of the sample will decay in a time 80 years if the substance is decaying both by α and β- emissions simultaneously

(a) $\frac{63}{64}$ (b) $\frac{31}{32}$ (c) $\frac{15}{16}$ (d) $\frac{7}{8}$

46. α- particle has a binding energy 7 MeV per nucleon and binding energy of deuteron $_1H^2$ is 1.2 MeV per nucleon. In the reaction $_1H^2 +_1 H^2 \longrightarrow _2He^4 + Q$ energy released Q is

(a) 4.6 MeV (b) 18.4 MeV (c) 20.6 MeV (d) 23.2 MeV

47. Two solid objects *A* and *B* of equal mass are heated at a uniform rate. In the given figure, graphs *A* and *B*, respectively, represent their temperature variation. (i) what is the ratio of their latent heats (*A* and *B*) and (ii) what is the ratio of their specific heats (*A* and *B*) in the solid state?



(a) $\frac{4}{3}, 1$ (b) $\frac{4}{3}, 4$ (c) $\frac{3}{4}, \frac{1}{4}$ (d) $\frac{3}{4}, 1$

48. Pressure of ideal gas, during an adiabatic process, is found to be proportional to the fourth power of its temperature. What amount of heat will be required to raise the temperature of 5 moles of this gas from 10^0 C to25^0 C during an isobaric process. (*R* – Gas constant)

(a) 300 *R* (b) 350 *R* (c) 225 *R* (d) zero

49. A carnot engine *X* operating between 27^0C and 227^0C, absorbs certain heat from the source and delivers a work output of 150 joule per cycle. Another heat engine *Y* based upon an irreversible cyclic process and operating between the same temperatures of source and sink, absorbs an amount of heat *Q* from the source and delivers 300 joule of work per cycle. *Q* is equal to

(a) 700 J (b) 750 J (c) 775 J (d) 500 J

50. A quantity of heat 700 joule is supplied to 5 moles of an ideal diatomic gas (O_2) at constant pressure. Internal energy of the gas increases by

(a) 250 J (b) 400 J (c) 140 J (d) 500 J

51. Systems A and B contain, respectively, 32g of H_2 and 32 g of O_2 at the same temperature. Ratio of their kinetic (internal) energies is

(a) 16 : 1 (b) 1 : 1 (c) 1 : 32 (d) 32 :1

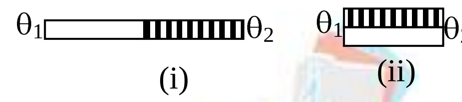
52. What amount of heat is required to raise the temperature of a mixture of 2g Helium and 8g oxygen from 20^0C to 70^0C at constant pressure? [R = 2cal/ (mole K)]

(a) 248.5 cal (b) 236.5 cal (c) 212.5 cal (d) 137.5 cal

53. A body is heated to a temperature 100^0C and kept in a surrounding, which is maintained at a constant temperature 15^0C. The body, while cooling, takes 10 minutes to cool from 90^0C to 60^0C. What time approximately, does it take to cool from 30^0C to 20^0C?

(a) 20 min (b) 30 min (c) 30 min (d) 50 min

54. As shown in the figure, two identical rods are welded end to end. Extreme ends of the system are kept at constant temperatures θ_1 and θ_2 ($\theta_1 > \theta_2$) such that 20 cal of heat flows through the system in a time 5 minute. The rods are now welded as shown in figure. (ii) what time will it take for 160 cal of heat to flow through the system



(a) 8 min (b) 10 min (c) 5 min (d) 1.25 min

55. At a cold place, during winter, a lake in which water is at -15^0C begins to freeze, atmospheric temperature being 0^0C. If it takes 8 hours for the layer of ice to grow in thickness from 0 to 2 cm, what time does it take for the thickness of ice layer to increase from 2 cm to 4cm?

(a) 16 hr (b) 12 hr (c) 24 hr (d) 36 hr

56. A body is executing simple harmonic motion of amplitude A. At a displacement from mean position $y = A/2$, its kinetic energy is E. Potential energy of the body at extreme position will be

(a) E (b) $\frac{5E}{4}$ (c) $\frac{4E}{3}$ (d) $\frac{E}{3}$

57. Two simple harmonic motions are represented by equations $y_1 = 4\sin(4\pi t + \pi/3)$ and $y_2 = 4(\sin 4\pi t + \sqrt{3}\cos 4\pi t)$. Ratio of their amplitudes is

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

58. A particle executes SHM of amplitude A and time period T = 16 sec. What is the time taken by the particle to travel from extreme position to when its displacement from mean position becomes $y = \frac{\sqrt{3}}{2}A$ for the first time

(a) $\frac{4}{3}$sec (b) $\frac{2}{3}$sec (c) $\frac{7}{5}$sec (d) $\frac{5}{3}$sec

59. A charge $-q$, free to move, is placed on the axis of a uniformly charged ring at a distance x from the centre x being very small compared to radius of the ring, the charge $-q$ oscillates in a simple harmonic manner along the axis with a time period 4 sec. If the given ring is replaced by another uniformly charged ring carrying 32 times more charge and of double the radius, time period of oscillation of $-q$ becomes

(a) 2 sec (b) 1.5 sec (c) 2.5 sec (d) 4 sec

60. Two tuning forks X and Y are sounded together. Sound waves from the tuning forks which can be represented, respectively, by equations, $y_1 = 0.5\sin(404\pi t - x)$ and $y_2 = 0.25\sin(\omega t - x)$, give 15 beats in 3 sec. The tuning fork Y is loaded with certain amount of wax and the number of beats is again found to be 15 in 3 sec, ω (in the equation of y_2) is

(a) 414 π (b) 394 π (c) 410 π (d) 400 π

CHEMISTRY

61. With rise in temperature; viscosity of a liquid
(a) increases (b) decreases
(c) remains constant (d) may increase or decrease

62. The heat of formation of CO and CO_2 are –26.4 kcal and –94.6 kcal respectively. Heat of combustion of carbon monoxide will be
(a) +26.4 kcal (b) –68.2 kcal
(c) –120.6 kcal (d) +52.8 kcal

63. The difference between heat of reaction at constant pressure and constant volume of the following reaction would be

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

(a) –7.43 (b) +3.72
(c) –3.72 (d) +7.43

64. The reaction, $\frac{1}{2}H_2(g) + AgCl(s) \longrightarrow H^+(aq) + Cl^-(aq) + Ag(s)$, occurs in the galvanic cell:
(a) Ag(s) | AgCl(s) | KCl (solution) || $AgNO_3$(solution) | Ag(s)
(b) Pt | H_2(g) | HCl (solution) || $AgNO_3$(solution) | Ag(s)
(c) Pt | H_2(g) | HCl (solution) | AgCl(s) | Ag(s)
(d) Pt | H_2(g) | KCl (solution) | AgCl(s) | Ag(s)

65. In the formation of sulphur trioxide by contact process, $2SO_2 + O_2 \longrightarrow 2SO_3$, the rate of reaction was measured as

$$-\frac{d[O_2]}{dt} = 2.5 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$$

The rate of reaction expressed in terms of SO_3 will be
(a) -5.0×10^{-4} mol L^{-1} s^{-1} (b) -1.25×10^{-4} mol L^{-1} s^{-1}
(c) 2.5×10^{-4} mol L^{-1} s^{-1} (d) 5.00×10^{-4} mol L^{-1} s^{-1}

66. Which of the following statements is not correct?
(a) Boric acid is a very weak monobasic acid.
(b) Boric acid contains planar BO_3 units, which are bonded together through hydrogen bonds forming a layer structure.
(c) Boric acid is used as a food preservative.
(d) Boric acid is tribasic acid.

67. Sodium is not ordinarily observed in the +2 oxidation state because of its
(a) high first ionization potential. (b) high second oxidation potential.
(c) high ionic radius. (d) high electronegativity.

68. Which of the following ions has the highest reduction potential?
(a) Li^+ (b) Na^+
(c) K^+ (d) Rb^+

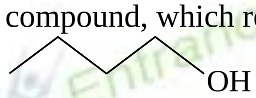
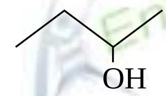
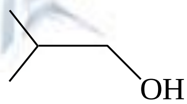
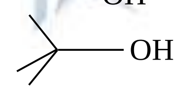
69. Oxidation of Cr^{3+} in acid solution forms
(a) CrO_2^- (b) CrO_4^{2-}

(c) $Cr_2O_7^{2-}$ (d) Cr^{2+}

70. In solid $CuSO_4.5H_2O$, copper is coordinated to

(a) five water molecules. (b) four water molecules.
(c) one sulphate ion. (d) one water molecule.

71. The compound, which reacts fastest with Lucas reagent at room temperature is

(a) 
(b) 
(c) 
(d) 

72. The critical temperature of a substance is defined as

(a) the temperature above which the substance decomposes.
(b) the temperature above which a substance can exist only as a gas.
(c) melting point of the substance.
(d) boiling point of the substance.

73. Correct set of four quantum numbers for the valence (outermost) electrons of rubidium

(a) 5, 0, 0, +1/2 (b) $5, 1, 0, +\frac{1}{2}$
(c) 5, 1, 1, +1/2 (d) $6, 0, 0, +\frac{1}{2}$

74. Which one is a colligative property?

(a) Boiling point (b) Vapour pressure
(c) Osmotic pressure (d) Freezing point

75. 1.1 mol of A is mixed with 2.2 mol of B and the mixture is kept in a one–litre flask till the equilibrium, $A + 2B \rightleftharpoons 2C + D$ is reached. At equilibrium 0.2 mol of C is formed. The equilibrium constant of the above reaction is

(a) 0.002 (b) 0.004
(c) 0.001 (d) 0.003

76. In which of the following compounds, the oxidation number of iodine is fractional?

(a) IF_7 (b) I_3^-
(c) IF_5 (d) IF_3

77. The rate law expression for the hypothetical reaction $2A + 3B \longrightarrow 2C$ is

$$\frac{dx}{dt} = k[A]\,[B]^2$$

The order of reaction is

(a) 1 (b) 2
(c) 3 (d) 5

78. An element belongs to Group 15 and third period. Its electronic configuration will be

(a) $1s^2 2s^2 2p^3$ (b) $1s^2 2s^2 2p^6 3s^2 3p^3$
(c) $1s^2 2s^2 2p^2$ (d) $1s^2 2s^2 2p^6 3s^2 3p^2$

79. Which of the following is an electron deficient compound?

(a) NH_3 (b) NH_2OH

(c) BCl_3

(d) $H_3N \longrightarrow BCl_3$

80. A dehydrating agent commonly used in the laboratory is

(a) $MgCO_3$

(b) CaF_2

(c) $CaCl_2$

(d) MgF_2

81. Which of the following represents baryta?

(a) BaO

(b) $Ba(OH)_2$

(c) $BaCO_3$

(d) $Ba(NO_3)_2$

82. The outer electronic configuration of copper is

(a) $3d^{10}4s^1$

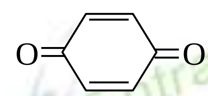
(b) $3d^9 4s^2$

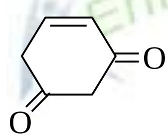
(c) $3d^{10}4s^0$

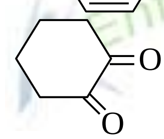
(d) $3d^{10}4s^2$

83. Tautomerism is not exhibited by

(a) $C_6H_5CH{=}CHOH$

(b) 

(c) 

(d) 

84. In the compound $CH_2{=}CH{-}CH_2{-}C{\equiv}CH$, the C_2–C_3 bond is of the type

(a) $sp{-}sp^2$

(b) $sp^2{-}sp^2$

(c) $sp{-}sp^3$

(d) $sp^2{-}sp^3$

85. Which of the following compounds will give a yellow precipitate with I_2 and alkali?

(a) 3–hydroxy pentene

(b) Acetophenone

(c) Methyl acetate

(d) Acetamide

86. Alkaline hydrolysis of an ester is called:

(a) neutralization

(b) esterification

(c) polymerisation

(d) saponification

87. Which one is a colligative property?

(a) Boiling point

(b) Vapour pressure

(c) Osmotic pressure

(d) Freezing point

88. The number of effective atoms per unit cell in a simple cubic, face centered cubic and body–centred cubic are ….respectively

(a) 1, 4, 2

(b) 4, 1, 2

(c) 2, 4, 1

(d) 4, 8, 2

89. Absence of one cation and one anion in a crystal lattice is

(a) ionic defect

(b) Frenkel defect

(c) Schottky defect

(d) interstitial defect

90. Which of the following expression is correct in case of a CsCl unit cell (edge length, a)?

(a) $r_c + r_a = a$

(b) $r_c + r_a = \frac{a}{\sqrt{2}}$

(c) $r_c + r_a = \frac{\sqrt{3}a}{2}$ (d) $r_c + r_a = \frac{a}{2}$

91. In a face–centred cubic system the distance 'd' between the nearest neighbours is given by (a = edge length)

(a) $d = a$ (b) $d = \sqrt{2}\,a$

(c) $d = \frac{\sqrt{3}\,a}{2}$ (d) $d = \frac{a}{\sqrt{2}}$

92. The rate constant for the reaction: $2N_2O_5 \longrightarrow 4NO_2 + O_2$ is $3 \times 10^{-5}\ s^{-1}$. If the rate at a given time is 2.40×10^{-5} mol $L^{-1}\ s^{-1}$. Then concentration of N_2O_5 at that time is

(a) 1.4 (b) 1.2

(c) 0.04 (d) 0.8

93. The atomic weight of a trivalent element is 27. Its electrochemical equivalent is

(a) 9×10^{-5} (b) 2.8×10^{-4}

(c) 9.33×10^{-5} (d) 4.67×10^{-5}

94. 100 ml each of 0.5 N NaOH, N/5 HCl and N/10 H_2SO_4 are mixed together. The resulting solution will be

(a) acidic (b) neutral

(c) alkaline (d) none of these

95. $C(s) + O_2(g) \longrightarrow CO_2(g)$; $\Delta H = r$

$CO(g) + ½\,O_2(g) \longrightarrow CO_2(g)$; $\Delta H = s$

The heat of formation of CO is

(a) $r \times s$ (b) $s - r$

(c) $r - s$ (d) $r + s$

96. Energy of electron in the third orbit of Bohr's H–atom is

(a) −13.6 eV (b) −34 eV

(c) −1.5 eV (d) none of the three

97. For the combustion reaction at 298 K,

$2Ag(s) + ½\,O_2(g) \longrightarrow 2Ag_2O(s)$

which of the following relation will be true?

(a) $\Delta H = \Delta U$

(b) $\Delta H > \Delta U$

(c) $\Delta H < \Delta U$

(d) ΔH and ΔU bear no relation with each other

98. If in a standard hydrogen electrode half cell, $2H^+(aq) + 2e^- \longrightarrow H_2(g)$ (1 atm), hydrogen ion concentration is reduced to 10^{-1} M by adding a base, then the emf will be

(a) + 0.0591 V (b) 0.1182 V

(c) – 0.0591 V (d) – 0.1182 V

99. The plot of log k vs $\frac{1}{T}$ helps to calculate

(a) Energy of activation (b) Rate constant of the reaction

(c) Order of the reaction

(d) Energy of activation as well as the frequency factor.

100. The halide, which will not react with benzene in presence of anhydrous $AlCl_3$, is

(a) $CH_3CHClCH_3$ (b) $C_6H_5CH_2Cl$

(c) C_6H_5Cl (d) $CH_3CH_2CH_2Cl$

101. An S_N2 reaction at an asymmetric carbon of a compound always gives

(a) an enantiomer of the substrate (b) a product with opposite optical rotation

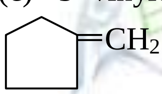
(c) a mixture of diastereoisomers (d) a single stereoisomer

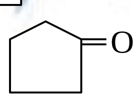
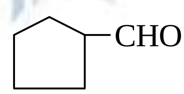
102. IUPAC name of

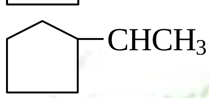
$$\underset{\displaystyle\overset{|}{CH_2CH_2CH_2CH_3}}{OHC{-}CH{=}CH{-}CH{-}CH{=}CH_2} \text{ is}$$

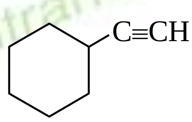
(a) 4–butyl–2,5–hexadien–1–al (b) 5–vinyloct–3–en–1–al

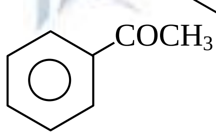
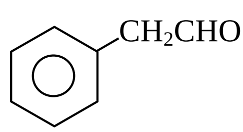
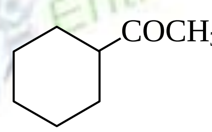
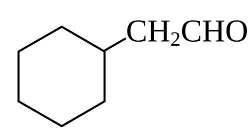
(c) 5–vinyloct–5–en–8–al (d) 3–butyl–1,4–hexadien–6–al

103.  on ozonolysis gives

(a)  + HCHO (b) 

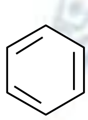
(c)  (d) None of these

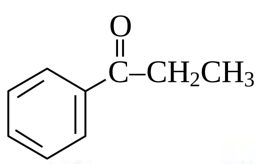
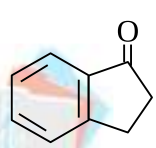
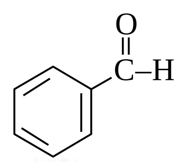
104. Hydroxylation of  in presence of $H_2SO_4/HgSO_4$ gives:

(a)  (b)  (c)  (d) 

105. Which of the following carbocation is most stable?

(a) $Ph{-}\overset{CH_3}{\underset{Ph}{C^{\oplus}}}$ (b) $Ph{-}\overset{H}{\underset{Ph}{C^{\oplus}}}$ (c) $Ph{-}\overset{NO_2}{\underset{\oplus}{CH}}$ (d) $Ph{-}\overset{Ph}{\underset{Ph}{C^{\oplus}}}$

106.  + $CH_3{-}\overset{O}{\overset{\|}{C}}{-}O{-}\overset{O}{\overset{\|}{C}}{-}CH_3 \xrightarrow{AlCl_3}$ products. One of the products formed in the reaction will be

(a)  (b)  (c)  (d) $CH_3{-}\overset{O}{\overset{\|}{C}}{-}OH$

107. $Ph{-}C{\equiv}C{-}CH_3 \xrightarrow[H_2SO_4]{HgSO_4}$ major product will be

(a) $Ph{-}\overset{O}{\overset{\|}{C}}{-}CH_2CH_3$ (b) $Ph{-}CH_2{-}\overset{O}{\overset{\|}{C}}{-}CH_3$

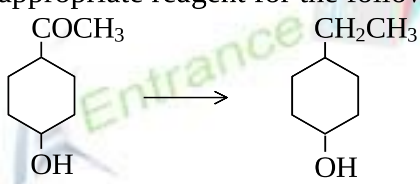
(c) $\text{Ph–}\underset{}{\overset{\text{OH}}{\overset{|}{\text{C}}}}\text{H–CH}_2\text{CH}_3$ (d) $\text{Ph–CH}_2\text{–}\overset{\text{OH}}{\overset{|}{\text{C}}}\text{H–CH}_3$

108. $CH_3\text{–C≡C–}CH_3 \xrightarrow[\text{Liq. NH}_3]{\text{Na}}$ product will be

(a) cis 2–butene (b) trans 2–butene
(c) both (a) and (b) (d) none of these

109. The correct order of rate of S_N1 reaction for alkyl halide is
(a) 3° > 2° > 1° (b) 3° < 2° < 1°
(c) 1° < 2° > 3° (d) 3° ≈ 2° > 1°

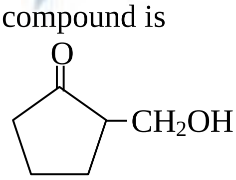
110. The appropriate reagent for the following transformation is

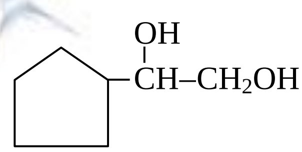


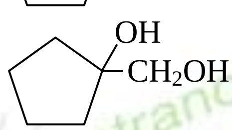
(a) Zn–Hg, HCl (b) NH_2NH_2, KOH
(c) $LiAlH_4$ (d) HI, P_4

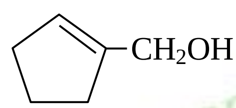
111. Cyclohexanone is subjected to reduction by $NaBH_4$. The product formed is:
(a) Cyclohexane (b) Cyclohexanal
(c) Cyclohexadiene (d) Cyclohexanol

112. An organic compound on treatment with HIO_4 gives cyclopentanone and formaldehyde. The compound is

(a) 

(b) 

(c) 

(d) 

113. IUPAC name of

$$\text{OHC–CH=CH–}\underset{\underset{\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_3}{|}}{\text{CH}}\text{–CH=CH}_2 \text{ is}$$

(a) 4–butyl–2,5–hexadien–1–al (b) 5–vinyloct–3–en–1–al
(c) 5–vinyloct–5–en–8–al (d) 3–butyl–1,4–hexadien–6–al

114. The vapour pressure of benzene and pure toluene at 70°C are 500 mm and 200 mm Hg respectively. If they form an ideal solution what is the mole fraction of benzene in a mixture boiling at 70°C at a total pressure of 380 mm Hg?
(a) 0.20 (b) 0.40
(c) 0.60 (d) 0.80

115. At certain temperature, dissociation constant of formic acid and acetic acid are 1.8×10^{-4} and 1.8×10^{-5} respectively. At what concentration of acetic solution, the H_3O^+ ion concentration is same as that in 0.001 M formic acid solution

(a) 0.01 M
(b) 1×10^{-3} M
(c) 1×10^{-1} M
(d) 1×10^{-4} M

116. The analysis of a rock shows that relative number of ^{206}Pb and ^{238}U atoms is Pb/U = 0.25. If $t_{0.5}$ $^{238}U \longrightarrow {}^{206}Pb$ is 4×10^9 years. The age of rock is

(a) $\dfrac{2.303}{0.693} \times (4 \times 10^9) \log 1.25$
(b) $\dfrac{2.303}{0.693} \times (4 \times 10^9) \log 0.25$
(c) $\dfrac{2.303}{0.693} \times 4 \times 10^9 \log 4$
(d) $\dfrac{2.303}{4 \times 10^9} \times 0.693 \times \log 4$

117. An alkene upon ozonolysis yield

$\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>CH-CHO$ and CH_3-CHO.

The alkene is

(a) $CH_3CH_2CH_2CH{=}CH-CH_3$
(b) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>CH-CH{=}CH-CH\!\!<\!\begin{matrix} CH_3 \\ CH_3 \end{matrix}$
(c) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>CH-CH{=}CH-CH_3$
(d) $\begin{matrix} CH_3 \\ CH_3 \end{matrix}\!\!>C{=}C\!\!<\!\begin{matrix} CH_3 \\ CH_3 \end{matrix}$

118. Which out of the following is potash alum?

(a) $K_2SO_4.Al_2(SO_4)_3.24H_2O$
(b) $K_2SO_4.Cr_2(SO_4)_3.24H_2O$
(c) $K_2SO_4.Fe_2(SO_4)_3.24H_2O$
(d) $[NH_4]_2SO_4.FeSO_4.6H_2O$

119. Which of the following is a natural polymer?

(a) Bakelite
(b) Cellulose
(c) PVC
(d) Nylon

120. Mark the correct order of increasing reactivity.

(a) $CH_3CONH_2 < CH_3COOC_2H_5 < CH_3COCl$
(b) $CH_3COOC_2H_5 < CH_3COCl < CH_3CONH_2$
(c) $CH_3COCl < CH_3CONH_2 < CH_3COOC_2H_5$
(d) $CH_3COOC_2H_5 < CH_3CONH_2 < CH_3COCl$