UPSEE- 2006

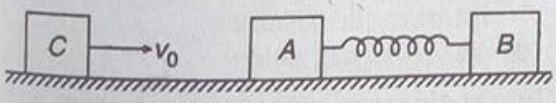
Physics

1. Which of the following is true for rays coming from infinity ?

(a) Two images are formed
(b) Continuous image is formed between focal points of upper and lower lens
(c) One image is formed
(d) None of the above

2. What is dimensional formula of thermal conductivity ?
(a) $[MLT^{-1}\theta^{-1}]$ (b) $[MLT^{-3}\theta^{-1}]$
(c) $[M^2LT^{-3}\theta^{-2}]$ (d) $[ML^2T^{-2}\theta]$

3. A block C of mass m is moving with velocity v_0 and collides elastically with block A of mass m and connected to another block B of mass $2m$ through spring constant k. What is k if x_0 is compression of spring when velocity of A and B is same ?



(a) $\frac{mv_0^2}{x_0^2}$ (b) $\frac{mv_0^2}{2x_0^2}$
(c) $\frac{3}{2}\frac{mv_0^2}{x_0^2}$ (d) $\frac{2}{3}\frac{mv_0^2}{x_0^2}$

4. A bullet of mass 20g and moving with 600 m/s collides with a block of mass 4 kg hanging with the string. What is velocity of bullet when it comes out of block, if block rises to height 0.2 m after collison ?
(a) 200 m/s (b) 150 m/s
(c) 400 m/s (d) 300 m/s

5. What is moment of inertia in terms of angular momentum (L) and kinetic energy (K) ?
(a) $\frac{L^2}{K}$ (b) $\frac{L^2}{2K}$
(c) $\frac{L}{2K^2}$ (d) $\frac{L}{2K}$

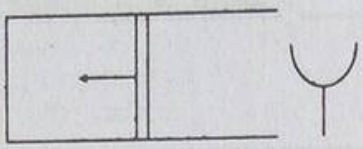
6. A disc of mass 2 kg and radius 0.2 m is rotating with angular velocity 30 rad/s. What is angular velocity, if a mass of 0.25 kg is put on periphery of the disc ?
(a) 24 rad/s (b) 36 rad/s
(c) 15 rad/s (d) 26 rad/s

7. If a body is raised from the surface of the earth upto height R, what is the change in potential energy ?
(a) mgR (b) $\frac{3}{2}mgR$
(c) $\frac{mgR}{2}$ (d) $\frac{mgR}{4}$

8. A piston of cross-section area A is fitted in cylinder in which gas of volume V at pressure P is enclosed. Gas obeys Boyle's law, what is angular frequency if piston is displaced slightly ?
(a) $\sqrt{\frac{Ag}{V}}$ (b) $2\sqrt{\frac{Ag}{V}}$
(c) $\sqrt{\frac{2Ag}{V}}$ (d) $\frac{3Ag}{V}$

9. Carbon, silicon and germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$ respectively. Which one of the following relationships is true in their case ?
(a) $(E_g)_C > (E_g)_{Si}$ (b) $(E_g)_C = (E_g)_{Si}$
(c) $(E_g)_C < (E_g)_{Ge}$ (d) $(E_g)_C < (E_g)_{Si}$

10. A piston fitted in cylindrical pipe is pulled as shown in the figure. A tuning fork is sounded at open end and loudest sound is heard at open length 13 cm, 41 cm and 69 cm, the frequency of tuning fork if velocity of sound is 350 m/s, is :



(a) 1250 Hz (b) 625 Hz
(c) 417 Hz (d) 715 Hz

11. A man is standing on the platform and one train is approaching and another train is going away with speed of 4 m/s, frequency of sound produced by train is 240 Hz. What will be the no. of beats heard by him per second ?
(a) 12 (b) Zero
(c) 6 (d) 3

12. A capacitor having capacitance 1 μF with air is filled with two dielectrics as shown. How many times capacitance will increase ?

(a) 12 (b) 6
(c) 8/3 (d) 3

13. Permanent magnet has properties retentivity and coercivity respectively :
(a) high-high (b) low-low
(c) low-high (d) high-low

14. Hydrogen bomb is based upon :
(a) fission
(b) fusion
(c) chemical reaction
(d) transmutation

15. Six moles of O_2 gas is heated from 20°C to 35°C at constant volume. If specific heat capacity at constant pressure is 8 cal/mol-K and R=8.31 J/mol-K, what is change in internal energy of gas ?
(a) 180 cal (b) 300 cal
(c) 360 cal (d) 540 cal

16. In Carnot engine efficiency is 40% at hot reservoir temperature T. For efficiency 50% what will be temperature of hot reservoir ?
(a) $\frac{T}{5}$ (b) $\frac{2T}{5}$ (c) $6T$ (d) $\frac{6T}{5}$

17. A ball of mass 2 kg moving with velocity 3 m/s, collides with spring of natural length 2 m and force constant 144 N/m. What will be length of compressed spring ?
(a) 2 m (b) 1.5 m
(c) 1 m (d) 0.5 m

18. A proton moving horizontally downward enters in a magnetic field pointing towards north. In which direction proton will deflect ?
(a) East (b) West
(c) North (d) South

19. Induced emf in the coil depends upon :
(a) conductivity of coil
(b) amount of flux
(c) rate of change of linked flux
(d) resistance of coil

20. With in depletion region of p-n junction diode :
(a) p-side is positive and n-side is negative
(b) p-side is negative and n-side is positive
(c) both sides are positive or both negative
(d) both sides are neutral

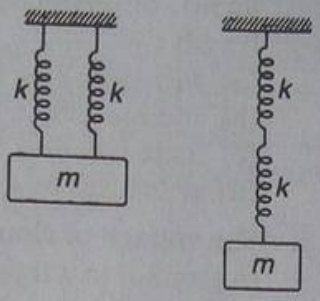
21. 27 small drops each having charge q and radius r coalesce to form big drop. How many times charge and capacitance will become?
(a) 3, 27 (b) 27, 3
(c) 27, 27 (d) 3, 3

22. X-rays are used in determining the molecular structure of crystalline because its :
(a) energy is high
(b) it can penetrate the material
(c) its wavelength is comparable to interatomic distance
(d) its frequency is low

23. In a radioactive material the activity at time t_1 is R_1 and at a later time t_2, it is R_2. If the decay constant of the material is λ, then :
(a) $R_1 = R_2 e^{-\lambda(t_1 - t_2)}$
(b) $R_1 = R_2 e^{\lambda(t_1 - t_2)}$
(c) $R_1 = R_2 (t_2/t_1)$
(d) $R_1 = R_2$

24. A steel ball of mass 5g is thrown downward with velocity 10 m/s from height 19.5 m. It penetrates sand by 50 cm. The change in mechanical energy will be : ($g = 10\ m/s^2$)
(a) 1 J (b) 1.25 J
(c) 1.5 J (d) 1.75 J

25. Two identical springs are connected in series and parallel as shown in the figure. If f_s and f_p are frequencies of series and parallel arrangements, what is $\frac{f_s}{f_p}$?



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

26. Light of frequency ν falls on material of threshold frequency ν_0. Maximum kinetic energy of emitted electron is proportional to :
(a) $\nu - \nu_0$ (b) ν
(c) $\sqrt{\nu - \nu_0}$ (d) ν_0

27. A wave equation is given by

$$y = 4 \sin\left[\pi\left(\frac{t}{5} - \frac{x}{9} + \frac{1}{6}\right)\right]$$

where, x is in cm and t in sec. Which of the following is true ?
(a) $\lambda = 18$ cm (b) $v = 4\ m/s$
(c) $a = 0.4$ m (d) $f = 50$ Hz

28. A light moves from denser to rarer medium. Which of the following is correct ?
(a) Energy increases
(b) Frequency increases
(c) Phase changes by 90°
(d) Velocity increases

29. A small disc of radius 2 cm is cut from a disc of radius 6 cm. If the distance between their centres is 3.2 cm, what is the shift in the centre of mass of the disc ?
(a) 0.4 cm (b) 2.4 cm
(c) 1.8 cm (d) 1.2 cm

30. Which one of the following statements is true ?
(a) Both light and sound waves in air are transverse
(b) The sound waves in air are longitudinal while the light waves are transverse
(c) Both light and sound waves in air are longitudinal
(d) Both light and sound waves can travel in vacuum

31. What is not true for equipotential surface for uniform electric field ?
(a) Equipotential surface is flat
(b) Equipotential surface is spherical
(c) Electric lines are perpendicular to equipotential surface
(d) Work done is zero

32. Two copper wires of lengths l and $2l$ have radii r and $2r$ respectively. What is ratio of their specific resistances ?
(a) 1 : 2 (b) 2 : 1
(c) 1 : 1 (d) 1 : 3

33. A metro trains strats from rest and in five seconds achieves 108 km/h. After that it moves with constant velocity and comes to rest after travelling 45 m with unifrom retardation. If total distance travelled is 395 m, find total time of travelling.
(a) 12.2 s (b) 15.3 s
(c) 9 s (d) 17.2 s

34. The radius of germanium (Ge) nuclide is measured to be twice the radius of $^{9}_{4}Be$. The number of nucleons in Ge are :
(a) 73 (b) 74
(c) 75 (d) 72

35. The displacement of particle is given by

$$x = a_0 + \frac{a_1 t}{2} - \frac{a_2 t^2}{3}$$

What is its acceleration ?
(a) $\frac{2a_2}{3}$ (b) $-\frac{2a_2}{3}$
(c) a_2 (d) Zero

36. If $|\vec{A} \times \vec{B}| = \sqrt{3}\,\vec{A} \cdot \vec{B}$, then the value of $|\vec{A} + \vec{B}|$ is :
(a) $(A^2 + B^2 + AB)^{1/2}$
(b) $\left(A^2 + B^2 + \frac{AB}{\sqrt{3}}\right)^{1/2}$
(c) $A + B$
(d) $(A^2 + B^2 + \sqrt{3}AB)^{1/2}$

37. Pressure of an ideal gas is increased by keeping temperature constant. What is the effect on kinetic energy of molecules ?
(a) Increase
(b) Decrease
(c) No change
(d) Can't be determined

38. Two spheres of same size, one of mass 2 kg and another of mass 4 kg, are dropped simultaneously from the top of Qutab Minar (height = 72 m). When they are 1 m above the ground, the two spheres have the same :
(a) momentum
(b) kinetic energy
(c) potential energy
(d) acceleration

39. The moment of inertia of a rod about an axis through its centre and perpendicular to it is $\frac{1}{12} ML^2$ (where, M is the mass and L, the length of the rod). The rod is bent in the middle so that the two halves make an angle of 60°. The moment of inertia of the bent rod about the same axis would be :
(a) $\frac{1}{48} ML^2$ (b) $\frac{1}{12} ML^2$
(c) $\frac{1}{24} ML^2$ (d) $\frac{ML^2}{8\sqrt{3}}$

40. A boat at anchor is rocked by waves whose crests are 100 m apart and velocity is 25 m/s. The boat bounces up once in every :
(a) 2500 s (b) 75 s
(c) 4 s (d) 0.25 s

41. By sucking through a straw, a student can reduce the pressure in his lungs to 750 mm of Hg (density = 13.6 g/cm^3). Using the straw, he can drink water from a glass upto a maximum depth of :
(a) 10 cm (b) 75 cm
(c) 13.6 cm (d) 1.36 cm

42. Two parallel large thin metal sheets have equal surface charge densities ($\sigma = 26.4 \times 10^{-12}$ C/m^2) of opposite signs. The electric field between these sheets is :
(a) 1.5 N/C (b) 1.5×10^{-10} N/C
(c) 3 N/C (d) 3×10^{-10} N/C

43. A wire mesh consisting of very small squares is viewed at a distance of 8 cm through a magnifying converging lens of focal length 10 cm, kept close to the eye. The magnification produced by the lens is :
(a) 5 (b) 8
(c) 10 (d) 20

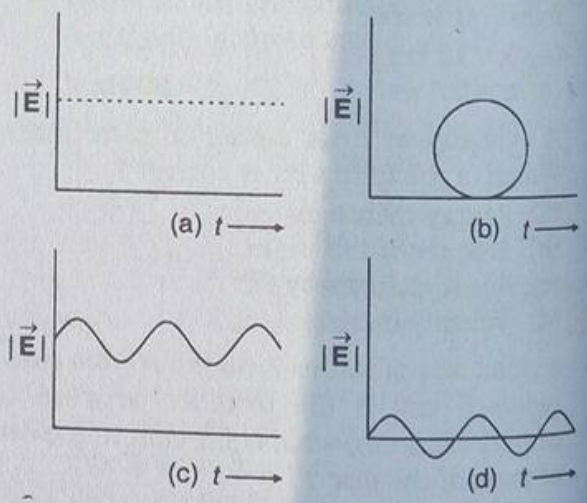
44. Hard X-rays for the study of fractures in bones should have a minimum wavelength of 10^{-11} m. The accelerating voltage for electrons in X-ray machine should be :
(a) < 124 kV
(b) > 124 kV
(c) between 60 kV and 70 kV
(d) = 100 kV

45. A lens is made of flint glass (refractive index=1.5). When the lens is immersed in a liquid of refractive index 1.25, the focal length :
(a) increases by a factor of 1.25
(b) increases by a factor of 2.5
(c) increases by a factor of 1.2
(d) decreases by a factor of 1.2

46. The voltage of clouds is 4×10^6 V with respect to ground. In a lightning strike lasting 100 ms, a charge of 4 C is delivered to the ground. The power of lightning strike is :
(a) 160 MW (b) 80 MW
(c) 20 MW (d) 500 kW

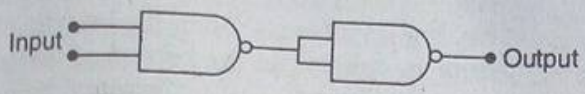
47. For inelastic collision between two spherical rigid bodies :
(a) the total kinetic energy is conserved
(b) the total mechanical energy is not conserved
(c) the linear momentum is not conserved
(d) the linear momentum is conserved

48. Which of the following diagrams represent the variation of electric field vector with time for a circularly polarised light ?



49. The operation of a nuclear reactor is said to be critical, if the multiplication factor (k) has a value :
(a) 1
(b) 1.5
(c) 2.1
(d) 2.5

50. The circuit given below represents which of the logic operations ?



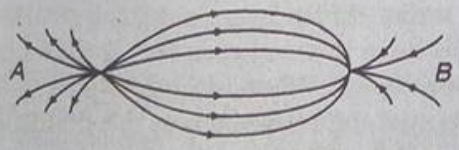
(a) AND (b) NOT
(c) OR (d) NOR

51. Three objects coloured black, gray and white can with stand hostile conditions at 2800°C. These objects are thrown into furnace where each of them attains a temperature of 2000°C. Which object will glow brightest ?
(a) The white object
(b) The black object
(c) All glow with equal brightness
(d) Gray object

52. Two balloons are filled, one with pure He gas and the other by air, respectively. If the pressure and temperature of these balloons are same then the number of molecules per unit volume is :
(a) more in the He filled balloon
(b) same in both balloons
(c) more in air filled balloon
(d) in the ratio of 1 : 4

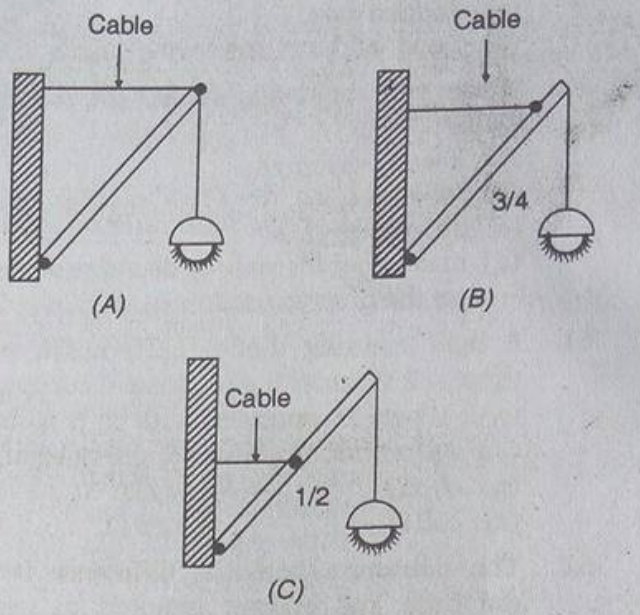
53. Flash light equipped with a new set of batteries, produces bright white light. As the batteries wear out :
(a) the light intensity gets reduced with no change in its colour
(b) light colour changes first to yellow and then red with no change in intensity
(c) it stops working suddenly while giving white light
(d) colour changes to red and also intensity gets reduced

54. The spatial distribution of the electric field due to charges (A, B) is shown in figure. Which one of the following statements is correct ?



(a) A is +ve and B –ve, $|A|>|B|$
(b) A is –ve and B +ve, $|A|=|B|$
(c) Both are +ve but $A>B$
(d) Both are –ve but $A>B$

55. If a street light of mass M is suspended from the end of a uniform rod of length L in different possible patterns as shown in figure, then :



(a) pattern A is more sturdy
(b) pattern B is more sturdy
(c) pattern C is more sturdy
(d) all will have same sturdiness

56. $^{238}_{92}U$ has 92 protons and 238 nucleons. It decays by emitting an alpha particle and becomes :
(a) $^{234}_{92}U$ (b) $^{234}_{90}Th$
(c) $^{235}_{92}U$ (d) $^{237}_{93}Np$

57. The fossil bone has a $^{14}C : ^{12}C$ ratio, which is $\left[\frac{1}{16}\right]$ of that in a living animal bone. If the half-life of ^{14}C is 5730 years, then the age of the fossil bone is :
(a) 11460 years
(b) 17190 years
(c) 22920 years
(d) 45840 years

58. Two tuning forks P and Q when set vibrating, give 4 beats per second. If a prong of the fork P is filed, the beats are reduced to 2/s. What is frequency of P, if that of Q is 250 Hz ?
(a) 246 Hz
(b) 250 Hz
(c) 254 Hz
(d) 252 Hz

59. If alpha, beta and gamma rays carry same momentum, which has the longest wavelength ?
(a) Alpha rays
(b) Beta rays
(c) Gamma rays
(d) None, all have same wavelength

60. When you make ice cubes, the entropy of water :
(a) does not change
(b) increases
(c) decreases
(d) may either increase or decrease depending on the process used

61. A light emitting diode (LED) has a voltage drop of 2 V across it and passes a current of 10 mA. When it operates with a 6 V battery through a limiting resistor R, the value of R is :
(a) 40 kΩ (b) 4 kΩ
(c) 200 Ω (d) 400 Ω

62. The minimum potential difference between the base and emitter required to switch a silicon transistor 'ON' is approximately :
(a) 1 V (b) 3 V
(c) 5 V (d) 4.2 V

63. Given that : $y = A \sin\left[\left(\frac{2\pi}{\lambda}\right)(ct - x)\right]$
where, y and x are measured in metres. Which of the following statements is true ?
(a) The unit of λ is same as that of x and A
(b) The unit of λ is same as that of x but not of A
(c) The unit of c is same as that of $\frac{2\pi}{\lambda}$
(d) The unit of $(ct - x)$ is same as that of $\frac{2\pi}{\lambda}$

64. A projectile is thrown in the upward direction making an angle of 60° with the horizontal direction with a velocity of 147 ms^{-1}. Then the time after which its inclination with the horizontal is 45°, is :
(a) 15 s (b) 10.98 s
(c) 5.49 s (d) 2.745 s

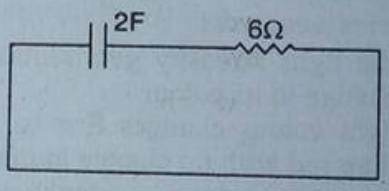
65. A wire 3m in length and 1 mm in diameter at 30°C is kept in a low temperature at −170°C and is stretched by hanging a weight of 10 kg at one end. The change in length of the wire is : [$Y = 2 \times 10^{11}$ N/m^2, $g = 10$ m/s^2 and $\alpha = 1.2 \times 10^{-5}$/°C]
(a) 5.2 mm (b) 2.5 mm
(c) 52 mm (d) 25 mm

66. A tank is filled with water of density 1g per cm^3 and oil of density 0.9 g per cm^3. The height of water layer is 100 cm and of the oil layer is 400 cm. If $g = 980$ cm/s^2, then the velocity of efflux from an opening in the bottom of the tank is :
(a) $\sqrt{900 \times 980}$ cm/s (b) $\sqrt{1000 \times 980}$ cm/s
(c) $\sqrt{920 \times 980}$ cm/s (d) $\sqrt{950 \times 980}$ cm/s

67. An engineer claims to have made an engine delivering 10 kW power with fuel consumption of 1 g/s. The calorific value of fuel is 2 kcal/g. This claim is :
(a) valid
(b) invalid
(c) depends on engine design
(d) dependent on load

68. Two concentric spheres of radii R and r have similar charges with equal surface densities (σ). What is the electric potential at their common centre ?
(a) σ/ε_0 (b) $\frac{\sigma}{\varepsilon_0}(R - r)$
(c) $\frac{\sigma}{\varepsilon_0}(R + r)$ (d) None of these

69. In the condenser shown in the circuit is charged to 5V and left in the circuit, in 12 s the charge on the condenser will become :



(a) $\frac{10}{e}$ C (b) $\frac{e}{10}$ C
(c) $\frac{10}{e^2}$ C (d) $\frac{e^2}{10}$ C
($e = 2.718$)

70. Two cells, having the same emf, are connected in series through an external resistance R. Cells have internal resistances r_1 and r_2 ($r_1 > r_2$) respectively. When the circuit is closed, the potential difference across the first cell is zero. The value of R is :
(a) $r_1 - r_2$
(b) $\frac{r_1 + r_2}{2}$
(c) $\frac{r_1 - r_2}{2}$
(d) $r_1 + r_2$

71. Fleming's left and right hand rules are used in :
(a) DC motor and AC generator
(b) DC generator and AC motor
(c) DC motor and DC generator
(d) both rules are same, any one can be used

72. A long hollow copper tube carries a current I. Then which of the following will be true ?
(a) The magnetic field B will be zero at all points inside the tube
(b) The magnetic field B will be zero only at points on the axis of the tube
(c) The magnetic field B will be maximum at points on the axis of the tube
(d) The magnetic field will be zero at any point outside the tube

73. A battery has an emf of 15 V and internal resistance of 1 Ω. Is the terminal to terminal potential difference less than, equal to or greater than 15 V if the current in the battery is (1) from negative to positive terminal, (2) from positive to negative terminal (3) zero current ?
(a) Less, greater, equal
(b) Less, less, equal
(c) Greater, greater, equal
(d) Greater, less, equal

74. An inductance L and a resistance R are connected in series with a battery of emf ε. The maximum rate at which the energy is stored in the magnetic field is :
(a) $\frac{\varepsilon^2}{4R}$ (b) $\frac{\varepsilon^2}{2R}$
(c) $\frac{2R}{\varepsilon}$ (d) $\frac{4R}{\varepsilon}$

75. cause of heat production in a current carrying conductor is :
(a) collisions of free electrons with one another
(b) high drift speed of free electrons
(c) collisions of free electrons with atoms or ions of the conductor
(d) high resistance value

Chemistry

1. Bakelite is obtained from phenol by reacting with :
(a) acetaldehyde (b) acetal
(c) formaldehyde (d) chlorobenzene

2. The molecule which does not exhibit dipole moment is :
(a) NH_3 (b) $CHCl_3$
(c) H_2O (d) CCl_4

3. What is the half-life of ${}_6C^{14}$, if its disintegration constant is 2.31×10^{-4} year^{-1} ?
(a) 0.3×10^4 year (b) 0.3×10^3 year
(c) 0.3×10^8 year (d) 0.3×10^2 year

4. One mole of CO_2 contains :
(a) 3 g atoms of CO_2
(b) 18.1×10^{23} molecules of CO_2
(c) 6.02×10^{23} atoms of O
(d) 6.02×10^{23} atoms of C

5. Which of the following is isoelectronic with CO_2 ?
(a) NO_2 (b) NO
(c) N_2O (d) N_2O_4

6. All bond angles are exactly equal to 109° 28' in :
(a) methyl chloride (b) iodoform
(c) chloroform (d) carbon tetrachloride

7. The heats of combustion of carbon monoxide at constant pressure and at constant volume at 27°C will differ from one another by :
(a) 27 cal (b) 54 cal
(c) 300 cal (d) 600 cal

8. For the reaction
$$A(g) + 2B(g) \longrightarrow 2C(g) + 3D(g)$$
the change of enthalpy at 27°C is 19 kcal. The value of ΔE is :
(a) 21.2 kcal (b) 17.8 kcal
(c) 18.4 kcal (d) 20.6 kcal

9. In acidic medium MnO_4^- is converted to Mn^{2+}. The quantity of electricity in faraday required to reduce 0.5 mole of MnO_4^- to Mn^{2+} would be :
(a) 2.5 (b) 5
(c) 1 (d) 0.5

10. During electrolysis of water the volume of O_2 liberated is 2. 24 dm^3. The volume of hydrogen liberated, under same conditions will be :
(a) 2.24 dm^3 (b) 1.12 dm^3
(c) 4.48 dm^3 (d) 0.56 dm^3

11. Calculate the total pressure in a 10.0 L cylinder which contains 0.4 g helium, 1.6 g oxygen and 1.4 g nitrogen at 27°C.
(a) 0.492 atm (b) 49.2 atm
(c) 4.92 atm (d) 0.0492 atm

12. If the energy difference between the ground state of an atom and its excited state is 4.4×10^{-4} J, the wavelength of photon required to produce the transition :
(a) 2.26×10^{-12} m (b) 1.13×10^{-12} m
(c) 4.52×10^{-16} m (d) 4.52×10^{-12} m

13. The activity of a radioactive substance falls to 87.5% of the initial value in 5 years. What is the half-life of the element ?
(a) 52 years (b) 104 years
(c) 26 years (d) 13 years

14. Metals are good conductors of electricity because they contain :
(a) ionic bonds
(b) a network structure
(c) very few valence electrons
(d) free electrons

15. The oxidation states of iodine in HIO_4, H_3IO_5 and H_5IO_6 are respectively :
(a) + 1, + 3, + 7 (b) + 7, + 7, + 3
(c) + 7, + 7, + 7 (d) + 7, + 5, + 3

16. Crystalline form of silica is called :
(a) crystalline silicon (b) quartz
(c) rock (d) talc

17. The elements commonly used for making transistors are :
(a) C and Si (b) Ga and In
(c) P and As (d) Si and Ge

18. Ethyl alcohol is used as a preservative for chloroform because it :
(a) prevents aerial oxidation of chloroform
(b) prevents decomposition of chloroform
(c) decomposes phosgene to CO and Cl_2
(d) removes phosgene by converting it to ethyl carbonate

19. In the following sequence of reactions
$C_2H_5Br \xrightarrow{AgCN} X \xrightarrow{\text{Reduction}} Y$; Y is :
(a) *n*-propyl amine
(b) isopropylamine
(c) ethylamine
(d) ethylmethyl amine

20. Alcoholic beverages contain :
(a) isopropyl alcohol (b) *n*-propyl alcohol
(c) ethyl alcohol (d) methyl alcohol

21. In the reaction :
$A \xrightarrow[H_2SO_4]{K_2Cr_2O_7}$ acetone $\xrightarrow{\text{oxidation}}$ acetic acid,
A is :
(a) 1-propanol (b) 2-butanol
(c) 2-propanol (d) ethanol

22. The enzymes which are used to convert starch into ethyl alcohol are :
(a) maltase, diastase
(b) diastase, maltase, zymase
(c) invertase, zymase
(d) invertase, diastase, maltase

23. Picric acid is :
(a) 2, 4, 6-tribromophenol
(b) *sym*-trinitrophenol
(c) trinitrophenol
(d) 2, 4, 6-trinitrotoluene

24. 2-pentanone and 3-pentanone can be distinguished by :
(a) Cannizaro's reaction
(b) Aldol condensation
(c) Iodoform reaction
(d) Clemmensen's reduction

25. The acid which contains the aldehyde group is :
(a) acetic acid (b) formic acid
(c) benzoic acid (d) propionic acid

26. Sour taste of lemon is due to the presence of :
(a) citric acid (b) acetic acid
(c) oxalic acid (d) none of these

27. Vinegar is a solution of acetic acid which is :
(a) 15 – 20% (b) 20 – 25%
(c) 6 – 8% (d) 2 – 4%

28. Calcium formate on distillation gives :
(a) HCOOH (b) CH_3COOH
(c) CH_3CHO (d) HCHO

29. In the reaction :
$CH_3OH \xrightarrow{\text{oxidation}} A \xrightarrow{NH_3} B$; A and B are :
(a) HCHO, $HCOONH_4$
(b) HCOOH, $HCOONH_4$
(c) HCOOH, $HCONH_2$
(d) HCHO, $HCONH_2$

30. The cleavage of an aryl-alkyl ether with cold HI gives :
(a) alkyl iodide and water
(b) aryl iodide and water
(c) alkyl iodide, aryl iodide and water
(d) phenol and alkyl iodide

31. The number of σ and π bonds in a molecule of acetonitrile are respectively :
(a) 2, 5 (b) 3, 4
(c) 4, 3 (d) 5, 2

32. Proteins are :
(a) polypeptides with low molecular weights
(b) polypeptides with high molecular weights
(c) polymers of amides
(d) polymers of secondary amines

33. Glucose is a/an :
(a) polyhydroxy ketone
(b) alcohol
(c) hydrate of carbon
(d) pentahydroxy aldehyde

34. Which one of the following is an ester ?
(a) Coconout oil (b) Kerosene oil
(c) Soap (d) Glycerine

35. Among the following, a natural polymer is :
(a) cellulose (b) PVC
(c) polyethylene (d) Teflon

36. The mass of 1 mole of electrons is :
(a) 9.1×10^{-28} g (b) 1.008 mg
(c) 0.55 mg (d) 9.1×10^{-27} g

37. The bond order of N_2^+ is :
(a) 1.5 (b) 3.0
(c) 2.5 (d) 2.0

38. An aqueous solution of glucose is 20% in strength. The volume in which 1 g-mole of it is dissolved will be :
(a) 9 L (b) 1.8 L
(c) 8 L (d) 0.9 L

39. Green vitriol is :
(a) $FeSO_4 \cdot 7H_2O$ (b) $ZnSO_4 \cdot 7H_2O$
(c) $CuSO_4 \cdot 5H_2O$ (d) $CaSO_4 \cdot \frac{1}{2} H_2O$

40. Amphoteric-oxide combinations are in:
(a) ZnO, K_2O, SO_3
(b) ZnO, P_2O_5, Cl_2O_7
(c) SnO_2, Al_2O_3, ZnO
(d) PbO_2, SnO_2, SO_3

41. The element having highest electron affinity is :
(a) bromine (b) iodine
(c) fluorine (d) chlorine

42. The correct order according to size is :
(a) $O > O^- > O^{2-}$
(b) $O^- > O^{2-} > O$
(c) $O^{2-} > O^- > O$
(d) $O > O^{2-} > O^-$

43. Diagonal relationship is for :
(a) Li – Na (b) Be – Mg
(c) Si – C (d) B – Si

44. Mixture of $MgCl_2$ and MgO is called :
(a) Portland cement (b) Sorrel's cement
(c) double salt (d) none of these

45. Baking powder contains :
(a) $NaHCO_3$, $Ca(H_2PO_2)_2$ and starch
(b) $NaHCO_3$, $Ca(H_2PO_2)_2$
(c) $NaHCO_3$, starch
(d) $NaHCO_3$

46. Estimation of calcium and magnesium is done by :
(a) EDTA (b) oxalate
(c) phosphate (d) none of these

47. Buckminster fullerene is :
(a) pure graphite (b) C-60
(c) diamond (d) C-90

48. Pb reacts with dilute HNO_3 produces :
(a) NO (b) NH_4NO_3
(c) N_2O_5 (d) NO_2

49. End-product of the hydrolysis of XeF_6 is :
(a) XeF_4O (b) XeF_2O_2
(c) XeO_3 (d) XeO_3^-

50. Dry ice is :
(a) solid SO_2 (b) solid NH_3
(c) solid O_2 (d) solid CO_2

51. For advertisement, the coloured discharged tubes contain :
(a) He (b) Ne
(c) Ar (d) Kr

52. The deficiency of iodine in diet causes :
(a) rickets (b) nightblindness
(c) beri-beri (d) goitre

53. Bronze is a mixture of :
(a) Pb + Sn (b) Cu + Sn
(c) Cu + Zn (d) Pb + Zn

54. The process of zinc-plating on iron sheet is known as :
(a) annealing (b) roasting
(c) galvanization (d) smelting

55. Vitamin B_{12} contains :
(a) Co (b) Mn
(c) Mg (d) Fe

56. Philosopher's wool on heating with BaO at 1100°C produce :
(a) $Ba + ZnCl_2$ (b) $BaCdO_2$
(c) $BaZnO_2$ (d) $BaO_2 + Zn$

57. Following method is not used for extraction of Al :
(a) van Arkel (b) Serpeck
(c) Baeyer (d) Hall-Heroult

58. In electrorefining of copper, some gold is deposited as :
(a) cathode (b) electrode
(c) cathode mud (d) anode mud

59. The pH value of 1/1000 N-KOH solution is :
(a) 3 (b) 10^{-11}
(c) 2 (d) 11

60. Geometrical isomers can exist for :
(a) $CH_3CH(CH_3)CH_2CH_2CH_3$
(b) $CH_3CH = CH \cdot CH_3$
(c) $CH_3CH = CH_2$
(d) $ClH_2C - CH_2Cl$

61. Size of colloidal particles is in the range :
(a) 0.05 mμ – 0.1 mμ
(b) 25 μ – 30 μ
(c) 0.1 μ – 1 mμ
(d) 10 μ – 20 μ

62. Osmotic pressure of 0.4% urea solution is 1.64 atm. and that of 3.42% cane sugar is 2.46 atm. When the above two solutions are mixed, the osmotic pressure of the resulting solution is :
(a) 0.82 atm (b) 2.46 atm
(c) 1.64 atm (d) 4.10 atm

63. LPG mainly contains :
(a) ethyne (b) butane
(c) methane (d) ethane

64. Which of the following metal ions is not coloured ?
(a) Ti^{3+} (b) Fe^{3+}
(c) V^{2+} (d) Zn^{2+}

65. Volume of water needed to mix with 10 mL N HCl to get 0.1 N HCl is :
(a) 900 mL (b) 9 mL
(c) 90 mL (d) 100 mL

66. Heavy water is :
(a) water containing Fe, Cr, Mn
(b) water at 0°C
(c) D_2O
(d) water obtained after distillation

67. Two moles of PCl_5 were heated in a closed vessel of 2 L. At equilibrium 40% of PCl_5 is dissociated into PCl_3 and Cl_2. The value of equilibrium constant is :
(a) 0.53 (b) 0.267
(c) 2.63 (d) 5.3

68. Equal moles of water and urea are taken in a flask. What is mass percentage of urea in the solution ?
(a) 23.077% (b) 230.77%
(c) 2.3077% (d) 0.23077%

69. The radiant energy from the sun is due to :
(a) combustion
(b) nuclear fusion
(c) nuclear fission
(d) chemical reaction

70. The IUPAC name of $K_2[PtCl_6]$ is :
(a) hexachloroplatinate potassium
(b) potassium hexachloroplatinate (IV)
(c) potassium hexachloroplatinate
(d) potassium hexachloroplatinum (IV)

71. The solubility of CaF_2 in pure water is 2.3×10^{-6} mol dm^{-3}. Its solubility product will be :
(a) 4.8×10^{-18}
(b) 48.66×10^{-18}
(c) 4.9×10^{-11}
(d) 48.66×10^{-15}

72. In the reaction,
$RNH_2 \xrightarrow{HNO_2} A + B + C\uparrow$; C is :
(a) NH_3 (b) N_2
(c) O_2 (d) CO_2

73. In an isochoric process, ΔH for a system is equal to :
(a) $P \cdot \Delta V$ (b) PV
(c) $E + P \cdot \Delta V$ (d) ΔE

74. The value of the ionic product of water depends :
(a) on volume of water
(b) on temperature
(c) changes by adding acid or alkali
(d) always remain constant

75. Fluorine exhibits an oxidation state of only -1 because :
(a) it can readily accept an electron
(b) it is very strongly electronegative
(c) it is a non-metal
(d) it belongs to halogen family

. If z_1, z_2 are any two complex numbers, then :
(a) $|z_1 + z_2| \geq |z_1| + |z_2|$
(b) $|z_1 + z_2| > |z_1| + |z_2|$
(c) $|z_1 + z_2| \leq |z_1| + |z_2|$
(d) $|z_1 + z_2| = |z_1| + |z_2|$

. If $z = x + iy$ is a variable complex number such that $\arg \frac{z-1}{z+1} = \frac{\pi}{4}$, then :
(a) $x^2 - y^2 - 2x = 1$ (b) $x^2 + y^2 - 2x = 1$
(c) $x^2 + y^2 - 2y = 1$ (d) $x^2 + y^2 + 2x = 1$

. If arithmetic mean of two positive numbers is A, their geometric mean is G and harmonic mean is H, then H is equal to :
(a) G^2 / A (b) A^2 / G^2
(c) A / G^2 (d) G / A^2

. The sum of n terms of two arithmetic series are in the ratio $2n + 3 : 6n + 5$, then the ratio of their 13th terms is :
(a) 53 : 155 (b) 27 : 87
(c) 29 : 83 (d) 31 : 89

. If α, β, γ are the roots of the equation $x^3 + x + 1 = 0$, then the value of $\alpha^3 + \beta^3 + \gamma^3$ is :
(a) 0 (b) 3
(c) -3 (d) -1

. If $A = \begin{bmatrix} 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \end{bmatrix}$, then A^{-1} is :
(a) $-A$ (b) A
(c) 1 (d) none of these

. If $A = \begin{bmatrix} 6 & 8 & 5 \\ 4 & 2 & 3 \\ 9 & 7 & 1 \end{bmatrix}$ is the sum of a symmetric matrix B and skew-symmetric matrix C, then B is :
(a) $\begin{bmatrix} 6 & 6 & 7 \\ 6 & 2 & 5 \\ 7 & 5 & 1 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 2 & -2 \\ -2 & 5 & -2 \\ 2 & 2 & 0 \end{bmatrix}$
(c) $\begin{bmatrix} 6 & 6 & 7 \\ -6 & 2 & -5 \\ -7 & 5 & 1 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 6 & -2 \\ 2 & 0 & -2 \\ -2 & -2 & 0 \end{bmatrix}$

8. If $A = \begin{bmatrix} 1 & 1 \\ 1 & 1 \end{bmatrix}$, then A^{100} is equal to :
(a) $2^{100} A$ (b) $2^{99} A$
(c) $100\, A$ (d) $299\, A$

9. If $\begin{bmatrix} 1 & 1 & 1 \\ 1 & -2 & -2 \\ 1 & 3 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 3 \\ 4 \end{bmatrix}$, then $\begin{bmatrix} x \\ y \\ z \end{bmatrix}$ is equal to :
(a) $\begin{bmatrix} 0 \\ 1 \\ 1 \end{bmatrix}$ (b) $\begin{bmatrix} 1 \\ 2 \\ -3 \end{bmatrix}$
(c) $\begin{bmatrix} 5 \\ -2 \\ 1 \end{bmatrix}$ (d) $\begin{bmatrix} 1 \\ -2 \\ 3 \end{bmatrix}$

10. If $y = \cos^2 x + \sec^2 x$, then :
(a) $y \leq 2$ (b) $y \leq 1$
(c) $y \geq 2$ (d) $1 < y < 2$

11. If $x + \frac{1}{x} = 2\cos\theta$, then $x^3 + \frac{1}{x^3}$ is equal to :
(a) $\sin 3\theta$ (b) $2 \sin 3\theta$
(c) $\cos 3\theta$ (d) $2 \cos 3\theta$

12. If $\sin\theta + \operatorname{cosec}\theta = 2$, the value of $\sin^{10}\theta + \operatorname{cosec}^{10}\theta$ is :
(a) 2 (b) 2^{10}
(c) 2^9 (d) 10

13. The value of $\sin\frac{\pi}{16} \sin\frac{3\pi}{16} \sin\frac{5\pi}{16} \sin\frac{7\pi}{16}$ is :
(a) $\frac{\sqrt{2}}{16}$ (b) $\frac{1}{8}$
(c) $\frac{1}{16}$ (d) $\frac{\sqrt{2}}{32}$

14. If $\frac{\tan 3\theta - 1}{\tan 3\theta + 1} = \sqrt{3}$, then the general value of θ is :
(a) $\frac{n\pi}{3} - \frac{\pi}{12}$ (b) $n\pi + \frac{7\pi}{12}$
(c) $\frac{n\pi}{3} + \frac{7\pi}{36}$ (d) $n\pi + \frac{\pi}{12}$

15. In any triangle ABC, if $\cos A = \frac{\sin B}{2 \sin C}$, then :
(a) $a = b = c$ (b) $c = a$
(c) $a = b$ (d) $b = c$

16. In a triangle ABC, if $b + c = 2a$ and $\angle A = 60°$, then ΔABC is :
(a) equilateral
(b) right angled
(c) isosceles
(d) scalene

17. The co-ordinates of the point which divides the join of the points $(2, -1, 3)$ and $(4, 3, 1)$ in the ratio 3 : 4 internally are given by :

(a) $\frac{2}{7}, \frac{20}{7}, \frac{10}{7}$ (b) $\frac{10}{7}, \frac{15}{7}, \frac{2}{7}$

(c) $\frac{20}{7}, \frac{5}{7}, \frac{15}{7}$ (d) $\frac{15}{7}, \frac{20}{7}, \frac{3}{7}$

18. The area of the triangle ABC, in which $a = 1$, $b = 2$, $\angle C = 60°$, is :

(a) 4 sq unit (b) $\frac{1}{2}$ sq unit

(c) $\frac{\sqrt{3}}{2}$ sq unit (d) $\sqrt{3}$ sq unit

19. In a triangle ABC, $b = \sqrt{3}$, $c = 1$ and $\angle A = 30°$, then the largest angle of the triangle is :

(a) 60° (b) 135° (c) 90° (d) 120°

20. If $A + B + C = \pi$, then $\sin 2A + \sin 2B + \sin 2C$ is equal to :

(a) $4 \sin A \sin B \sin C$

(b) $4 \cos A \cos B \cos C$

(c) $2 \cos A \cos B \cos C$

(d) $2 \sin A \sin B \sin C$

21. A flag is standing vertically on a tower of height b. On a point at a distance a from the foot of the tower, the flag and the tower subtend equal angles. The height of the flag is :

(a) $b \cdot \frac{a^2 + b^2}{a^2 - b^2}$ (b) $a \cdot \frac{a^2 - b^2}{a^2 + b^2}$

(c) $b \cdot \frac{a^2 - b^2}{a^2 + b^2}$ (d) $a \cdot \frac{a^2 + b^2}{a^2 - b^2}$

22. If α, β are the roots of the equation $6x^2 - 5x + 1 = 0$, then the value of $\tan^{-1}\alpha + \tan^{-1}\beta$ is :

(a) 0 (b) $\pi/4$ (c) 1 (d) $\pi/2$

23. The three straight lines $ax + by = c$, $bx + cy = a$ and $cx + ay = b$ are collinear, if :

(a) $b + c = a$ (b) $c + a = b$

(c) $a + b + c = 0$ (d) $a + b = c$

24. The length of perpendicular from the point $(a \cos \alpha, a \sin \alpha)$ upon the straight line $y = x \tan \alpha + c$, $c > 0$, is :

(a) c (b) $c \sin^2 \alpha$

(c) $c \cos^2 \alpha$ (d) $c \sec^2 \alpha$

25. The equation of the circumcircle of the triangle formed by the lines $x = 0, y = 0, 2x + 3y = 5$ is :

(a) $6(x^2 + y^2) + 5(3x - 2y) = 0$

(b) $x^2 + y^2 - 2x - 3y + 5 = 0$

(c) $x^2 + y^2 + 2x - 3y - 5 = 0$

(d) $6(x^2 + y^2) - 5(3x + 2y) = 0$

26. The differential equation of system of concentric circles with centre (1, 2) is :

(a) $(x - 2) + (y - 1)\frac{dy}{dx} = 0$

(b) $(x - 1) + (y - 2)\frac{dy}{dx} = 0$

(c) $(x + 1)\frac{dy}{dx} + (y - 2) = 0$

(d) $(x + 2)\frac{dy}{dx} + (y - 1) = 0$

27. The equation of pair of lines joining origin to the points of intersection of $x^2 + y^2 = 9$ and $x + y = 3$ is :

(a) $x^2 + (3 - x)^2 = 9$

(b) $xy = 0$

(c) $(3 + y)^2 + y^2 = 9$

(d) $(x - y)^2 = 9$

28. The value of λ, for which the circle $x^2 + y^2 + 2\lambda x + 6y + 1 = 0$ intersects the circle $x^2 + y^2 + 4x + 2y = 0$ orthogonally, is :

(a) 11/8 (b) −1

(c) −5/4 (d) 5/2

29. The value of m, for which the line $y = mx + \frac{25\sqrt{3}}{3}$ is a normal to the conic $\frac{x^2}{16} - \frac{y^2}{9} = 1$, is :

(a) $-\frac{2}{\sqrt{3}}$ (b) $\sqrt{3}$

(c) $-\frac{\sqrt{3}}{2}$ (d) none of these

30. The value of c, for which the line $y = 2x + c$ is a tangent to the circle $x^2 + y^2 = 16$, is :

(a) $-16\sqrt{5}$ (b) $4\sqrt{5}$

(c) $16\sqrt{5}$ (d) 20

31. The value of λ, for which the equation $x^2 - y^2 - x + \lambda y - 2 = 0$ represents a pair of straight lines, are :

(a) −3, 1 (b) −1, 1

(c) 3, −3 (d) 3, 1

32. The focus of the parabola $x^2 + 2y + 6x = 0$ is :

(a) (−3, 4) (b) (3, 4)

(c) (3, −4) (d) (−3, −4)

33. The value of m, for which the line $y = mx + 2$ becomes a tangent to the conic $4x^2 - 9y^2 = 36$, are :

(a) $\pm\frac{2}{3}$ (b) $\pm\frac{2\sqrt{2}}{3}$

(c) $\pm\frac{8}{9}$ (d) $\pm\frac{4\sqrt{2}}{3}$

eccentricity of the conic $4x^2 + 16y^2 - 24x - 32y = 1$ is :

(a) $\frac{1}{2}$ (b) $\sqrt{3}$

(c) $\frac{\sqrt{3}}{2}$ (d) $\frac{\sqrt{3}}{4}$

35. The number of maximum normals which can be drawn from a point to ellipse is :

(a) 4 (b) 2

(c) 1 (d) 3

36. The equation of line of intersection of planes $4x + 4y - 5z = 12$, $8x + 12y - 13z = 32$ can be written as :

(a) $\frac{x-1}{2} = \frac{y+2}{-3} = \frac{z}{4}$

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

(c) $\frac{x}{2} = \frac{y+1}{3} = \frac{z-2}{4}$

(d) $\frac{x}{2} = \frac{y}{3} = \frac{z-2}{4}$

37. If a line makes angles $\alpha, \beta, \gamma, \delta$ with four diagonals of a cube, then the value of $\sin^2\alpha + \sin^2\beta + \sin^2\gamma + \sin^2\delta$ is :

(a) 4/3 (b) 8/3

(c) 7/3 (d) 1

38. The equation of the plane, which makes with co-ordinate axes, a triangle with its centroid (α, β, γ), is :

(a) $\alpha x + \beta y + \gamma z = 3$ (b) $\alpha x + \beta y + \gamma z = 1$

(c) $\frac{x}{\alpha} + \frac{y}{\beta} + \frac{z}{\gamma} = 3$ (d) $\frac{x}{\alpha} + \frac{\gamma}{\beta} + \frac{z}{\gamma} = 1$

39. If the points $(1, 1), (-1, -1), (-\sqrt{3}, \sqrt{3})$ are the vertices of a triangle, then this triangle is :

(a) right-angled (b) isosceles

(c) equilateral (d) none of these

40. A variable plane moves so that sum of the reciprocals of its intercepts on the co-ordinate axes is 1/2. Then the plane passes through :

(a) $\left(\frac{1}{2}, \frac{1}{2}, -\frac{1}{2}\right)$ (b) $(-1, 1, 1)$

(c) $(2, 2, 2)$ (d) $(0, 0, 0)$

41. The direction cosines l, m, n of two lines are connected by the relations $l + m + n = 0$, $lm = 0$, then the angle between them is :

(a) $\pi/3$

(b) $\pi/4$

(c) $\pi/2$

(d) 0

42. The value of $[\vec{a}\ \vec{b} + \vec{c}\ \vec{a} + \vec{b} + \vec{c}]$ is :

(a) $[\vec{a}\ \vec{b}\ \vec{c}]$ (b) 0

(c) $2[\vec{a}\ \vec{b}\ \vec{c}]$ (d) $\vec{a} \times (\vec{b} \times \vec{c})$

43. The area of the triangle having vertices as $\hat{i} - 2\hat{j} + 3\hat{k}, -2\hat{i} + 3\hat{j} - \hat{k}, 4\hat{i} - 7\hat{j} + 7\hat{k}$ is :

(a) 36 sq unit (b) 0 sq unit

(c) 39 sq unit (d) 11 sq unit

44. The figure formed by the four points $\hat{i} + \hat{j} - \hat{k}$, $2\hat{i} + 3\hat{j}$, $5\hat{j} - 2\hat{k}$ and $\hat{k} - \hat{j}$ is :

(a) trapezium

(b) rectangle

(c) parallelogram

(d) none of the above

45. The equation of the plane passing through three non-collinear points $\vec{a}, \vec{b}, \vec{c}$ is :

(a) $\vec{r} \cdot (\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}) = 0$

(b) $\vec{r} \cdot (\vec{b} \times \vec{c} + \vec{c} \times \vec{a} + \vec{a} \times \vec{b}) = [\vec{a}\ \vec{b}\ \vec{c}]$

(c) $\vec{r} \cdot (\vec{a} \times (\vec{b} \times \vec{c})) = [\vec{a}\ \vec{b}\ \vec{c}]$

(d) $\vec{r} \cdot (\vec{a} + \vec{b} + \vec{c}) = 0$

46. The unit vector perpendicular to $\hat{i} - \hat{j}$ and coplanar with $\hat{i} + 2\hat{j}$ and $2\hat{i} + 3\hat{j}$ is :

(a) $\frac{2\hat{i} - 5\hat{j}}{\sqrt{29}}$ (b) $2\hat{i} + 5\hat{j}$

(c) $\frac{1}{\sqrt{2}}(\hat{i} + \hat{j})$ (d) $\hat{i} + \hat{j}$

47. $(\vec{a} \times \vec{b})^2 + (\vec{a} \cdot \vec{b})^2$ is equal to :

(a) $\vec{a}^2\,\vec{b}^2$ (b) $\vec{a}^2 + \vec{b}^2$

(c) 1 (d) $2\vec{a} \cdot \vec{b}$

48. The domain of the function $f(x) = \exp(\sqrt{5x - 3 - 2x^2})$ is :

(a) $[3/2, \infty)$

(b) $[1, 3/2]$

(c) $(-\infty, 1]$

(d) $(1, 3/2)$

49. $\lim_{x \to \infty} \frac{\sin x}{x}$ is equal to :

(a) ∞
(b) 1
(c) 0
(d) does not exist

50. For the function

$$f(x)=\begin{cases}\frac{e^{1/x}-1}{e^{1/x}+1}, & x \neq 0 \\ 0, & x=0\end{cases}$$

$x = 0$, which of the following is correct :

(a) $\lim_{x \to 0} f(x)$ does not exist
(b) $\lim_{x \to 0} f(x) = 1$
(c) $\lim_{x \to 0} f(x)$ exists but $f(x)$ is not continuous at $x = 0$
(d) $f(x)$ is continuous at $x = 0$

51. If $f(x) = \frac{x}{x-1}$, then $\frac{(fo\, fo \ldots of)(x)}{19 \text{ times}}$ is equal to :

(a) $\frac{x}{x-1}$ (b) $\left(\frac{x}{x-1}\right)^{19}$
(c) $\frac{19x}{x-1}$ (d) x

52. A function f is defined by $f(x) = 2 + (x-1)^{2/3}$ in [0, 2]. Which of the following is not correct ?

(a) f is not derivable in (0, 2)
(b) f is continuous in [0, 2]
(c) $f(0) = f(2)$
(d) Rolle's theorem is true in [0, 2]

53. If $f(x) = \frac{2x-1}{x+5}$ $(x \neq -5)$, then $f^{-1}(x)$ is equal to :

(a) $\frac{x+5}{2x-1}, x \neq \frac{1}{2}$ (b) $\frac{5x+1}{2-x}, x \neq 2$
(c) $\frac{x-5}{2x+1}, x \neq \frac{1}{2}$ (d) $\frac{5x-1}{2-x}, x \neq 2$

54. $\frac{d}{dx}\left(\tan^{-1}\frac{\sqrt{1+x^2}-1}{x}\right)$ is equal to :

(a) $\frac{1}{1+x^2}$
(b) $\frac{x^2}{2\sqrt{1+x^2}\,(\sqrt{1+x^2}-1)}$
(c) $\frac{2}{1+x^2}$
(d) $\frac{1}{2(1+x^2)}$

55. $\frac{d}{dx}\left(\tan^{-1}\sqrt{\frac{1+\cos\frac{x}{2}}{1-\cos\frac{x}{2}}}\right)$ is equal to :

(a) $-1/4$ (b) $1/4$
(c) $-1/2$ (d) $1/2$

56. The maximum value of $x^{1/x}$ is :

(a) $1/e^e$ (b) e
(c) $e^{1/e}$ (d) $1/e$

57. The function f defined by $f(x) = 4x^4 - 2x + 1$ is increasing for :

(a) $x < 1$ (b) $x > 0$
(c) $x < 1/2$ (d) $x > 1/2$

58. A particle moves in a straight line so that $s = \sqrt{t}$, then its acceleration is proportional to :

(a) (velocity)^3 (b) velocity
(c) (velocity)^2 (d) (velocity)$^{3/2}$

59. $\int 32x^3 (\log x)^2 \, dx$ is equal to :

(a) $8x^4 (\log x)^2 + c$
(b) $x^4 \{8(\log x)^2 - 4(\log x) + 1\} + c$
(c) $x^4 \{8(\log x)^2 - 4 \log x\} + c$
(d) $x^3 \{(\log x)^2 - 2 \log x\} + c$

60. $\int \frac{\cos x - 1}{\sin x + 1} e^x \, dx$ is equal to :

(a) $\frac{e^x \cos x}{1+\sin x} + c$ (b) $c - \frac{e^x \sin x}{1+\sin x}$
(c) $c - \frac{e^x}{1+\sin x}$ (d) $c - \frac{e^x \cos x}{1+\sin x}$

61. If $\int f(x)\,dx = g(x) + c$, then $\int f^{-1}(x)\,dx$ is equal to :

(a) $x f^{-1}(x) + c$
(b) $f(g^{-1}(x)) + c$
(c) $x f^{-1}(x) - g(f^{-1}(x)) + c$
(d) $g^{-1}(x) + c$

62. The value of $\int_1^2 \frac{dx}{x(1+x^4)}$ is :

(a) $\frac{1}{4}\log\frac{17}{32}$ (b) $\frac{1}{4}\log\frac{32}{17}$
(c) $\log\frac{17}{2}$ (d) $\frac{1}{4}\log\frac{17}{2}$

63. The value of the integral $\int_a^b \frac{\sqrt{x}\,dx}{\sqrt{x}+\sqrt{a+b-x}}$ is :

(a) π (b) $\frac{1}{2}(b-a)$

(c) $\pi/2$ (d) $b-a$

64. The area bounded by $y = \log x$, x-axis and ordinates $x = 1$, $x = 2$ is :

(a) $\frac{1}{2}(\log 2)^2$ (b) $\log 2/e$

(c) $\log 4/e$ (d) $\log 4$

65. The area of the segment of a circle of radius a subtending an angle of 2α at the centre is :

(a) $a^2\left(\alpha + \frac{1}{2}\sin 2\alpha\right)$

(b) $\frac{1}{2}a^2 \sin 2\alpha$

(c) $a^2\left(\alpha - \frac{1}{2}\sin 2\alpha\right)$

(d) $a^2\,\alpha$

66. The solution of the differential equation $\frac{dy}{dx} + \frac{2yx}{1+x^2} = \frac{1}{(1+x^2)^2}$ is :

(a) $y(1+x^2) = c + \tan^{-1} x$

(b) $\frac{y}{1+x^2} = c + \tan^{-1} x$

(c) $y \log(1+x^2) = c + \tan^{-1} x$

(d) $y(1+x^2) = c + \sin^{-1} x$

67. The solution of the differential equation $x\,dy - y\,dx = \sqrt{x^2+y^2}\,dx$ is :

(a) $x + \sqrt{x^2+y^2} = cx^2$

(b) $y - \sqrt{x^2+y^2} = cx$

(c) $x - \sqrt{x^2+y^2} = cx$

(d) $y + \sqrt{x^2+y^2} = cx^2$

68. The solution of the differential equation $\frac{dy}{dx} = e^{x-y} + x^2 e^{-y}$ is :

(a) $y = e^{x-y} - x^2e^{-y} + c$

(b) $e^y - e^x = \frac{1}{3}x^3 + c$

(c) $e^x + e^y = \frac{1}{3}x^3 + c$

(d) $e^x - e^y = \frac{1}{3}x^3 + c$

69. If A and B are 2×2 matrices, then which of the following is true ?

(a) $(A+B)^2 = A^2 + B^2 + 2AB$

(b) $(A-B)^2 = A^2 + B^2 - 2AB$

(c) $(A-B)(A+B) = A^2 + AB - BA - B^2$

(d) $(A+B)(A-B) = A^2 - B^2$

70. If M and N are any two events. The probability, that exactly one of them occurs, is :

(a) $P(M) + P(N) - P(M \cap N)$

(b) $P(M) + P(N) + P(M \cap N)$

(c) $P(M) + P(N)$

(d) $P(M) + P(N) - 2P(M \cap N)$

71. If four dice are thrown together. Probability that the sum of the number appearing on them is 13, is :

(a) $\frac{35}{324}$ (b) $\frac{5}{216}$

(c) $\frac{11}{216}$ (d) $\frac{11}{432}$

72. If θ is the angle between two regression lines with correlation coefficient γ, then :

(a) $\sin\theta \geq 1 - \gamma^2$

(b) $\sin\theta \leq 1 - \gamma^2$

(c) $\sin\theta \leq \gamma^2 + 1$

(d) $\sin\theta \leq \gamma^2 - 1$

73. The value of $.0\overline{37}$, where $0.0\overline{37}$ stands for the number 0.0373737....., is :

(a) 37/1000

(b) 37/990

(c) 1/37

(d) 1/27

74. If ω is an imaginary root of unity, then the value of $\begin{vmatrix} a & b\omega^2 & a\omega \\ b\omega & c & b\omega^2 \\ c\omega^2 & a\omega & c \end{vmatrix}$ is :

(a) $a^3 + b^3 + c^3$

(b) $a^2b - b^2c$

(c) 0

(d) $a^3 + b^3 + c^3 - 3abc$

75. If $A = \{x, y\}$, then the power set of A is :

(a) $\{x^y, y^x\}$

(b) $\{\phi, x, y\}$

(c) $\{\phi, \{x\}, \{2y\}\}$

(d) $\{\phi, \{x\}, \{y\}, \{x, y\}\}$

ANSWERS

→ PHYSICS

1. (a)	2. (b)	3. (d)	4. (a)	5. (b)	6. (a)	7. (c)	8. (a)	9. (a)	10. (b)
11. (c)	12. (b)	13. (a)	14. (b)	15. (d)	16. (d)	17. (b)	18. (a)	19. (c)	20. (b)
21. (b)	22. (c)	23. (a)	24. (b)	25. (a)	26. (a)	27. (a)	28. (d)	29. (a)	30. (b)
31. (b)	32. (c)	33. (d)	34. (d)	35. (b)	36. (a)	37. (c)	38. (d)	39. (b)	40. (c)
41. (c)	42. (c)	43. (a)	44. (a)	45. (b)	46. (a)	47. (d)	48. (a)	49. (a)	50. (a)
51. (b)	52. (b)	53. (d)	54. (a)	55. (a)	56. (b)	57. (c)	58. (a)	59. (d)	60. (c)
61. (d)	62. (a)	63. (a)	64. (c)	65. (a)	66. (c)	67. (b)	68. (c)	69. (a)	70. (a)
71. (c)	72. (d)	73. (a)	74. (a)	75. (c)					

→ CHEMISTRY

1. (c)	2. (d)	3. (a)	4. (d)	5. (c)	6. (d)	7. (c)	8. (b)	9. (a)	10. (c)
11. (a)	12. (d)	13. (c)	14. (d)	15. (c)	16. (b)	17. (d)	18. (d)	19. (d)	20. (c)
21. (c)	22. (b)	23. (b)	24. (c)	25. (b)	26. (a)	27. (c)	28. (d)	29. (b)	30. (d)
31. (d)	32. (b)	33. (d)	34. (a)	35. (a)	36. (c)	37. (c)	38. (d)	39. (a)	40. (c)
41. (d)	42. (c)	43. (d)	44. (b)	45. (a)	46. (a)	47. (b)	48. (a)	49. (c)	50. (d)
51. (b)	52. (d)	53. (b)	54. (c)	55. (a)	56. (c)	57. (a)	58. (d)	59. (d)	60. (b)
61. (c)	62. (d)	63. (b)	64. (d)	65. (c)	66. (c)	67. (b)	68. (a)	69. (b)	70. (b)
71. (b)	72. (b)	73. (d)	74. (b)	75. (b)					

→ MATHEMATICS

1. (c)	2. (c)	3. (a)	4. (a)	5. (c)	6. (b)	7. (a)	8. (b)	9. (b)	10. (c)
11. (d)	12. (a)	13. (a)	14. (c)	15. (b)	16. (a)	17. (c)	18. (c)	19. (d)	20. (a)
21. (a)	22. (b)	23. (c)	24. (c)	25. (d)	26. (b)	27. (b)	28. (c)	29. (a)	30. (b)
31. (c)	32. (a)	33. (b)	34. (c)	35. (d)	36. (b)	37. (b)	38. (c)	39. (c)	40. (c)
41. (a)	42. (b)	43. (b)	44. (d)	45. (b)	46. (c)	47. (a)	48. (b)	49. (c)	50. (c)
51. (a)	52. (d)	53. (b)	54. (d)	55. (a)	56. (c)	57. (d)	58. (a)	59. (b)	60. (a)
61. (c)	62. (b)	63. (b)	64. (c)	65. (d)	66. (a)	67. (d)	68. (b)	69. (c)	70. (d)
71. (a)	72. (b)	73. (b)	74. (c)	75. (d)					