

# UPSEE - 2010

## Physics

1. The dimensional formula of modulus of elasticity is  
(a)  $[ML^{-1}T^{-2}]$  (b)  $[M^0LT^{-2}]$   
(c)  $[MLT^{-2}]$  (d)  $[ML^2T^{-2}]$
2. Which of the following is true for elastic potential energy density?  
(a) Energy density =  $1/2 \times \text{strain} \times \text{stress}$   
(b) Energy density =  $(\text{strain})^2 \times \text{volume}$   
(c) Energy density =  $(\text{strain}) \times \text{volume}$   
(d) Energy density =  $(\text{stress}) \times \text{volume}$
3. To obtain p-type Si semiconductor, we need to dope pure Si with  
(a) aluminium (b) phosphorous  
(c) oxygen (d) germanium
4. By increasing the temperature, the conductance of a conductor and a semiconductor  
(a) increases for both  
(b) decreases for both  
(c) increases, decreases  
(d) decreases, increases
5. Which of the following is true?  
(a) Lyman series is a continuous spectrum  
(b) Paschen series is a line spectrum in the infrared  
(c) Balmer series is a line spectrum in the ultraviolet  
(d) The spectral series formula can be derived from the Rutherford model of the hydrogen atom
6. A particle of mass 100 g is thrown vertically upwards with a speed of 5m/s. The work done by the force of gravity during the time the particle goes up is  
(a) - 1.25 J (b) 1.25 J  
(c) 0.5 J (d) - 0.5 J
7. When light travels from one medium to the other of which the refractive index is different, then which of the following will change?  
(a) Frequency, wavelength and velocity  
(b) Frequency and wavelength  
(c) Frequency and velocity  
(d) Wavelength and velocity
8. The following truth table corresponds to the logic gate  

A	B	X
0	0	0
0	1	1
1	0	1
1	1	1

  
(a) NAND (b) OR  
(c) AND (d) XOR
9. Which of the following is the smallest unit?  
(a) Millimetre (b) Angstrom  
(c) Fermi (d) Metre
10. In transformer, core is made of soft iron to reduce  
(a) hysteresis losses  
(b) eddy current losses  
(c) force opposing electric current  
(d) None of the above
11. Light is an electromagnetic wave. Its speed in vacuum is given by the expression  
(a)  $\sqrt{\mu_0 \epsilon_0}$  (b)  $\sqrt{\frac{\mu_0}{\epsilon_0}}$   
(c)  $\sqrt{\frac{\epsilon_0}{\mu_0}}$  (d)  $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$
12. Kirchhoff's first law i.e.,  $\sum i = 0$  at a junction is based on the law of conservation of  
(a) charge (b) energy  
(c) momentum (d) angular momentum



13. Bernoulli's principle is based on the law of conservation of

- (a) angular momentum
- (b) linear momentum
- (c) mass
- (d) energy

14. The frequency and work function of an incident photon are  $\nu$  and  $\phi_0$ . If  $\nu_0$  is the threshold frequency, then necessary condition for the emission of photoelectron is

- (a)  $\nu < \nu_0$
- (b)  $\nu = \frac{\nu_0}{2}$
- (c)  $\nu \geq \nu_0$
- (d) None of these

15. Lenz's law is a consequence of the law of conservation of

- (a) charge
- (b) momentum
- (c) mass
- (d) energy

16. The capacity of a condenser is  $20 \times 10^{-6}$  F and the potential is 20 V. The energy released on discharging it fully will be

- (a)  $2 \times 10^{-3}$  J
- (b)  $4 \times 10^{-3}$  J
- (c)  $8 \times 10^{-3}$  J
- (d)  $10 \times 10^{-3}$  J

17. If a gymnast, sitting on a rotating stool with his arms outstretched, suddenly lowers his hands.

- (a) The angular velocity decreases
- (b) His moment of inertia decreases
- (c) The angular velocity stays constant
- (d) The angular momentum increases

18. For the myopic eye, the defect is cured by

- (a) convex lens
- (b) concave lens
- (c) cylindrical lens
- (d) toric lens

19. Doppler's effect will not be applicable when the velocity of sound source is

- (a) less than the velocity of sound
- (b) greater than the velocity of sound
- (c) zero
- (d) None of the above

20. Two masses  $m_1 = m/2$  and  $m_2 = m$  kg tied to a string are hanging over a light frictionless pulley. What is the acceleration of the masses when they are free to move? ( $g = 9.8 \text{ m/s}^2$ )



- (a)  $g$
- (b)  $g/2$
- (c)  $g/3$
- (d)  $g/4$

21. A ball is dropped from a height  $h$ . If the coefficient of restitution be  $e$ , then the body rebounds to a height of

- (a)  $eh$
- (b)  $e^2h$
- (c)  $e^3h$
- (d)  $e^4h$

22. A cube has a side of length  $1.2 \times 10^{-2}$  m. Calculate its volume.

- (a)  $1.7 \times 10^{-6} \text{ m}^3$
- (b)  $1.73 \times 10^{-6} \text{ m}^3$
- (c)  $1.70 \times 10^{-6} \text{ m}^3$
- (d)  $1.732 \times 10^{-6} \text{ m}^3$

23. A particle is projected with velocity  $\sqrt{2gh}$ , such that it just crosses two walls of height  $h$  and separated by  $h$ . Find the angle of projection.

- (a)  $15^\circ$
- (b)  $75^\circ$
- (c)  $60^\circ$
- (d)  $30^\circ$

24. A particle located at  $x = 0$  at time  $t = 0$ , starts moving along the positive  $x$ -direction with a velocity  $v$  that varies as  $v = \alpha\sqrt{x}$ . The displacement of the particle varies with time as

- (a)  $t^2$
- (b)  $t$
- (c)  $t^{1/2}$
- (d)  $t^3$

25. Keeping the banking angle same, to increase the maximum speed with which a vehicle can travel on the curved road by 10%, the radius of curvature of the road has to be changed from 20 m to

- (a) 16 m
- (b) 18 m
- (c) 24.2 m
- (d) 30.5 m

26. A mass of 400 g and a mass of 100 g have same KE, then the ratio of their momentums will be

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

27. The earth's radius is  $R$  and acceleration due to gravity at its surface is  $g$ . If a body of mass  $m$  is sent to a height  $h = \frac{R}{5}$  from the earth's surface,

the potential energy increases by

- (a)  $mgh$
- (b)  $\frac{4}{5}mgh$
- (c)  $\frac{5}{6}mgh$
- (d)  $\frac{6}{7}mgh$

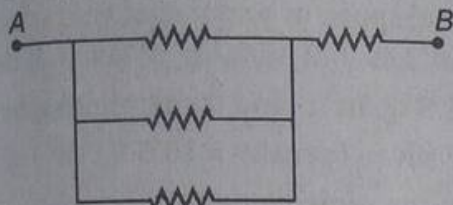
28. A bomb of mass 30 kg at rest explodes into two pieces of masses 18 kg and 12 kg. The velocity of 18 kg mass is  $6 \text{ ms}^{-1}$ . The KE of the other mass is

- (a) 256 J
- (b) 486 J
- (c) 524 J
- (d) 324 J



29. A ball is moved along a straight line by a machine delivering constant power. The distance moved by the body in time  $t$  is proportional to
- (a)  $t^{1/2}$  (b)  $t^{3/4}$   
(c)  $t^{3/2}$  (d)  $t^2$

30. If all the resistors shown have the value of  $2\ \Omega$  each, the equivalent resistance over  $AB$  is



- (a)  $2\ \Omega$  (b)  $4\ \Omega$   
(c)  $1\frac{2}{3}\ \Omega$  (d)  $2\frac{2}{3}\ \Omega$
31. The potential difference in open circuit for a cell is  $2.2\text{ V}$ . When a  $4\ \Omega$  resistor is connected between its two electrodes the potential difference becomes  $2\text{ V}$ . The internal resistance of the cell will be
- (a)  $1\ \Omega$  (b)  $0.2\ \Omega$   
(c)  $2.5\ \Omega$  (d)  $0.4\ \Omega$

32. In a Wheatstone's bridge, three resistances  $P$ ,  $Q$  and  $R$  are connected in the three arms and the fourth arm is formed by two resistances  $S_1$  and  $S_2$  connected in parallel. The condition for the bridge to be balanced will be

(a)  $\frac{P}{Q} = \frac{2R}{S_1 + S_2}$   
(b)  $\frac{P}{Q} = \frac{R(S_1 + S_2)}{S_1 S_2}$   
(c)  $\frac{P}{Q} = \frac{R(S_1 + S_2)}{2S_1 S_2}$   
(d)  $\frac{P}{Q} = \frac{R}{S_1 + S_2}$

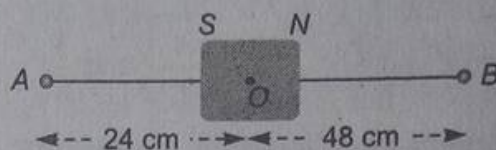
33. The resistance of an ammeter is  $13\ \Omega$  and its scale is graduated for a current upto  $100\text{ A}$ . After an additional shunt has been connected to this ammeter it becomes possible to measure currents upto  $750\text{ A}$  by this meter. The value of shunt resistance is

- (a)  $20\ \Omega$  (b)  $2\ \Omega$   
(c)  $0.2\ \Omega$  (d)  $2\text{ k}\Omega$

34. The magnetic force required to demagnetize the material is

- (a) retentivity (b) coercivity  
(c) energy loss (d) hysteresis

35. A bar magnet of length  $3\text{ cm}$  has points  $A$  and  $B$  along its axis at distances of  $24\text{ cm}$  and  $48\text{ cm}$  on the opposite sides. Ratio of magnetic fields at these points will be



- (a) 8 (b)  $\frac{1}{2\sqrt{2}}$   
(c) 3 (d) 4

36. A long solenoid has  $200$  turns per  $\text{cm}$  and carries a current  $I$ . The magnetic field at its centre is  $6.28 \times 10^{-2}\text{ Wb/m}^2$ . Another long solenoid has  $100$  turns per  $\text{cm}$  and it carries a current  $i/3$ . The value of the magnetic field at its centre is

- (a)  $1.05 \times 10^{-2}\text{ Wb/m}^2$   
(b)  $1.05 \times 10^{-5}\text{ Wb/m}^2$   
(c)  $1.05 \times 10^{-3}\text{ Wb/m}^2$   
(d)  $1.05 \times 10^{-4}\text{ Wb/m}^2$

37. An  $\alpha$ -particle and a proton travel with same velocity in a magnetic field perpendicular to the direction of their velocities. Find the ratio of the radii of their circular paths.

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

38. A coil of resistance  $10\ \Omega$  and an inductance  $5\text{ H}$  is connected to a  $100\text{ V}$  battery. The energy stored in the coil is

- (a)  $125\text{ erg}$  (b)  $125\text{ J}$   
(c)  $250\text{ erg}$  (d)  $250\text{ J}$

39. The work function of sodium is  $2.3\text{ eV}$ . The threshold wavelength of sodium will be

- (a)  $2900\text{ \AA}$  (b)  $2500\text{ \AA}$   
(c)  $5380\text{ \AA}$  (d)  $2000\text{ \AA}$

40. The  $K_\alpha$  X-ray emission line of tungsten occurs at  $\lambda = 0.021\text{ nm}$ . The energy difference between  $K$  and  $L$  levels in this atom is about

- (a)  $0.51\text{ MeV}$  (b)  $1.2\text{ MeV}$   
(c)  $59\text{ keV}$  (d)  $13.6\text{ eV}$

41. Half-life of radioactive substance is  $3.20\text{ h}$ . What is the time taken for a  $75\%$  of substance to be used?

- (a)  $6.38\text{ h}$  (b)  $12\text{ h}$   
(c)  $4.18\text{ day}$  (d)  $1.2\text{ day}$



42. If the decay constant of a radioactive substance is  $\lambda$ , then its half-life and mean life are respectively

(a)  $\frac{1}{\lambda}$  and  $\frac{\log_e 2}{\lambda}$  (b)  $\frac{\log_e 2}{\lambda}$  and  $\frac{1}{\lambda}$   
 (c)  $\lambda \log_e 2$  and  $\frac{1}{\lambda}$  (d)  $\frac{\lambda}{\log_e 2}$  and  $\frac{1}{\lambda}$

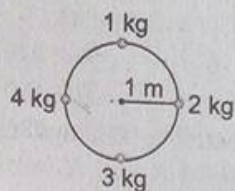
43. In a common-base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA. The value of the base current amplification factor ( $\beta$ ) will be

(a) 49 (b) 50  
 (c) 51 (d) 48

44. A satellite moves in elliptical orbit about a planet. Its maximum and minimum velocities of satellites are  $3 \times 10^4$  m/s and  $1 \times 10^3$  m/s respectively. What is the minimum distance of satellite from planet is maximum distance if  $4 \times 10^4$  km?

(a)  $4 \times 10^3$  km (b)  $3 \times 10^3$  km  
 (c)  $4/3 \times 10^3$  km (d)  $1 \times 10^3$  km

45. Four balls each of radius 10 cm and mass 1 kg, 2 kg, 3 kg and 4 kg are attached to the periphery of massless plate of radius 1 m.



What is moment of inertia of the system about the centre of plate?

(a)  $12.04 \text{ kg-m}^2$  (b)  $10.04 \text{ kg-m}^2$   
 (c)  $11.50 \text{ kg-m}^2$  (d)  $5.04 \text{ kg-m}^2$

46. The escape speed from the earth is about 11 km/s. The escape speed from a planet, having twice the radius and the same mean density as the earth, is

(a) 22 km/s (b) 11 km/s  
 (c) 5.5 km/s (d) 15.5 km/s

47. 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 period of the second satellite is larger than that of first one by approximately

(a) 0.5% (b) 1.0%  
 (c) 1.5% (d) 3.0%

48. A solid which is not transparent to visible light and whose conductivity increases with temperature is formed by

(a) ionic binding  
 (b) covalent binding  
 (c) van der Waals' binding  
 (d) metallic binding

49. If the terminal speed of a sphere of gold (density  $= 19.5 \text{ kg/m}^3$ ) is 0.2 m/s in a viscous liquid (density  $= 1.5 \text{ kg/m}^3$ ), find the terminal speed of a sphere of silver (density  $= 10.5 \text{ kg/m}^3$ ) of the same size in the same liquid.

(a) 0.4 m/s (b) 0.133 m/s  
 (c) 0.1 m/s (d) 0.2 m/s

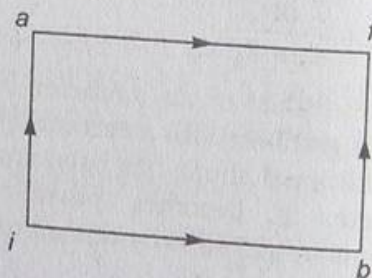
50. A 10 cm long wire is placed horizontally on the surface of water and is gently pulled up with a force of  $2 \times 10^{-2}$  N. To keep the wire in equilibrium, the surface tension of water in  $\text{Nm}^{-1}$  is

(a) 0.1 (b) 0.2  
 (c) 0.001 (d) 0.002

51. A Carnot engine used first an ideal monoatomic gas and then an ideal diatomic gas. If the source and sink temperature are  $411^\circ\text{C}$  and  $69^\circ\text{C}$  respectively and the engine extracts 1000 J of heat in each cycle, then area enclosed by  $pV$  diagram is

(a) 100 J (b) 300 J  
 (c) 500 J (d) 700 J

52. When a system is taken from state  $i$  to state  $f$  along the path  $iaf$ , it is found that  $Q = 50 \text{ cal}$  and  $W = 20 \text{ cal}$ . Along the path  $ibf$   $Q = 36 \text{ cal}$ .  $W$  along the path  $ibf$  is

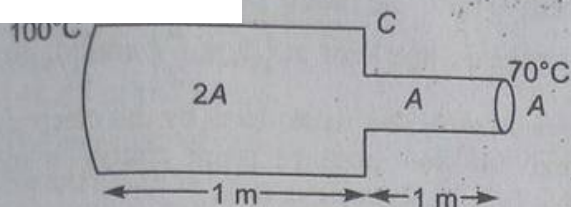


(a) 6 cal (b) 16 cal  
 (c) 66 cal (d) 14 cal

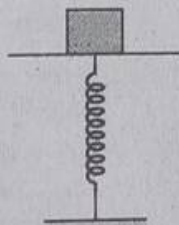
53. A metal rod of length 2 m has cross-sectional areas  $2A$  and  $A$  as shown in figure. The two ends are maintained at temperatures  $100^\circ\text{C}$  and  $70^\circ\text{C}$ . The temperature of middle point  $C$  is

58. A so  
 20 d  
 (a)  
 (c)





- (a) 80°C (b) 85°C  
(c) 90°C (d) 95°C
54. Temperature of two stars are in ratio 3 : 2. If wavelength of maximum intensity of first body is 4000 Å, what is corresponding wavelength of second body?  
(a) 9000 Å (b) 6000 Å  
(c) 2000 Å (d) 8000 Å
55. If a metallic sphere gets cooled from 62°C to 50°C in 10 min and in the next 10 min gets cooled to 42°C, then the temperature of the surroundings is  
(a) 30°C (b) 36°C  
(c) 26°C (d) 20°C
56. The mass and diameter of a planet are twice those of earth. The period of oscillation of pendulum on this planet will be (if it is a second's pendulum on earth)  
(a)  $\frac{1}{\sqrt{2}}$  s (b)  $2\sqrt{2}$  s  
(c) 2s (d)  $\frac{1}{2}$  s
57. A mass of 2.0 kg is put on a flat pan attached to a vertical spring fixed on the ground as shown in the figure. The mass of the spring and the pan is negligible. When pressed slightly and released the mass executes a simple harmonic motion. The spring constant is 200 N/m. What should be the minimum amplitude of the motion, so that the mass gets detached from the pan?  
(Take  $g = 10 \text{ m/s}^2$ )  
(a) 8.0 cm  
(b) 10.0 cm  
(c) Any value less than 12.0 cm  
(d) 4.0 cm
58. A sound absorber attenuates the sound level by 20 dB. The intensity decreases by a factor of  
(a) 1000 (b) 10000  
(c) 10 (d) 100



59. A wave travels in a medium according to the equation of displacement given by  
 $y(x, t) = 0.03 \sin \pi(2t - 0.01x)$   
where  $y$  and  $x$  are in metre and  $t$  in second. The wavelength of the wave is  
(a) 200 m (b) 100 m  
(c) 20 m (d) 10 m
60. A steel rod 100 cm long is clamped at its mid-point. The fundamental frequency of longitudinal vibrations of the rod is given to be 2.53 kHz. What is the speed of sound in steel?  
(a) 5.06 km/s (b) 6.06 km/s  
(c) 7.06 km/s (d) 8.06 km/s
61. A resonance air column of length 20 cm resonates with a tuning fork of frequency 250 Hz. The speed of sound in air is  
(a) 300 m/s (b) 200 m/s  
(c) 150 m/s (d) 75 m/s
62. A ray of light is incident on the surface of separation of a medium at an angle  $45^\circ$  and is refracted in the medium at an angle  $30^\circ$ . What will be the speed of light in the medium?  
(a)  $1.96 \times 10^8 \text{ m/s}$  (b)  $2.12 \times 10^8 \text{ m/s}$   
(c)  $3.18 \times 10^8 \text{ m/s}$  (d)  $3.33 \times 10^8 \text{ m/s}$
63. A microscope is focused on a coin lying at the bottom of a beaker. The microscope is now raised up by 1 cm. To what depth should the water be poured into the beaker so that coin is again in focus? (Refractive index of water is  $\frac{4}{3}$ )  
(a) 1 cm (b)  $\frac{4}{3}$  cm  
(c) 3 cm (d) 4 cm
64. 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
65. What is the luminous intensity of the sun if it produces the same illuminance on the earth as produced by a bulb of 10000 cd at a distance of 0.3 m. The distance between the sun and earth is  $1.5 \times 10^{11} \text{ m}$ .  
(a)  $2.5 \times 10^{23} \text{ cd}$  (b)  $2.5 \times 10^{19} \text{ cd}$   
(c)  $2.5 \times 10^{27} \text{ cd}$  (d)  $2.5 \times 10^{36} \text{ cd}$



66. In a Young's double slit experiment, the separation of the two slits is doubled. To keep the same spacing of fringes, the distance  $D$  of the screen from the slits should be made
- (a)  $\frac{D}{2}$  (b)  $\frac{D}{\sqrt{2}}$   
(c)  $2D$  (d)  $4D$
67. A slit of width  $a$  is illuminated by white light. For red light ( $\lambda = 6200 \text{ \AA}$ ), the first minima is obtained at a diffraction angle of  $30^\circ$ . Then the value of  $a$  is
- (a)  $3250 \text{ \AA}$  (b)  $6.5 \times 10^{-4} \text{ mm}$   
(c)  $1.24 \text{ micron}$  (d)  $2.6 \times 10^{-4} \text{ cm}$
68. Two plates are  $2 \text{ cm}$  apart and a potential difference of  $10 \text{ V}$  is applied between them. The electric field between the plates is
- (a)  $20 \text{ N/C}$  (b)  $500 \text{ N/C}$   
(c)  $5 \text{ N/C}$  (d)  $250 \text{ N/C}$
69. The capacity of a parallel plate capacitor with no dielectric substance but with a separation of  $0.4 \text{ cm}$  is  $2 \mu\text{F}$ . The separation is reduced to half and it is filled with a dielectric substance of value  $2.8$ . The final capacity of the capacitor is
- (a)  $11.2 \mu\text{F}$  (b)  $15.6 \mu\text{F}$   
(c)  $19.2 \mu\text{F}$  (d)  $22.4 \mu\text{F}$
70. Three capacitors of  $2 \mu\text{F}$ ,  $3 \mu\text{F}$  and  $6 \mu\text{F}$  are joined in series and the combination is charged by means of a  $24 \text{ V}$  battery. The potential difference between the plates of the  $6 \mu\text{F}$  capacitor is
- (a)  $4 \text{ V}$  (b)  $6 \text{ V}$   
(c)  $8 \text{ V}$  (d)  $10 \text{ V}$
71. Positive and negative point charges of equal magnitude are kept at  $(0, 0, \frac{a}{2})$  and  $(0, 0, -\frac{a}{2})$ , respectively. The work done by the electric field when another positive point charge is moved from  $(-a, 0, 0)$  to  $(0, a, 0)$  is
- (a) positive  
(b) negative  
(c) zero  
(d) depends on the path connecting the initial and final positions
72. A nichrome wire  $50 \text{ cm}$  long and  $1 \text{ mm}^2$  cross-section carries a current of  $4 \text{ A}$  when connected to a  $2 \text{ V}$  battery. The resistivity of nichrome wire is
- (a)  $1 \times 10^{-6} \Omega\text{-m}$  (b)  $4 \times 10^{-7} \Omega\text{-m}$   
(c)  $3 \times 10^{-7} \Omega\text{-m}$  (d)  $2 \times 10^{-7} \Omega\text{-m}$
73. A laser device produces amplification in the
- (a) microwave region  
(b) ultraviolet or visible region  
(c) infrared region  
(d) None of the above
74. Two wires of same length are shaped into a square and a circle. If they carry same current, ratio of magnetic moment is
- (a)  $2 : \pi$  (b)  $\pi : 2$   
(c)  $\pi : 4$  (d)  $4 : \pi$
75. The angle of incidence at which reflected light is totally polarised for reflection from air to glass (refractive index  $n$ ) is
- (a)  $\sin^{-1}(n)$  (b)  $\sin^{-1}(\frac{1}{n})$   
(c)  $\tan^{-1}(\frac{1}{n})$  (d)  $\tan^{-1}(n)$

## Chemistry

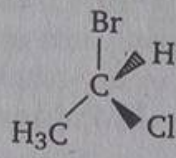
1. If a species has 16 protons, 18 electrons and 16 neutrons, the symbol (with charge) of species is
- (a)  $\text{S}^-$  (b)  $\text{Si}^{2-}$   
(c)  $\text{P}^{3-}$  (d)  $\text{S}^{2-}$
2. Which is not present in Grignard reagent?
- (a) Methyl group  
(b) Magnesium ion  
(c) Halogen atom  
(d) Carboxylic group
3. The normality of  $10 \text{ L}$  volume  $\text{H}_2\text{O}_2$  is
- (a)  $0.176$  (b)  $0.88$   
(c)  $1.78$  (d)  $3.52$
4. When one litre one molar sulphuric acid solution is diluted with  $5 \text{ L}$  water, the normality of the obtained solution is
- (a)  $0.2 \text{ N}$  (b)  $0.33 \text{ N}$   
(c)  $10 \text{ N}$  (d)  $5 \text{ N}$
5. The method which is used to measure the osmotic pressure of a solution quickly and accurately is



- (a) Debye-Hückel's method  
(b) Debye-Hückel's method  
(c) Pfeffer's method  
(d) All of the above
6. The number of octahedral sites per sphere in a fcc structure is  
(a) 1 (b) 2  
(c) 4 (d) 8
7. The petrol, octane number of which is 80, has  
(a) 20 % *n*-heptane + 80 % iso-octane  
(b) 20 % *n*-heptane + 80 % *n*-octane  
(c) 80 % *n*-heptane + 20 % iso-octane  
(d) 80 % *n*-heptane + 20 % *n*-octane
8. Which of the following compounds does not give Friedel-Craft's reaction?  
(a) benzene (b) xylene  
(c) nitrobenzene (d) phenol
9. On Pauling scale, the electronegativity of an element is measured by using  
(a)  $\chi_A - \chi_B = \sqrt{\Delta}$   
(b)  $\chi_A - \chi_B = 0.208 \sqrt{\Delta}$   
(c)  $\chi_A + \chi_B = 0.208 \sqrt{\Delta}$   
(d)  $\chi_A - \chi_B = 0.208 \Delta^2$
10. Transitional metal ions have an ability of complex formation. They have this tendency due to  
(a) catalytic property  
(b) high enthalpy of atomisation  
(c) high nuclear charge  
(d) All of the above
11. Which of the following pairs will show common ion effect?  
(a) barium chloride + barium sulphate  
(b) silver cyanide + potassium nitrite  
(c) ammonium hydroxide + ammonium chloride  
(d) sodium chloride + hydrogen chloride
12. Hypo is used in photography due to its  
(a) reaction with light  
(b) reducing property  
(c) oxidising property  
(d) complex forming nature
13. Which of the following is not a true alum?  
(a)  $\text{Na}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$   
(b)  $\text{MgSO}_4 \cdot \text{Cr}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$   
(c)  $\text{K}_2\text{SO}_4 \cdot \text{Cr}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$   
(d)  $(\text{NH}_4)_2\text{SO}_4 \cdot \text{Fe}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$
14. The oxidation number of chromium in  $\text{CrO}_5$  is  
(a) +6 (b) +5  
(c) +10 (d) 0
15. Given,  $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{g}); \Delta H_1 = +43.7 \text{ kJ}$   
 $\text{H}_2\text{O}(\text{s}) \rightarrow \text{H}_2\text{O}(\text{l}); \Delta H_2 = +6.05 \text{ kJ}$ . Calculate the enthalpy of sublimation of ice.  
(a)  $49.75 \text{ kJ mol}^{-1}$  (b)  $37.65 \text{ kJ mol}^{-1}$   
(c)  $43.7 \text{ kJ mol}^{-1}$  (d)  $55.23 \text{ kJ mol}^{-1}$
16. Consider the following reaction,  
 $(\text{CH}_3)_3\text{CCl} + \text{OH}^- \longrightarrow (\text{CH}_3)_3\text{C}-\text{OH} + \text{Cl}^-$   
If  $\text{OH}^-$  does not take part in slow step, the molecularity and order of the reaction are respectively,  
(a) 2, 2 (b) 2, 1  
(c) 1, 2 (d) 1, 1
17. The formula of haematite is  
(a)  $\text{Fe}_3\text{O}_4$  (b)  $\text{Fe}_2\text{O}_3$   
(c)  $\text{FeCO}_3$  (d)  $\text{FeS}_2$
18. Coagulation is not done by  
(a) persistent dialysis (b) boiling  
(c) electrophoresis (d) peptisation
19. Which of the following is an intrinsic colloid?  
(a) Glue (b) Arsenic sulphide  
(c) Gold (d) All of these
20. Which of the following compounds does not rotate the plane polarised light?  
(a) 2-chloropropanoic acid  
(b) 2-chlorobutane  
(c) 4-hydroxy heptane  
(d) 2-chloro-1-deuteropropane
21. No new C—C bond is formed in  
(a) Cannizzaro reaction  
(b) Reimer-Tiemann reaction  
(c) Wurtz reaction  
(d) Aldol condensation
22. Friedel-Craft's acylation reaction involves  
(a) nucleophilic substitution  
(b) electrophilic substitution  
(c) electrophilic addition  
(d) nucleophilic addition
23. Phenol reacts with dilute nitric acid at normal temperature to form  
(a) *o*-nitrophenol  
(b) *m*-nitrophenol  
(c) *o*- and *p*-nitrophenol  
(d) 2, 4, 6-trinitrophenol



24. Favourable conditions for the formation of electrovalent bond is that the cation and anion must have, respectively
- high ionisation potential and low electron affinity
  - low ionisation potential and high electron affinity
  - high ionisation potential and high electron affinity
  - low ionisation potential and low electron affinity
25. The magnetic nature of boron molecule is same as the magnetic nature of
- nitrogen molecule
  - carbon molecule
  - unipositive nitrogen molecule
  - oxide ion
26. When common salt is dissolved in water,
- the melting point of the solution increases
  - the boiling point of the solution increases
  - the boiling point of the solution decreases
  - both the melting and boiling point of the solution decrease
27. For the decomposition reaction of lime stone, the correct expression for rate constant,  $K_p$  is
- $K_p = \frac{P_{\text{CaO}} \cdot P_{\text{CO}_2}}{P_{\text{CaCO}_3}}$
  - $K_p = \frac{[\text{CaO}][\text{CO}_2]}{[\text{CaCO}_3]}$
  - $K_p = \frac{P_{\text{CaO}} + P_{\text{CO}_2}}{P_{\text{CaCO}_3}}$
  - $K_p = P_{\text{CO}_2}$
28. Mutarotation is not exhibited by
- sucrose
  - glucose
  - maltose
  - fructose
29. What is the product when nitrobenzene is treated sequentially with (i)  $\text{NH}_4\text{Cl}/\text{Zn}$  dust and (ii)  $\text{H}_2\text{SO}_4/\text{Na}_2\text{Cr}_2\text{O}_7$ ?
- m*-chloronitrobenzene
  - p*-chloronitrobenzene
  - nitrosobenzene
  - benzene
30. Sindhur, an oxide of lead, is an example of ..... oxide.
- basic
  - super
  - mixed
  - amphoteric
31. Bleaching powder is obtained by the interaction of chlorine with
- concentrated solution of calcium hydroxide
  - dilute solution of calcium hydroxide
  - dry calcium oxide
  - dry slaked lime

32. Which is the strongest Lewis base?
- $\text{SbH}_3$
  - $\text{AsH}_3$
  - $\text{PH}_3$
  - $\text{NH}_3$
33. Cannizaro as well as aldol condensation reaction is given by
- benzaldehyde
  - 2-methylpropanal
  - 2,2-dimethylpropanal
  - acetaldehyde
34. When benzaldehyde is treated with acetic anhydride, in the presence of corresponding salt of the acid, the product obtained is
- cinnamic acid
  - cinnamaldehyde
  - crotonic acid
  - benzillic acid
35. Which of the following is not a nucleophile?
- Water
  - Sulphur trioxide
  - Ammonia
  - Ether
36. Which order is correct regarding the  $-I$  effect of the substituents?
- $-\text{NR}_2 < -\text{OR} < -\text{F}$
  - $-\text{NR}_2 > -\text{OR} < -\text{F}$
  - $-\text{NR}_2 < -\text{F} < -\text{OR}$
  - $-\text{NR}_2 > -\text{OR} > -\text{F}$
37. Consider the following carbocations
- $(\text{CH}_3)_2\text{CH}^+$
  - $\text{CH}_3\text{CH}_2^+$
  - $\text{C}_6\text{H}_5\text{CH}_2^+$
  - $(\text{CH}_3)_3\text{C}^+$
- The correct sequence for the stability of these is
- $\text{II} < \text{I} < \text{III} < \text{IV}$
  - $\text{II} < \text{III} < \text{I} < \text{IV}$
  - $\text{III} < \text{I} < \text{II} < \text{IV}$
  - $\text{IV} < \text{III} < \text{I} < \text{II}$
38. The chirality of the compound
- 
- is
- R
  - S
  - Z
  - E
39. The total number of isomers formed by  $\text{C}_5\text{H}_{10}$  is
- 2
  - 3
  - 4
  - 5
40. The shape of electrophile which attacks on benzene nucleus in the Friedel-Craft's alkylation (methylation) reaction is
- linear
  - planar
  - pyramidal
  - tetrahedral



41. The boiling point of ethanol is higher as compared to the boiling point of diethyl ether though both have the same molecular formula. This is due to  
 (a) resonance (b) -R group  
 (c) H-bonding (d) covalent bonding
42. Which defect causes decrease in the density of crystal?  
 (a) Frenkel (b) Schottky  
 (c) Interstitial (d) F-centre
43. Which of the following is not a usual method for the preparation of primary amines?  
 (a) Hofmann's method  
 (b) Gabriel phthalamide reaction  
 (c) Curtius method  
 (d) Reductive amination of  $>C=O$
44. Which among the following is a catalyst for the preparation of Grignard reagent?  
 (a) Iron powder (b) Iodine powder  
 (c) Activated charcoal (d) Manganese dioxide
45. The metal which deposits copper from copper sulphate solution is  
 (a) gold (b) iron  
 (c) platinum (d) mercury
46. The correct order of electron affinity of oxygen, sulphur, chlorine, fluorine is  
 (a)  $S < O < Cl < F$  (b)  $S < O < F < Cl$   
 (c)  $O < S < F < Cl$  (d)  $O < S < Cl < F$
47. The order of increasing boiling points of  
 I. acetyl chloride;  
 II. acetic anhydride;  
 III. acetamide;  
 IV. acetic acid is  
 (a)  $IV > I > II > III$  (b)  $I > IV > II > III$   
 (c)  $II < I < III < IV$  (d)  $I < IV < II < III$
48. The  $pK_a$  value of (I) 2-bromo propanoic acid, (II) 2-fluoro propanoic acid, (III) 3-fluoro propanoic acid, (IV) 3-bromo propanoic acid decreases as  
 (a)  $I > III > IV > II$  (b)  $II > IV > III > I$   
 (c)  $I > IV > III > II$  (d)  $IV > I > III > II$
49. Density of a 2.05 M solution of acetic acid in water is 1.02 g/mL. The molality of the solution is  
 (a) 2.28 mol  $kg^{-1}$  (b) 3.28 mol  $kg^{-1}$   
 (c) 0.44 mol  $kg^{-1}$  (d) 1.14 mol  $kg^{-1}$
50. In stoichiometric defect, the ratio of positive and negative ions as indicated by chemical formula of the compound  
 (a) decreases  
 (b) increases  
 (c) changes by a factor of 2  
 (d) remains same
51. The melting point is highest for  
 (a) rock salt (b) potassium chloride  
 (c) magnesium oxide (d) barium oxide
52. When petroleum is heated gradually, the first batch of vapours evolved will be rich in  
 (a) kerosene oil (b) diesel oil  
 (c) lubricating oil (d) petroleum ether
53. An alkene having molecular formula,  $C_6H_{10}$ , gives  $OHC(CH_2)_4CHO$ , on ozonolysis. The alkene is  
 (a) hexene-1  
 (b) hexene-2  
 (c) cyclohexene  
 (d) 1-methylcyclohexene-1
54. Which of the following is the most reactive towards ring nitration?  
 (a) benzene (b) toluene  
 (c) *m*-xylene (d) mesitylene
55. Which is heaviest?  
 (a) 25g mercury  
 (b) 2 mol carbon dioxide  
 (c) 2 mol water  
 (d) 4 g-atom of oxygen
56. The standard electrode potential ( $E^\circ$ ) for  $OCl^-/Cl^-$  and  $Cl^-/\frac{1}{2}Cl_2$  respectively are 0.94 V and -1.36 V. The  $E^\circ$  value for  $OCl^-/\frac{1}{2}Cl_2$  will be  
 (a) -0.42 V (b) -2.20 V  
 (c) 0.52 V (d) 1.04 V
57. Zinc is used to protect iron from rusting. This is because  
 (a)  $E^\circ_{red}$  of Zn is greater than that of Fe  
 (b)  $E^\circ_{ox}$  of Zn is greater than that of Fe  
 (c)  $E^\circ_{red}$  of Zn is nearly equal to that of Fe  
 (d) Zn is cheap
58. According to Bohr's theory, the angular momentum for an electron in 5th orbit is  
 (a)  $2.5 h/\pi$  (b)  $5 h/\pi$   
 (c)  $25 h/\pi$  (d)  $5\pi/2h$
59. Consider the following ions:  
 (i)  $Ni^{2+}$  (ii)  $Co^{2+}$  (iii)  $Cr^{2+}$  (iv)  $Fe^{3+}$   
 (Given, at. no. Cr = 24, Fe = 26, Co = 27, Ni = 28)



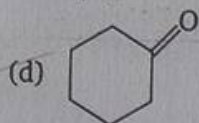
The correct order of magnetic moment of these ions is

- (a) (i) < (ii) < (iii) < (iv)
- (b) (iv) < (ii) < (iii) < (i)
- (c) (i) < (iii) < (ii) < (iv)
- (d) (iii) < (iv) < (ii) < (i)

60. Born-Haber cycle can be used to estimate
- (a) electronegativity
  - (b) electron affinity
  - (c) ionic radii
  - (d) All of these

61. The compound which does not exhibit geometrical isomerism, is

- (a)  $\text{CH}_3\text{CH}=\text{CHCOOH}$
- (b)  $\text{Br}-\text{CH}=\text{CH}-\text{Br}$
- (c)  $\text{C}_6\text{H}_5\text{CH}=\text{NOH}$



62. Lewisite, a chemical used in chemical warfare, is obtained from

- (a) phosphene
- (b) acetylene
- (c) ethylene
- (d) zinc phosphate

63. The step which never be involved in the dehydration of alcohol is

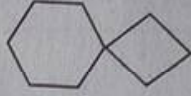
- (a) protonation
- (b) elimination
- (c) hydride transfer
- (d) carbanion formation

64. Which among the following is a chain growth polymer?

- (a) Nylon
- (b) Bakelite
- (c) Terylene
- (d) Teflon

65. Which of the following monomers, gives synthetic rubber on polymerisation?

- (a)  $\text{CH}_2=\text{CHCl}$
- (b)  $\text{CCl}_2=\text{CCl}_2$
- (c)  $\text{CH}_2=\text{C}(\text{CH}_3)-\text{CH}=\text{CH}_2$
- (d)  $\text{CH}_2=\text{CCl}-\text{CH}=\text{CH}_2$

66. The IUPAC name of  is

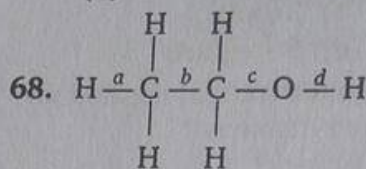
- (a) bicyclo (5.5.0) nonane
- (b) biphenyl
- (c) spiro (3.5) nonane
- (d) cyclobutyl cyclohexane

67.  $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$  and  $\text{CH}_3(\text{CH}_2)_2\text{CH}_2\text{OH}$



can be best distinguished by

- (a) Lucas test
- (b) Iodoform test
- (c) Victor-Meyer's test
- (d) All of the above



The correct order of bond length is

- (a)  $b > a > c > d$
- (b)  $a > b > c > d$
- (c)  $d > c > b > a$
- (d)  $c > d > b > a$

69. When borax is heated strongly, it gives

- (a)  $\text{BaBO}_2$
- (b)  $\text{B}_2\text{O}_3$
- (c)  $\text{B}_3\text{N}_3\text{H}_6$
- (d)  $\text{Na}_2\text{B}_4\text{O}_7$

70. The conjugated base of hydrazoic acid is

- (a)  $\text{HN}_3^-$
- (b)  $\text{N}_2^-$
- (c)  $\text{N}_3^-$
- (d)  $\text{N}^{3-}$

71. At a certain temperature, the solubility of the salt,  $M_m A_n$  in water is  $s$  mol/L. The solubility product of the salt is

- (a)  $M^m A^n$
- (b)  $(m+n)s^{m+n}$
- (c)  $m^m n^n s^{m+n}$
- (d)  $m^m A^n s$

72. Which of the following is not a buffer?

- (a)  $\text{NH}_3 + \text{HCl}$
- (b)  $\text{CH}_3\text{COOH} + \text{NaOH}$
- (c)  $\text{HCOOH} + \text{HCOOK}$
- (d)  $\text{NaOH} + \text{NaNO}_3$

73. When copper sulphate solution is added to potassium ferrocyanide, the formula of product obtained is

- (a)  $\text{Cu}_2\text{Fe}(\text{CN})_6$
- (b)  $\text{Cu}(\text{CN})_3$
- (c)  $\text{CuFe}(\text{CN})_6$
- (d)  $\text{Cu}(\text{CN})_2$

74. When acetone is treated with dilute alkali, the product obtained is

- (a) mesitylene
- (b) mesityl oxide
- (c) paraldehyde
- (d) phorone

75. The bond length of  $\text{H}_2^+$ ,  $\text{H}_2^-$  and  $\text{H}_2$  are in the following order

- (a)  $\text{H}_2^+ > \text{H}_2 > \text{H}_2^-$
- (b)  $\text{H}_2 > \text{H}_2^+ > \text{H}_2^-$
- (c)  $\text{H}_2^- > \text{H}_2 > \text{H}_2^+$
- (d)  $\text{H}_2^- > \text{H}_2^+ > \text{H}_2$



# Mathematics

- A set contains  $n$  elements. The power set contains
  - $n$  elements
  - $2^n$  elements
  - $n^2$  elements
  - None of these
- The relation  $R$  defined on the set  $N$  of natural number by
 
$$xRy \Leftrightarrow 2x^2 - 3xy + y^2 = 0$$
  - symmetric but not reflexive
  - only symmetric
  - not symmetric but reflexive
  - None of the above
- A survey shows that 64% of Americans like cheese where as 76% like apples. If  $x\%$  of the american like both cheese and apples, then
  - $x = 39$
  - $x = 63$
  - $39 \leq x \leq 63$
  - None of these
- The value of  $\sin \left[ \frac{\pi}{2} - \sin^{-1} \left( -\frac{\sqrt{3}}{2} \right) \right]$  is
  - $\frac{1}{2}$
  - $-\frac{1}{2}$
  - 1
  - 1
- If  $a \leq \sin^{-1} x + \cos^{-1} x + \tan^{-1} x \leq b$ , then
  - $a = 0, b = \pi$
  - $a = 0, b = \frac{\pi}{2}$
  - $a = \frac{\pi}{2}, b = \pi$
  - None of these
- If  $p$  is the perpendicular from origin to the line  $\frac{x}{a} + \frac{y}{b} = 1$ , then
  - $\frac{1}{p^2} = \frac{1}{a^2} + \frac{1}{b^2}$
  - $\frac{1}{p^2} = \frac{1}{a^2} - \frac{1}{b^2}$
  - $\frac{1}{p^2} = -\frac{1}{a^2} - \frac{1}{b^2}$
  - $\frac{1}{p^2} = -\frac{1}{a^2} + \frac{1}{b^2}$
- The condition that the straight line joining the origin to the points of intersection of the line  $4x + 3y = 24$  with the circle  $(x - 3)^2 + (y - 4)^2 = 25$ 
  - are coincident
  - are perpendicular
  - make equal angle with  $x$ -axis
  - None of the above
- The equation of circle passing through the origin and point of intersection of circle  $x^2 + y^2 - 2x + 4y - 20 = 0$  and line  $x + y - 1 = 0$  is
  - $x^2 + y^2 + 22x - 16y = 0$
  - $x^2 + y^2 + 22x + 16y = 0$
  - $x^2 + y^2 - 22x - 16y = 0$
  - None of the above
- The angle between the tangent drawn from origin to the circle  $(x - 7)^2 + (y + 1)^2 = 25$  is
  - $\frac{\pi}{3}$
  - $\frac{\pi}{6}$
  - $\frac{\pi}{2}$
  - $\frac{\pi}{8}$
- If  $x - 1 = 0$  is the directrix of parabola  $y^2 - kx + 8 = 0$ , then  $k$  is equal to
  - $1/8$
  - 8
  - 4
  - $1/4$
- The locus of point of intersection of tangent to an ellipse at two points, sum of whose eccentric angle is constant is
  - parabola
  - circle
  - ellipse
  - straight line
- The length of transverse axis of the rectangular hyperbola  $xy = 18$  is
  - 6
  - 12
  - 18
  - 3
- Find the least value of  $n$  for which  $\left( \frac{1+i}{1-i} \right)^n = 1$ 
  - 4
  - 3
  - 4
  - 1
- $\sin \frac{\pi}{14} \sin \frac{3\pi}{14} \sin \frac{5\pi}{14} \sin \frac{7\pi}{14}$  is equal to
  - 1
  - $\frac{1}{4}$
  - $\frac{1}{8}$
  - $\frac{\sqrt{2}}{7}$
- If the roots of the equation  $ax^2 + bx + c = 0$  are real and distinct then
  - both roots are greater than  $-\frac{b}{2a}$
  - both roots are less than  $-\frac{b}{2a}$
  - one of the roots exceeds  $-\frac{b}{2a}$
  - None of the above
- The number of positive integer satisfying the inequality  ${}^{n+1}C_{n-2} - {}^{n+1}C_{n-1} \leq 100$  is
  - 4
  - 3
  - 4
  - 1



- (a) 9 (b) 8  
(c) 5 (d) None of these

17. If  $H$  is harmonic mean between  $P$  and  $Q$ . Then the value of  $\frac{H}{P} + \frac{H}{Q}$  is

- (a) 2 (b)  $\frac{PQ}{P+Q}$   
(c)  $\frac{P+Q}{PQ}$  (d) None of these

18. Larger of  $99^{50} + 100^{50}$  and  $101^{50}$  is

- (a)  $101^{50}$  (b)  $99^{50} + 100^{50}$   
(c) both are equal (d) None of these

19. If  $A$  is invertible matrix and  $B$  is any matrix, then

- (a)  $\text{Rank}(AB) = \text{Rank}(A)$   
(b)  $\text{Rank}(AB) = \text{Rank}(B)$   
(c)  $\text{Rank}(AB) > \text{Rank}(A)$   
(d)  $\text{Rank}(AB) > \text{Rank}(B)$

20. Rank of the matrix

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 2 & 1 & 2 \\ 2 & 2 & 1 \end{bmatrix} \text{ is}$$

- (a) 0 (b) 1  
(c) 2 (d) 3

21. If  $y = |\cos x| + |\sin x|$ , then  $\frac{dy}{dx}$  at  $x = \frac{2\pi}{3}$  is

- (a)  $\frac{1-\sqrt{3}}{2}$  (b) 0  
(c)  $\frac{1}{2}(\sqrt{3}-1)$  (d) None of these

22. The graph of the function  $y = f(x)$  is symmetrical about the line  $x = 2$ . Then,

- (a)  $f(x+2) = f(x-2)$   
(b)  $f(2+x) = f(2-x)$   
(c)  $f(x) = f(-x)$   
(d)  $f(x) = -f(-x)$

23.  $\lim_{x \rightarrow 0} (\csc x)^{1/\log x}$  is equal to

- (a) 0 (b) 1  
(c)  $\frac{1}{e}$  (d) None of these

24.  $\int \frac{x^{e-1} + e^{x-1}}{x^e + e^x} dx$  is equal to

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

(c)  $\frac{1}{e} \log(e^x - x^e) + c$

(d) None of the above

25.  $\int_0^1 \frac{dx}{\sqrt{1+x} + \sqrt{x}}$  is equal to

- (a)  $\frac{4}{3}(\sqrt{2}-1)$  (b)  $\frac{3}{4}(\sqrt{2}-1)$   
(c)  $\frac{4}{3}(1-\sqrt{2})$  (d)  $\frac{3}{4}(1-\sqrt{2})$

26.  $\int_0^1 |5x-3| dx$  is equal to

- (a)  $\frac{10}{13}$  (b)  $\frac{31}{10}$   
(c)  $\frac{13}{10}$  (d) None of these

27. For  $0 \leq x \leq \pi$ , the area between the curve  $y = \sin x$  and  $x$ -axis is

- (a) 1 sq unit (b) 0 sq unit  
(c) 2 sq unit (d) -1 sq unit

28. The order and power of differential equation

$$\frac{d^2y}{dx^2} + 7 \frac{dy}{dx} + \int y dx = \sin x \text{ is}$$

- (a) 1, 3 (b) 3, 1  
(c) 1, 2 (d) 2, 1

29. The solution of differential equation  $x \cos^2 y dx = y \cos^2 x dx$  is

- (a)  $x \tan x - y \tan y - \log(\sec x / \sec y) = c$   
(b)  $y \tan x - x \tan x - \log(\sec x \cdot \sec y) = c$   
(c)  $x \tan x - y \tan y + \log(\sec x \cdot \sec y) = c$   
(d) None of the above

30. The equation of tangent of the curve  $y = be^{-x/a}$  at the point, where the curve meet  $y$ -axis is

- (a)  $bx + ay - ab = 0$  (b)  $ax + by - ab = 0$   
(c)  $bx - ay - ab = 0$  (d)  $ax + by - ab = 0$

31. The intersection angle of the curve  $xy = a^2$  and  $x^2 - y^2 = a^2$  is

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

32. The point of intersection of line  $\frac{x-6}{-1} = \frac{y+1}{0} = \frac{z+3}{4}$  and plane  $x + y - z = 3$  is

- (a) (2, 1, 0) (b) (7, -1, -7)  
(c) (1, 2, -6) (d) (5, -1, 1)



33. The addition of two active force is 18 N. If the magnitude of resultant is 12 N and meet at right angle. Then, magnitude of forces are

- (a) 5 N, 13 N (b) 6 N, 12 N  
(c) 8 N, 10 N (d) None of these

34. The angle between two active forces  $P + Q$  and  $P - Q$  is  $2\alpha$ . If their resultant make angle  $\theta$  with bisector of angle. Then

- (a)  $P \cos \theta = Q \cos \alpha$   
(b)  $P \tan \theta = Q \tan \alpha$   
(c)  $Q \cos \theta = P \cos \alpha$   
(d)  $Q \tan \theta = P \tan \alpha$

35. If the distance travel by a uniformly accelerated particle in  $p$ th,  $q$ th and  $r$ th second are  $a$ ,  $b$  and  $c$  respectively. Then

- (a)  $(q-r)a + (r-p)b + (p-q)c = 1$   
(b)  $(q-r)a + (r-p)b + (p-q)c = -1$   
(c)  $(q-r)a + (r-p)b + (p-q)c = 0$   
(d)  $(q+r)a + (r+p)b + (p+q)c = 0$

36. If the maximum height and horizontal range of a projectile are same. Then, projection angle is

- (a)  $45^\circ$  (b)  $30^\circ$   
(c)  $\tan^{-1} 3$  (d)  $\tan^{-1} 4$

37. A particle moves by constant acceleration from initial position. If the distance travel by particle in last second is  $\frac{7}{16}$  of total distance travel by particle. Then, time of motion is

- (a) 4 s (b)  $4/7$  s  
(c) 7 s (d) None of these

38. Inverse of function  $f(x) = \frac{10^x - 10^{-x}}{10^x + 10^{-x}}$  is

- (a)  $\log_{10} (2-x)$  (b)  $\frac{1}{2} \log_{10} \left( \frac{1+x}{1-x} \right)$   
(c)  $\frac{1}{2} \log_{10} (2x-1)$  (d)  $\frac{1}{4} \log_{10} \left( \frac{2x}{2-x} \right)$

39.  $\left(1 + \cos \frac{\pi}{8}\right) \left(1 + \cos \frac{3\pi}{8}\right) \left(1 + \cos \frac{5\pi}{8}\right) \left(1 + \cos \frac{7\pi}{8}\right)$  is equal to

- (a)  $\frac{1}{2}$  (b)  $\frac{1}{8}$   
(c)  $\cos \frac{\pi}{8}$  (d)  $\frac{1 + \sqrt{2}}{2\sqrt{2}}$

40. The solution of the equation  $\sec \theta - \operatorname{cosec} \theta = \frac{4}{3}$  is

- (a)  $\frac{1}{2} [n\pi + (-1)^n \sin^{-1} 3/4]$   
(b)  $\frac{n\pi}{2} + (-1)^n \sin^{-1} 3/4$   
(c)  $n\pi + (-1)^n \sin^{-1} 3/4$   
(d) None of the above

41. The sum of inradius and circumradius of incircle and circumcircle of a regular polygon of side  $n$  is

- (a)  $\frac{a}{4} \cot \frac{\pi}{2n}$  (b)  $a \cot \frac{\pi}{n}$   
(c)  $\frac{a}{2} \cot \frac{\pi}{2n}$  (d)  $a \cot \frac{\pi}{2n}$

42. Elevation angle of the top of the minar from the foot of the tower of height  $h$  is  $\alpha$  and the tower subtend an angle  $\beta$  at the top of the mirror. Then, height of minar is

- (a)  $\frac{h \cot(\alpha - \beta)}{\cot(\alpha - \beta) - \cot \alpha}$   
(b)  $\frac{h \tan(\alpha - \beta)}{\tan(\alpha - \beta) - \tan \alpha}$   
(c)  $\frac{h \cot(\alpha - \beta)}{\cot(\alpha - \beta) + \cot \alpha}$   
(d) None of the above

43. If  $\sin^{-1} x + \sin^{-1} y = \frac{2\pi}{3}$  and  $\cos^{-1} x - \cos^{-1} y = \frac{\pi}{3}$

Then,  $(x, y)$  is equal to

- (a) (0, 1) (b)  $(1/2, 1)$   
(c)  $(1, 1/2)$  (d)  $(\sqrt{3}/2, 1)$

44. The radius of circle made by meeting the plane  $x + 2y + 2z + 7 = 0$  to the sphere  $x^2 + y^2 + z^2 + 2x - 2y - 4z - 19 = 0$  is

- (a) 5 (b) 4  
(c) 3 (d) None of these

45. If  $\frac{1+3p}{3}$ ,  $\frac{1-p}{4}$  and  $\frac{1-2p}{2}$  are mutually exclusive events. Then, range of  $p$  is

- (a)  $\frac{1}{3} \leq p \leq \frac{1}{2}$  (b)  $\frac{1}{4} \leq p \leq \frac{1}{2}$   
(c)  $\frac{1}{3} \leq p \leq \frac{2}{3}$  (d)  $\frac{1}{3} \leq p \leq \frac{2}{5}$



46. The minimum value of  $9 \tan^2 \theta + 4 \cot^2 \theta$  is  
 (a) 13 (b) 9  
 (c) 6 (d) 12
47. The general solution of  $\tan\left(\frac{\pi}{2} \sin \theta\right) = \cot\left(\frac{\pi}{2} \cos \theta\right)$  is  
 (a)  $\theta = 2r\pi + \frac{\pi}{2}, r \in Z$   
 (b)  $\theta = 2r\pi, r \in Z$   
 (c)  $\theta = 2r\pi + \frac{\pi}{2}$  and  $\theta = 2r\pi, r \in Z$   
 (d) None of the above
48. If  $iz^3 + z^2 - z + i = 0$ , then  $|z|$  is equal to  
 (a) 0 (b) 1  
 (c) 2 (d) None of these
49. If  $x^{2n} - 2x \cos \theta + 1 = 0$ , then  $x^{2n} - 2x^n \cos n\theta + 1$  is equal to  
 (a)  $\cos 2n\theta$  (b)  $\sin 2n\theta$   
 (c) 0 (d)  $R - \{0\}$
50. If  $y^2 = P(x)$  be a cubic polynomial, then  $2 \frac{d}{dx} \left( y^3 \frac{d^2 y}{dx^2} \right)$  is equal to  
 (a)  $P'''(x) + P'(x)$  (b)  $P''(x) P'''(x)$   
 (c)  $P(x) P'''(x)$  (d) constant
51. Let  $f: R - \{x\} \rightarrow R$  be a function defined by  $f(x) = \frac{x-m}{x-n}$ , where  $m \neq n$ . Then  
 (a)  $f$  is one-one onto (b)  $f$  is one-one into  
 (c)  $f$  is many one onto (d)  $f$  is many one into
52. The number of the solutions of the equation  $z^2 + \bar{z} = 0$  is  
 (a) 1 (b) 2  
 (c) 3 (d) 4
53. Let  $a_1, a_2, \dots, a_{10}$  be in AP and  $h_1, h_2, \dots, h_{10}$  be in HP. If  $a_1 = h_1 = 2$  and  $a_{10} = h_{10} = 3$ . Then,  $a_4 h_7$  is  
 (a) 2 (b) 3  
 (c) 5 (d) 6
54. The total number of numbers of not more than 20 digits that are formed by using the digits 0, 1, 2, 3 and 4 is  
 (a)  $5^{20}$  (b)  $5^{20} - 1$   
 (c)  $5^{20} + 1$  (d) None of these
55. The coefficient of  $x^5$  in the expansion of  $(2 - x + 3x^2)^6$  is  
 (a) -4692 (b) 4692  
 (c) 2346 (d) -5052
56. If  $\alpha, \beta$  are the roots of the equation  $ax^2 + bx + c = 0$ , then  $\log(a - bx + cx^2)$  is equal to  
 (a)  $\log a + (\alpha + \beta)x + \frac{\alpha^2 + \beta^2}{2}x^2 + \frac{\alpha^3 + \beta^3}{3}x^3 + \dots$   
 (b)  $\log a + (\alpha + \beta)x - \left(\frac{\alpha^2 + \beta^2}{2}\right)x^2 + \left(\frac{\alpha^3 + \beta^3}{3}\right)x^3 - \dots$   
 (c)  $\log a - (\alpha + \beta)x - \left(\frac{\alpha^2 + \beta^2}{2}\right)x^2 - \left(\frac{\alpha^3 + \beta^3}{3}\right)x^3 - \dots$   
 (d) None of the above
57. For the equations  
 $x + 2y + 3z = 1, 2x + y + 3z = 2$   
 and  $5x + 5y + 9z = 4$   
 (a) there is only one solution  
 (b) there exists infinitely many solution  
 (c) there is no solution  
 (d) None of the above
58. If  $\omega$  is a cube root of unity, then  $\begin{vmatrix} 1 & \omega & \omega^2 \\ \omega & \omega^2 & 1 \\ \omega^2 & 1 & \omega \end{vmatrix}$  is equal to  
 (a) 1 (b)  $\omega$   
 (c)  $\omega^2$  (d) 0
59. The equations of the lines on which the perpendiculars from the origin make  $30^\circ$  angle with x-axis and which form a triangle of area  $\frac{50}{\sqrt{3}}$  with axes, are  
 (a)  $x + \sqrt{3}y \pm 10 = 0$   
 (b)  $\sqrt{3}x + y \pm 10 = 0$   
 (c)  $x \pm \sqrt{3}y - 10 = 0$   
 (d) None of the above
60. Let PQR be a right angled isosceles triangle, right angled at P(2, 1). If the equation of the line QR is  $2x + y = 3$ , Then the equation representing the pair of lines PQ and PR is  
 (a)  $3x^2 - 3y^2 + 8xy + 20x + 10y + 25 = 0$   
 (b)  $3x^2 - 3y^2 + 8xy - 20x - 10y + 25 = 0$   
 (c)  $3x^2 - 3y^2 + 8xy + 10x + 15y + 20 = 0$   
 (d)  $3x^2 - 3y^2 - 8xy - 10x - 15y - 20 = 0$



61. The curve with parametric equations  $x = 1 + 4 \cos \theta$ ,  $y = 2 + 3 \sin \theta$  is  
 (a) an ellipse (b) a parabola  
 (c) a hyperbola (d) a circle

62. If  $3f(x) - f\left(\frac{1}{x}\right) = \log e^{x^4}$  for  $x > 0$ , then  $f(e^x)$  is

- (a)  $2x$  (b)  $x^2$   
 (c)  $x$  (d) None of these

63. The domain of definition of function  $f(x) = \frac{1 + 2(x+4)^{-0.5}}{2 - (x+4)^{0.5}} + (x+4)^{0.5} + 4(x+4)^{0.5}$  is

- (a)  $R$  (b)  $(-4, 4)$   
 (c)  $R^+$  (d)  $(-4, 0) \cup (0, \infty)$

64. The value of  $\lim_{x \rightarrow \infty} \left(\frac{x+6}{x+1}\right)^{x+4}$  is

- (a)  $e$  (b)  $e^2$  (c)  $e^4$  (d)  $e^5$

65. The set of points where the function  $f(x) = x|x|$  is differentiable is

- (a)  $(-\infty, \infty)$  (b)  $(-\infty, 0) \cup (0, \infty)$   
 (c)  $(0, \infty)$  (d)  $[0, \infty)$

66. If

$$f(x) = \begin{cases} \frac{1 - \sin x}{(\pi - 2x)^2} \cdot \frac{\log \sin x}{\log(1 + \pi^2 - 4\pi x + 4x^2)}, & x \neq \frac{\pi}{2} \\ k, & x = \frac{\pi}{2} \end{cases}$$

is continuous at  $x = \frac{\pi}{2}$ , then  $k$  is equal to

- (a)  $-\frac{1}{16}$  (b)  $-\frac{1}{32}$   
 (c)  $-\frac{1}{64}$  (d)  $-\frac{1}{28}$

67. If  $y = 4x - 5$  is a tangent to the curve  $y^2 = px^3 + q$  at  $(2, 3)$ , then

- (a)  $p = 2, q = -7$  (b)  $p = -2, q = 7$   
 (c)  $p = -2, q = -7$  (d)  $p = 2, q = 7$

68. On which of the following intervals is the function  $f(x) = 2x^2 - \log|x|$ ,  $x \neq 0$  increasing 2.

- (a)  $\left(\frac{1}{2}, \infty\right)$   
 (b)  $\left(-\infty, -\frac{1}{2}\right) \cup \left(\frac{1}{2}, \infty\right)$   
 (c)  $\left(-\infty, -\frac{1}{2}\right) \cup \left(0, \frac{1}{2}\right)$   
 (d)  $\left(-\frac{1}{2}, 0\right) \cup \left(\frac{1}{2}, \infty\right)$

69. The greatest value of

$$f(x) = (x+1)^{1/3} - (x-1)^{1/3} \text{ on } [0, 1] \text{ is}$$

- (a) 1 (b) 2  
 (c) 3 (d)  $\frac{1}{3}$

70. The vector  $\vec{a}$  is equal to

- (a)  $(\vec{a} \cdot \hat{i})\hat{i} + (\vec{a} \cdot \hat{j})\hat{j} + (\vec{a} \cdot \hat{k})\hat{k}$   
 (b)  $(\vec{a} \cdot \hat{j})\hat{i} + (\vec{a} \cdot \hat{k})\hat{j} + (\vec{a} \cdot \hat{i})\hat{k}$   
 (c)  $(\vec{a} \cdot \hat{k})\hat{i} + (\vec{a} \cdot \hat{i})\hat{j} + (\vec{a} \cdot \hat{j})\hat{k}$   
 (d)  $(\vec{a} \cdot \vec{a})(\hat{i} + \hat{j} + \hat{k})$

71. If  $\vec{a}, \vec{b}, \vec{c}$  are the position vectors of the vertices of an equilateral triangle whose orthocentre is at the origin, then

- (a)  $\vec{a} + \vec{b} + \vec{c} = \vec{0}$  (b)  $\vec{a}^2 = \vec{b}^2 + \vec{c}^2$   
 (c)  $\vec{a} + \vec{b} = \vec{c}$  (d) None of these

72. If  $A$  and  $B$  are two events such that  $P(A) = \frac{3}{4}$  and

$$P(B) = \frac{5}{8}, \text{ then}$$

- (a)  $P(A \cup B) \geq 3/4$   
 (b)  $P(A' \cap B) \leq 1/4$   
 (c)  $\frac{3}{8} \leq P(A \cap B) \leq \frac{5}{8}$   
 (d) All of the above

73. Two dice are tossed 6 times, then the probability that 7 will show an exactly four of the tosses is

- (a)  $\frac{225}{18442}$  (b)  $\frac{116}{20003}$   
 (c)  $\frac{125}{15552}$  (d) None of these

74. The slope of common tangents of hyperbola

$$\frac{x^2}{9} - \frac{y^2}{16} = 1 \text{ and } \frac{y^2}{9} - \frac{x^2}{16} = 1 \text{ is}$$

- (a) 2, -2  
 (b) 1, -1  
 (c) 1, 2  
 (d) -1, -2

75. The number of values of  $C$  for which the line

$$y = 4x + c \text{ touch the curve } \frac{x^2}{4} + y^2 = 1$$

- (a) 0 (b) 1  
 (c) 2 (d)  $\infty$



# Answers

## Physics

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

## Chemistry

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

## Mathematics

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