# Mock Test-3

## SECTION-A

### PHYSICS

1. Which of the following relationship between the acceleration and displacement $x$ of a particle involve SHM?
   (a) $a = 2x$       (b) $a = 4x^2$
   (c) $a = -5x$       (d) $a = -3x^2$

2. What will be the maximum speed of a car on a road turn of radius 30 m if the coefficient of friction between the tyres and the road is 0.4 (Take g $= 9.8$ m/s$^2$)
   (a) 10.84 m/s       (b) 9.84 m/s
   (c) 8.84 m/s       (d) 6.84 m/s

3. When a body undergoes a linear tensile strain it experiences a lateral contraction also. The ratio of lateral contraction to longitudinal strain is known as
   (a) Young's modulus  (b) Bulk modulus
   (c) Poisson's ratio   (d) Hooke's law

4. When an unpolarized light of intensity $I_0$ is incident on a polarizing sheet, the intensity of the light which does not get transmitted is
   (a) $\frac{1}{4}I_0$       (b) $\frac{1}{2}I_0$
   (c) $I_0$       (d) zero

5. If the electric flux entering and leaving a closed surface are $6 \times 10^6$ and $9 \times 10^6$ respectively, then the charge inside the surface of permittivity of free space $\varepsilon_0$ is
   (a) $\varepsilon_0 \times 10^6$       (b) $-\varepsilon_0 \times 10^6$
   (c) $-2\varepsilon_0 \times 10^6$       (d) $3\varepsilon_0 \times 10^6$

6. The equivalent capacitance between A and B is (in µF)

   (a) 25
   (b) $\frac{84}{25}$
   (c) 9
   (d) 1



7. A voltmeter essentially consists of
   (a) a high resistance, in series with a galvanometer
   (b) a low resistance, in series with a galvanometer
   (c) a high resistance in parallel with a galvanometer
   (d) a low resistance in parallel with a galvanometer

8. A nucleus splits into two nuclear parts which have their velocity ratio equal to 5 : 1. What will be the ratio of their nuclear radius?
   (a) $5^{1/3} : 1$ (b) $1 : 5^{1/3}$ (c) $3^{1/2} : 1$ (d) $1 : 3^{1/2}$

9. In a stream line (laminar flow) the velocity of flow at any point in the liquid
   (a) does not vary with time
   (b) may vary in direction but not in magnitude
   (c) may vary in magnitude but not in direction
   (d) may vary both in magnitude and direction

10. When two quantities are divided, the relative error in the result is given by
    (a) the product of the relative error in the individual quantities
    (b) the quotient of the relative error in the individual quantities
    (c) the difference of the relative error in the individual quantities
    (d) the sum of the relative error in the individual quantities

11. $\vec{A}$ and $\vec{B}$ are two vectors and $\theta$ is the angle between them, if $|\vec{A} \times \vec{B}| = \sqrt{3}(\vec{A}.\vec{B})$, the value of $\theta$ is
    (a) 45°  (b) 30°  (c) 90°  (d) 60°

12. In semiconductors, at room temperature
    (a) the conduction band is completely empty
    (b) the valence band is partially empty and the conduction band is partially filled
    (c) the valence band is completely filled and the conduction band is partially filled
    (d) the valence band is completely filled

13. For an AM wave, the maximum voltage was found to be 10 V and minimum voltage was 4 V. The modulation index of the wave is
    (a) 0.33  (b) 0.43  (c) 0.56  (d) 0.64

14. The four wires from a larger circuit intersect at junction A as shown. What is the magnitude and direction of the current between points A and B ?
    (a) 2 A from A to B
    (b) 2A from B to A
    (c) 3A from A to B
    (d) 2A from B to A
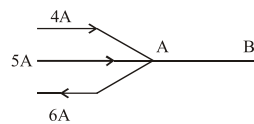
15. Two identical particles are located at $\vec{x}$ and $\vec{y}$ with reference to the origin of three dimensional co-ordinate system. The position vector of centre of mass of the system is given by
    (a) $\vec{x} - \vec{y}$
    (b) $\dfrac{\vec{x} + \vec{y}}{2}$
    (c) $(\vec{x} - \vec{y})$
    (d) $\dfrac{\vec{x} - \vec{y}}{2}$

16. Two coaxial solenoids are made by winding thin insulated wire over a pipe of cross-sectional area A = 10 cm$^2$ and length = 20 cm. If one of the solenoid has 300 turns and the other 400 turns, their mutual inductance is
    ($\mu_0 = 4\pi \times 10^{-7}\,\text{Tm A}^{-1}$)
    (a) $2.4\pi \times 10^{-5}\,\text{H}$  (b) $4.8\pi \times 10^{-4}\,\text{H}$
    (c) $4.8\pi \times 10^{-5}\,\text{H}$  (d) $2.4\pi \times 10^{-4}\,\text{H}$

17. An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is
    (a) 1 : 2  (b) 4 : 1  (c) 8 : 3  (d) 3 : 8

18. The angular velocity of the earth with which it has to rotate so that acceleration due to gravity on 60° latitude becomes zero is (Radius of earth = 6400 km, at the poles g = 10 ms$^{-2}$)
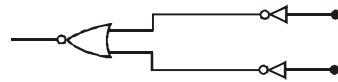    (a) $2.5 \times 10^{-3}$ rad/s  (b) $5.0 \times 10^{-1}$ rad/s
    (c) $10 \times 10^{1}$ rad/s  (d) $7.8 \times 10^{-2}$ rad/s

19. In the figure is shown Young's double slit experiment. Q is the position of the first bright fringe on the right side of O, P is the 11$^{th}$ fringe on the other side, as measured from Q. If the wavelength of the light used is 6000 × 10$^{-10}$m, then S$_1$B will be equal to
    (a) $6 \times 10^{-6}$ m  (b) $6.6 \times 10^{-6}$m
    (c) $3.138 \times 10^{-7}$ m  (d) $3.144 \times 10^{-7}$ m

20. Figure consists of two NOT gates followed by a NOR gate. This combination is equivalent to a single
    (a) NAND gate  (b) AND gate
    (c) OR gate  (d) XOR gate

21. A particle describe a horizontal circle of radius 0.5 m with uniform speed. The centripetal force acting is 10 N. The work done in describing a semicircle is
    (a) zero  (b) 5 J  (c) $5\pi$ J  (d) $10\pi$ J

22. A current of 5 ampere is flowing in a wire of length 1.5 metres. A force of 7.5 N acts on it when it is placed in a uniform magnetic field of 2 tesla. The angle between the magnetic field and the direction of the current is
    (a) 30°  (b) 45°  (c) 60°  (d) 90°

23. A particle describes uniform circular motion in a circle of radius 2 m, with the angular speed of 2 rad s$^{-1}$. The magnitude of the change in its velocity in $\dfrac{\pi}{2}$ s is

(a) $0 \, m \, s^{-1}$
(b) $2\sqrt{2} ms^{-1}$
(c) $8 \, m \, s^{-1}$
(d) $4 \, m \, s^{-1}$

24. A 100 turns coil of area of cross section 200 cm$^2$ having 2 Ω resistance is held perpendicular to a magnetic field of 0.1 T. If it is removed from the magnetic field in one second, the induced charge produced in it is

(a) 0.2 C (b) 2 C (c) 0.1 C (d) 1 C

25. The adjoining figure shows graph of pressure and volume of a gas at two tempertures $T_1$ and $T_2$. Which of the following inferences is correct?

(a) $T_1 > T_2$

(b) $T_1 = T_2$

(c) $T_1 < T_2$
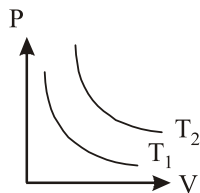
(d) None of these

26. A machine gun has a mass 5 kg. It fires 50 gram bullets at the rate of 30 bullets per minute at a speed of 400 ms$^{-1}$. What force is required to keep the gun in position?

(a) 10 N (b) 5 N (c) 15 N (d) 30 N

27. In an experiment to measure the internal resistance of a cell, by a potentiometer, it is found that the balance point is at a length of 2 m, when the cell is shunted by a 5 Ω resistance and is at a length of 3 m when the cell is shunted by a 10 Ω resistance. The internal resistance of the cell is then

(a) 1.5 Ω (b) 10 Ω (c) 15 Ω (d) 1 Ω

28. For transmission of e.m.wave of audible frequency, these waves are superimposed with waves of

(a) frequency less than 20 Hz
(b) frequency less than 10 KHz.
(c) frequency in the audible range.
(d) radio-frequency.

29. The binding energy of deuteron is 2.2 MeV and that of $^4_2He$ is 28 MeV. If two deuterons are fused to form one $^4_2He$, then the energy released is
(a) 23.6 MeV (b) 19.2 MeV
(c) 30.2 MeV (d) 25.8 MeV

30. A glass slab of thickness 4 cm contains the same number of waves as 5 cm of water when both are traversed by the same monochromatic light. If the refractive index of water is 4/3, what is that of glass?
(a) 5/3 (b) 5/4 (c) 16/15 (d) 1.5

31. Two concentric uniform shells of mass $M_1$ and $M_2$ are as shown in the figure. A particle of mass $m$ is located just within the shell $M_2$ on its inner surface. Gravitational force on '$m$' due to $M_1$ and $M_2$ will be
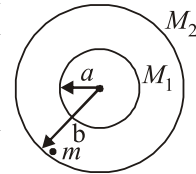
(a) zero
(b) $\dfrac{GM_1 m}{b^2}$

(c) $\dfrac{G(M_1 + M_2)m}{b^2}$
(d) None of these

32. The ionization energy of hydrogen atom is 13.6 eV. Following Bohr's theory, the energy corresponding to a transition between 3rd and 4th orbit is
(a) 3.40 eV (b) 1.51 eV
(c) 0.85 eV (d) 0.66 eV

33. A 100 N force acts horizontally on a block of 10 kg placed on a horizontal rough surface of coefficient of friction $\mu = 0.5$. If the acceleration due to gravity (g) is taken as 10 ms$^{-2}$, the acceleration of the block (in ms$^{-2}$) is
(a) 2.5 (b) 10 (c) 5 (d) 7.5

34. In the circuit given below, what will be the reading of the voltmeter?
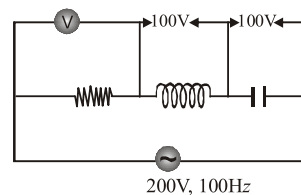
(a) 300 V (b) 900 V (c) 200 V (d) 400 V

35. If the moment of inertia of a disc about an axis tangential and parallel to its surface be $I$, then what will be the moment of inertia about the axis tangential but perpendicular to the surface?
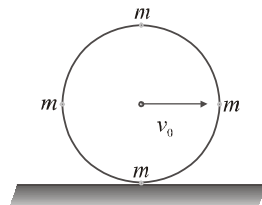
(a) $\dfrac{6}{5}I$  (b) $\dfrac{3}{4}I$  (c) $\dfrac{3}{2}I$ (d) $\dfrac{5}{4}I$

36. A simple pendulum performs S.H.M. about x = 0 with an amplitude a, and time period T. The speed of the pendulum at x = a/2 will be

(a) $\pi\dfrac{a\sqrt{3}}{T}$  (b) $\dfrac{\pi a\sqrt{3}}{2\,T}$

(c) $\dfrac{\pi a}{T}$  (d) $\dfrac{3\pi^2 a}{T}$

37. A ring of mass m and radius $R$ has four particles each of mass m attached to the ring as shown in figure. The centre of ring has a speed $v_0$. The kinetic energy of the system is

(a) $mv_0^2$

(b) $3mv_0^2$

(c) $5mv_0^2$

(d) $6mv_0^2$

38. A bar magnet of magnetic moment M and length L is cut into two equal parts each of length L/3. The magnetic moment of each part will be

(a) M  (b) M/4  (c) $\sqrt{2}$ M (d) M/3

39. Nickel shows ferromagnetic property at room temperature. If the temperature is increased beyond Curie temperature, then it will show
(a) anti ferromagnetism
(b) no magnetic property
(c) diamagnetism
(d) paramagnetism

40. Consider two hot bodies $B_1$ and $B_2$ which have temperatures 100°C and 80°C respectively at $t = 0$. The temperature of the surroundings is 40°C. The ratio of the respective rates of cooling $R_1$ and $R_2$ of these two bodies at $t = 0$ will be
(a) $R_1 : R_2 = 3 : 2$  (b) $R_1 : R_2 = 5 : 4$
(c) $R_1 : R_2 = 2 : 3$  (d) $R_1 : R_2 = 4 : 5$

41. Find the minimum thickness of a film which will strongly reflect the light of wavelength 598 nm. The refractive index of the material of the film is 1.25.
(a) 118 nm  (b) 120 nm
(c) 218 m  (d) 225 mm

42. Water rises in a capillary tube to a certain height such that the upward force due to surface tension is balanced by $7.5 \times 10^{-4}$N force due to the weight of the liquid. If the surface tension of water is $6 \times 10^{-2}$Nm$^{-1}$, the inner circumference of the capillary tube must be
(a) $1.25 \times 10^{-2}$m  (b) $0.50 \times 10^{-2}$m
(c) $6.5 \times 10^{-2}$m  (d) $12.5 \times 10^{-2}$m

43. Figure shows three oscillating $LC$ circuit with identical inductors and capacitors. If $t_1$, $t_2$, $t_3$ are the time taken by the circuits I, II, III for fully discharge, then
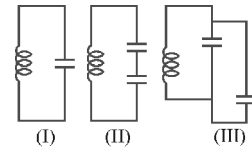
(a) $t_1 > t_2 > t_3$  (b) $t_1 < t_2 < t_3$
(c) $t_2 < t_1 < t_3$  (d) $t_3 = \sqrt{t_1 t_2}$

44. Two sources P and Q produce notes of frequency 660 Hz each. A listener moves from P to Q with a speed of 1 ms$^{-1}$. If the speed of sound is 330 m/s, then the number of beats heard by the listener per second will be
(a) zero  (b) 4  (c) 8  (d) 2

45. A liquid does not wet the sides of a solid, if the angle of contact is
(a) Zero
(b) Obtuse (more than 90°)
(c) Acute (less than 90°)
(d) 90° (right angle)

46. A steel ring of radius r and cross sectional area A is fitted onto a wooden disc of radius R (R > r). If the Young's modulus of steel is Y, then the force with which the steel ring is expanded is
(a) A Y (R/r)  (b) A Y (R−r)/r
(c) (Y/A)[(R−r)/r]  (d) Y r/A R

47. An ideal gas is initially at $P_1$, $V_1$ is expanded to $P_2$, $V_2$ and then compressed adiabatically to the same volume $V_1$ and pressure $P_3$. If $W$ is the net work done by the gas in complete process which of the following is true ?
(a) $W > 0 ; P_3 > P_1$  (b) $W < 0 ; P_3 > P_1$
(c) $W > 0 ; P_3 < P_1$  (d) $W < 0 ; P_3 < P_1$

48. A coaxial cable consists of a thin inner conductor fixed along the axis of a hollow outer conductor. The two conductors carry equal currents in opposites directions. Let $B_1$ and $B_2$ be the magnetic fields in the region betweem the conductors and outside the conductor, respectively Then,
(a) $B_1 \neq 0, B_2 \neq 0$  (b) $B_1 = B_2 = 0$
(c) $B_1 \neq 0, B_2 = 0$  (d) $B_1 = 0, B_2 \neq 0$

49. A drop of water is placed on a glass plate. A double convex lens having radius of curvature of each surface is 20 cm is placed on it. The focal length of water is ($\mu_w = 4/3$)
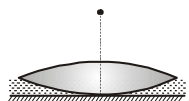


(a) $-20$ cm  (b) $60$ cm

(c) $20$ cm  (d) $-60$ cm

50. A source of light is placed at a distance of 50 cm from a photocell and the stopping potential is found to be $V_0$. If the distance between the light source and photocell is made 25 cm, the new stopping potential will be
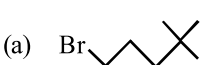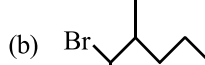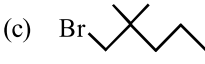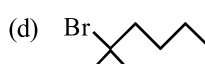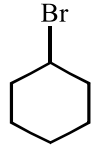(a) $2V_0$  (b) $V_0/2$  (c) $V_0$  (d) $4V_0$

## CHEMISTRY
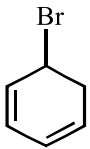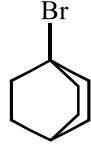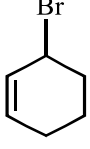
51. Which one of the following complexes will most likely absorb visible light?
(At nos. Sc = 21, Ti = 22, V = 23, Zn = 30)
(a) $[Sc(H_2O)_6]^{3+}$  (b) $[Ti(NH_3)_6]^{4+}$
(c) $[V(NH_3)_6]^{3+}$  (d) $[Zn(NH_3)_6]^{2+}$

52. Calcination is used in metallurgy for removal of
(a) moisture  (b) water and $CO_2$
(c) $CO_2$ and $H_2S$  (d) $H_2O$ and $H_2S$

53. If the rate of a gaseous reaction is independent of pressure, the order of reaction is:
(a) 0  (b) 1  (c) 2  (d) 3

54. Which amino acid is achiral?
(a) Alanine  (b) Valine
(c) Proline  (d) None of these

55. 1-Phenylethanol can be prepared by reaction of benzaldehyde with
(a) methyl bromide
(b) ethyl iodide and magnesium
(c) methyl bromide and aluminium bromide
(d) methyl iodide and magnesium

56. The acidic, basic or amphoteric nature of $Mn_2O_7$, $V_2O_5$ and CrO are respectively
(a) acidic, acidic and basic
(b) basic, amphoteric and acidic
(c) acidic, amphoteric and basic
(d) acidic, basic and amphoteric

57. The number of P – O – P bonds in cyclic metaphosphoric acid is
(a) zero  (b) two  (c) three  (d) four

58. In the electrochemical reaction
$$2Fe^{3+} + Zn \longrightarrow Zn^{2+} + 2Fe^{2+},$$
on increasing the concentration of $Fe^{2+}$
(a) increases cell emf
(b) increases the current flow
(c) decreases the cell emf
(d) alters the pH of the solution

59. The general formula $C_nH_{2n}O_2$ could be for open chain
(a) carboxylic acids  (b) diols
(c) dialdehydes  (d) diketones

60. In a cubic lattice A atom occupy all the corners. If B atom occupy one of the opposite face, and atom C occupy the remaining faces. The simplest formulae of the compound is
(a) $ABC_3$  (b) $ABC_2$  (c) ABC  (d) $AB_2C$

61. Out of the following isomeric alcohols containing five carbon atoms, the alcohol that exhibits optical isomerism is
(a) 1-pentanol
(b) 2-pentanol
(c) 3-pentanol
(d) 2-methyl-2-butanol

62. Reaction of alkyl halides with aromatic compounds in presence of anhydrous $AlCl_3$ is known as :
(a) Friedel Craft reaction
(b) Corey house synthesis
(c) Kolbe's synthesis
(d) Beckmann rearrangement

63. The molar ionic conductances of the octahedral complexes:
(I) $PtCl_4.5NH_3$  (II) $PtCl_4.4NH_3$
(III) $PtCl_4.3NH_3$  (IV) $PtCl_4.2NH_3$
Follow the order
(a) I < II < III < IV  (b) IV < III < II < I
(c) III < IV < II < I  (d) IV < III < I < II

64. Which one of the following binary liquid systems shows positive deviation from Raoult's law?
(a) Benzene-toluene
(b) Carbon disulphide-acetone
(c) Phenol-aniline
(d) Chloroform-acetone

65. Calcium carbide when treated with water gives:
(a) ethylene  (b) methane
(c) acetylene  (d) ethane

**66.** The standard reduction potentials at 298K for the following half reactions are given against each

$Zn^{2+}(aq) + 2e^- \rightleftharpoons Zn(s); -0.762\,V$

$Cr^{3+}(aq) + 3e^- \rightleftharpoons Cr(s); -0.740\,V$

$2H^+(aq) + 2e^- \rightleftharpoons H_2(g); 0.00\,V$

$Fe^{3+}(aq) + e^- \rightleftharpoons Fe^{2+}(aq); 0.770\,V$

Which is the strongest reducing agent?
(a) Zn (s)  (b) Cr (s)
(c) $H_2(g)$  (d) $Fe^{3+}(aq)$

**67.** Which polymer is used for making magnetic recording tapes?
(a) Dacron  (b) Acrilan
(c) Glyptal  (d) Bakelite

**68.** Carbylamine reaction is used for the detection of

(a) aliphatic 2° amines.
(b) aliphatic 1° amines.
(c) aromatic 1° amines.
(d) Both (b) and (c).

**69.** Which one of the following is not applicable to the phenomenon of adsorption?
(a) $\Delta H > 0$  (b) $\Delta G < 0$
(c) $\Delta S < 0$  (d) $\Delta H < 0$

**70.** For a reaction, activation energy $(E_a) = 0$ and rate constant $(k) = 3.2 \times 10^6\,s^{-1}$ at 300 K. What is the value of the rate constant at 310 K
(a) $3.2 \times 10^{-12}\,s^{-1}$  (b) $3.2 \times 10^6\,s^{-1}$
(c) $6.4 \times 10^{12}\,s^{-1}$  (d) $6.4 \times 10^6\,s^{-1}$

**71.** Which one of the following is a non-benzenoid aromatic compound?
(a) Aniline  (b) Benzoic acid
(c) Naphthalene  (d) Tropolone

**72.** Which of the following is the key step in the manufacture of sulphuric acid ?
(a) Burning of sulphur or sulphide ores in air to generate $SO_2$
(b) Conversion of $SO_2$ to $SO_3$ by the reaction with oxygen in presence of catalyst.
(c) Absorption of $SO_3$ in $H_2SO_4$ to give oleum.
(d) Both (b) and (c)

**73.** On the basis of data given below,

$E^{\ominus}_{Sc^{3+}/Sc^{2+}} = -0.37$, $E^{\ominus}_{Mn^{3+}/Mn^{2+}} = +1.57$

$E^{\ominus}_{Cr^{2+}/Cr} = -0.90$, $E^{\ominus}_{Cu^{2+}/Cu} = 0.34$

Which of the following statements is incorrect?
(a) $Sc^{3+}$ has good stability due of $[Ar]3d^04s^0$ configuration.
(b) $Mn^{3+}$ is more stable than $Mn^{2+}$.
(c) $Cr^{2+}$ is reducing in nature.
(d) Copper does not give $H_2$ on reaction with dil. $H_2SO_4$.

**74.** The decomposition of a substance follows first order kinetics. Its concentration is reduced to 1/8th of its initial value in 24 minutes. The rate constant of the decomposition process is
(a) $1/24\,min^{-1}$

(b) $\dfrac{0.692}{24}\,min^{-1}$

(c) $\dfrac{2.303}{24}\log\left(\dfrac{1}{8}\right)min^{-1}$

(d) $\dfrac{2.303}{24}\log\left(\dfrac{8}{1}\right)min^{-1}$

**75.** In Bosch's process, which gas is utilised for the production of hydrogen gas ?
(a) Producer gas  (b) Water gas
(c) Coal gas  (d) None of these

**76.** In the commercial electrochemical process for aluminium extraction the electrolyte used is
(a) $Al(OH)_3$ in NaOH solution
(b) An aqueous solution of $Al_2(SO_4)_3$
(c) A molten mixture of $Al_2O_3$ and $Na_3AlF_6$
(d) A molten mixture of $Al_2O_3$ and $Al(OH)_3$

**77.** A system absorbs 10 kJ of heat and does 4 kJ of work. The internal energy of the system
(a) increases by 6 kJ
(b) decreases by 6 kJ
(c) decreases by 14 kJ
(d) increases by 14 kJ

**78.** Reagents capable of converting cyclohexanone to N-ethyl cyclohexylamine is
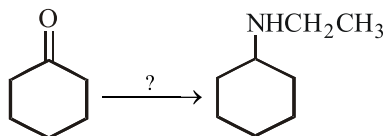


(a) $CH_3CH_2Br$ and $NH_3$

(b) $CH_3CH_2NH_2$ and $H_2/Pt$

(c) $CH_3CH = O$ and $NH_3$

(d) $LiAlH_4$ followed by $H_2O$ and then $CH_3CH_2Br$

**79.** Which one is the most likely structure of $CrCl_3 \cdot 6H_2O$ if 1/3 of total chlorine of the compound is precipitated by adding $AgNO_3$

(a) $CrCl_3 \cdot 6H_2O$

(b) $[Cr(H_2O)_3Cl_3] \cdot (H_2O)_3$

(c) $[CrCl_2(H_2O)_4]Cl \cdot 2H_2O$

(d) $[CrCl(H_2O)_5]Cl_2 \cdot H_2O$

**80.** The rate of reaction of which of the following is not affected by pressure

(a) $PCl_3 + Cl_2 \rightleftharpoons PCl_5$

(b) $N_2 + 3H_2 \rightleftharpoons 2NH_3$

(c) $N_2 + O_2 \rightleftharpoons 2NO$

(d) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

**81.** Among $Al_2O_3$, $SiO_2$, $P_2O_3$ and $SO_2$ the correct order of acid strength is

(a) $Al_2O_3 < SiO_2 < SO_2 < P_2O_3$

(b) $SiO_2 < SO_2 < Al_2O_3 < P_2O_3$

(c) $SO_2 < P_2O_3 < SiO_2 < Al_2O_3$

(d) $Al_2O_3 < SiO_2 < P_2O_3 < SO_2$

**82.** Which of the following statements about amorphous solids is incorrect ?

(a) They melt over a range of temperature

(b) They are anisotropic

(c) There is no orderly arrangement of particles

(d) They are rigid and incompressible

**83.** Cloud or fog is a colloidal system in which the dispersed phase and the dispersion medium are

(a) gas, liquid

(b) liquid, gas

(c) liquid, liquid

(d) solid, liquid

**84.** Which of the following ions will exhibit colour in aqueous solutions?

(a) $La^{3+}(Z=57)$

(b) $Ti^{3+}(Z=22)$

(c) $Lu^{3+}(Z=71)$

(d) $Sc^{3+}(Z=21)$

**85.** Which of the following cannot be made by using Williamson's synthesis?

(a) Methoxybenzene

(b) Benzyl $p$-nitrophenyl ether

(c) Methyl tertiary butyl ether

(d) Di-tert-butyl ether

**86.** 1 M, 2.5 litre NaOH solution is mixed with another 0.5 M, 3 litre NaOH solution. Then find out the molarity of resultant solution

(a) 0.80 M

(b) 1.0 M

(c) 0.73 M

(d) 0.50 M

**87.** In the manufacture of bromine from sea water, the mother liquor containing bromides is treated with

(a) carbon dioxide

(b) chlorine

(c) iodine

(d) sulphur dioxide

**88.** The oxidation potentails of A and B are +2.37 and +1.66 V respectively. In chemical reactions

(a) A will be replaced by B.

(b) A will replace B.

(c) A will not replace B.

(d) A and B will not replace each other.

**89.** Adenosine is an example of

(a) nucleotide

(b) nucleoside

(c) purine base

(d) pyrimidine base

**90.** Which of the folliowing metal oxides is anti-ferromagnetic in nature?

(a) MnO (b) $TiO_2$ (c) $VO_2$ (d) $CrO_2$

**91.** Which one of the following is the correct order of acidic strength?

(a) $CF_3COOH > CHCl_2COOH > HCOOH >$
$C_6H_5CH_2COOH > CH_3COOH$

(b) $CH_3COOH > HCOOH > CF_3COOH >$
$CHCl_2COOH > C_6H_5CH_2COOH$

(c) $HCOOH > C_6H_5CH_2COOH > CF_3COOH >$
$CHCl_2COOH > CH_3COOH$

(d) $CF_3COOH > CH_3COOH > HCOOH >$
$CHCl_2COOH > C_6H_5CH_2COOH$

**92.** The following compounds differ in



(a) configuration
(b) conformation
(c) structure
(d) chirality

**93.** Assume that a particular amino acid has an isoelectric point of 6.0. In a solution at pH 1.0, which of the following species will predominate?

(a) $H_3\overset{+}{N}CHCO_2H$ with R
(b) $H_2NCHCO_2H$ with R
(c) $H_3\overset{+}{N}CHCO_2$ with R
(d) $H_2NCHCO_2^-$ with R

**94.** Which one of the following forms micelles in aqueous solution above certain concentration?

(a) Dodecyltrimethylammonium chloride
(b) Glucose
(c) Urea
(d) Pyridinium chloride

**95.** The relationship between the dissociation energy of $N_2$ and $N_2^+$ is :

(a) Dissociation energy of $N_2^+$ > dissociation energy of $N_2$
(b) Dissociation energy of $N_2$ = dissociation energy of $N_2^+$
(c) Dissociation energy of $N_2$ > dissociation energy of $N_2^+$
(d) Dissociation energy of $N_2$ can either be lower or higher than the dissociation energy of $N_2^+$

**96.** Which has the maximum number of molecules among the following ?

(a) $44\,g\,CO_2$
(b) $48\,g\,O_3$
(c) $8\,g\,H_2$
(d) $64\,g\,SO_2$

**97.** Which one of the following statement is *not true*?

(a) In vulcanization the formation of sulphur bridges between different chains make rubber harder and stronger.
(b) Natural rubber has the *trans* -configuration at every double bond
(c) Buna-S is a copolymer of butadiene and styrene
(d) Natural rubber is a 1, 4 - polymer of isoprene

**98.** Which compound undergoes nucleophilic substitution with NaCN at the fastest rate?



**99.** Antibiotics that are effective against Gram-positive or Gram-negative bacteria X. Antibiotics that are effective against a single organism or disease are Y
What is X and Y ?

(a) X = Broad spectrum antibiotics.
Y = Narrow spectrum antibiotics.
(b) X = Broad spectrum antibiotics.
Y = Limited spectrum antibiotics.
(c) X = Narrow spectrum antibiotics.
Y = Limited spectrum antibiotics.
(d) X = Narrow spectrum antibiotics.
Y = Broad spectrum antibiotics.

**100.** Rate of $S_N2$ will be negligible in :

## MATHEMATICS

**1.** If $y = \cos^2 x + \sec^2 x$, then

(a) $y \leq 2$      (b) $y \leq 1$

(c) $y \geq 2$      (d) $1 < y < 2$

**2.** If A is the set of even natural numbers less than 8 and B is the set of prime numbers less than 7, then the number of relations from A to B is

(a) $2^9$   (b) $9^2$   (c) $3^2$   (d) $2^9 - 1$

**3.** 20 teachers of a school either teach mathematics or physics. 12 of them teach mathematics while 4 teach both the subjects. Then the number of teachers teaching physics only is

(a) 12      (b) 8

(c) 16      (d) None of these

**4.** In a G.P. of positive terms, if any term is equal to the sum of the next two terms then the common ratio of the G.P. is

(a) $\sin 18°$      (b) $2 \cos 18°$

(c) $\cos 18°$      (d) $2 \sin 18°$

**5.** Let $A(2, -3)$ and $B(-2, 1)$ be vertices of a triangle $ABC$. If the centroid of this triangle moves on the line $2x + 3y = 1$, then the locus of the vertex $C$ is the line

(a) $3x - 2y = 3$      (b) $2x - 3y = 7$

(c) $3x + 2y = 5$      (d) $2x + 3y = 9$

**6.** The equation of the parabola having axis parallel to y-axis and which passes through the points $(0, 4), (1, 9)$ and $(4, 5)$ is

(a) $y = \dfrac{-19}{12} x^2 + \dfrac{79}{12} x + 4$

(b) $y = \dfrac{-19}{12} x^2 + \dfrac{79}{12} x - 4$

(c) $y = \dfrac{19}{12} x^2 + \dfrac{79}{12} x + 4$

(d) None of these

**7.** $\left( \dfrac{-1 + \sqrt{-3}}{2} \right)^{100} + \left( \dfrac{-1 - \sqrt{-3}}{2} \right)^{100}$ is equal to

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

**8.** The number of ordered pairs $(x, y)$ satisfying $3^x \cdot 5^y = 75$ and $3^y \cdot 5^x = 45$ is

(a) 0      (b) 1

(c) 3      (d) None of these

**9.** The number of ways in which an examiner can assign 30 marks to 8 questions, giving not less than 2 marks to any question, is :

(a) $^{30}C_7$ (b) $^{21}C_8$ (c) $^{21}C_7$ (d) $^{30}C_8$

**10.** If number of terms in the expansion of $(x - 2y + 3z)^n$ is 45 then n =

(a) 7      (b) 8      (c) 9      (d) $6^{10}$

**11.** The ratio in which the line joining $(2, 4, 5), (3, 5, -4)$ is divided by the $yz$ plane, is

(a) $2 : 3$   (b) $3 : 2$   (c) $-2 : 3$   (d) $4 : -3$

**12.** The integer n for which

$$\lim_{x \to 0} \frac{(\cos x - 1)(\cos x - e^x)}{x^n}$$ is a finite non-zero number is

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

**13.** Which of the following is the inverse of the proposition? "If a number is a prime then it is odd."

(a) If a number is not a prime then it is odd

(b) If a number is not a prime then it is not odd

(c) If a number is not odd then it is not a prime

(d) If a number is not odd then it is a prime

**14.** The marks of some students were listed out of 75. The SD of marks was found to be 9. Subsequently the marks were raised to a maximum of 100 and variance of new marks was calculated. The new variance is

(a) 144      (b) 122

(c) 81      (d) None of these

**15.** If $f(x) = \dfrac{x}{x - 1}$, then $\dfrac{(f o f o ........ o f)(x)}{19 \text{ times}}$ is equal to:

(a) $\dfrac{x}{x - 1}$      (b) $\left( \dfrac{x}{x - 1} \right)^{19}$

(c) $\dfrac{19x}{x - 1}$      (d) $x$

**16.** Let A $= \begin{bmatrix} 0 & \alpha \\ 0 & 0 \end{bmatrix}$ and $(A + I)^{50} - 50A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$,

find abc + abd + bcd + acd

(a)  0         (b)  −1

(c)  1         (d)  None of these

**17.** If in a triangle ABC, $\begin{vmatrix} 1 & \sin A & \sin^2 A \\ 1 & \sin B & \sin^2 B \\ 1 & \sin C & \sin^2 C \end{vmatrix} = 0$ then the

triangle is

(a)  equilateral or isosceles

(b)  equilateral or right-angled

(c)  right angled or isosceles

(d)  None of these

**18.** The value of p for which the function

$$f(x) = \begin{cases} \dfrac{(4^x - 1)^3}{\sin \dfrac{x}{p} \log\left[1 + \dfrac{x^2}{3}\right]}, & x \neq 0 \\ 12(\log 4)^3, & x = 0 \end{cases}$$

may be continuous at $x = 0$, is

(a)  1         (b)  2

(c)  3         (d)  None of these

**19.** If $((\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d})).(\vec{a} \times \vec{d}) = 0$, then which of the following is always true ?

(a)  $\vec{a}, \vec{b}, \vec{c}, \vec{d}$ are necessarily coplanar

(b)  either $\vec{a}$ or $\vec{d}$ must lie in the plane of $\vec{b}$ and $\vec{c}$

(c)  either $\vec{b}$ or $\vec{c}$ must lie in the plane of $\vec{a}$ and $\vec{d}$

(d)  either $\vec{a}$ or $\vec{b}$ must lie in the plane of $\vec{c}$ and $\vec{d}$

**20.** $\displaystyle\int \dfrac{dx}{\cos x + \sqrt{3} \sin x}$ equals

(a)  $\log \tan \left( \dfrac{x}{2} + \dfrac{\pi}{12} \right) + C$

(b)  $\log \tan \left( \dfrac{x}{2} - \dfrac{\pi}{12} \right) + C$

(c)  $\dfrac{1}{2} \log \tan \left( \dfrac{x}{2} + \dfrac{\pi}{12} \right) + C$

(d)  $\dfrac{1}{2} \log \tan \left( \dfrac{x}{2} - \dfrac{\pi}{12} \right) + C$

**21.** Under what condition do $\left\langle \dfrac{1}{\sqrt{2}}, \dfrac{1}{2}, k \right\rangle$ represent direction cosines of a line?

(a)  $k = \dfrac{1}{2}$         (b)  $k = -\dfrac{1}{2}$

(c)  $k = \pm\dfrac{1}{2}$         (d)  k can take any value

**22.** The function $f(x) = \sin x - kx - c$, where $k$ and $c$ are constants, decreases always when

(a)  $k > 1$    (b)  $k \geq 1$    (c)  $k < 1$    (d)  $k \leq 1$

**23.** $\displaystyle\int_3^8 \dfrac{2 - 3x}{x\sqrt{1 + x}} dx =$

(a)  $2\log\left( \dfrac{3}{2e^3} \right)$         (b)  $\log\left( \dfrac{3}{e^3} \right)$

(c)  $4\log\left( \dfrac{3}{e^3} \right)$         (d)  None of these

**24.** Corner points of the feasible region for an LPP are (0, 2) (3, 0) (6, 0), (6, 8) and (0, 5). Let F $= 4x + 6y$ be the objective function.

The minimum value of F occurs at

(a)  (0, 2) only

(b)  (3, 0) only

(c)  the mid-point of the line segment joining the points (0, 2) and (3, 0) only

(d)  any point on the line segment joining the points (0, 2) and (3, 0)

**25.** If $y = \tan^{-1}\left( \dfrac{\log_e(e/x^2)}{\log_e(ex^2)} \right) + \tan^{-1}\left( \dfrac{3 + 2\log_e x}{1 - 6\log_e x} \right)$,

then $\dfrac{d^2 y}{dx^2}$ is

(a)  2     (b)  1     (c)  0     (d)  −1

26. Three persons, A, B and C, fire at a target in turn, starting with A. Their probability of hitting the target are 0.4, 0.3 and 0.2 respectively. The probability of two hits is
(a) 0.024 (b) 0.188 (c) 0.336 (d) 0.452

27. The area enclosed by the curve $x^2 y = 36$, the x-axis and the lines $x = 6$ and $x = 9$ is
(a) 6 (b) 1 (c) 4 (d) 2

28. A random variable X assumes values which are rational numbers of the form $\dfrac{n}{n+1}$ and $\dfrac{n+1}{n}$, where $n = 1, 2, 3, .....$

If $P\left(X = \dfrac{n}{n+1}\right) = P\left(X = \dfrac{n+1}{n}\right) = \left(\dfrac{1}{2}\right)^{n+1}$, then:

(a) $P(X < 1) = P(X > 1)$

(b) $P(\dfrac{1}{2} < X < 1) < P(X > 1)$

(c) $P(X > \dfrac{3}{2}) < P(X < 1)$

(d) All above are correct

29. A card is drawn at random from a pack of 100 cards numbered 1 to 100. The probability of drawing a number which is a square, is

(a) $\dfrac{1}{10}$ (b) $\dfrac{1}{100}$ (c) $\dfrac{9}{10}$ (d) $\dfrac{90}{100}$

30. The sum of 11 terms of an A.P. whose middle term is 30,
(a) 320 (b) 330 (c) 340 (d) 350

31. The intercept cut off by a line from y-axis twice than that from x-axis, and the line passes through the point (1, 2). The equation of the line is
(a) $2x + y = 4$ (b) $2x + y + 4 = 0$
(c) $2x - y = 4$ (d) $2x - y + 4 = 0$

32. The length of intercept, the circle $x^2 + y^2 + 10x - 6y + 9 = 0$ makes on the x-axis is :
(a) 2 (b) 4 (c) 6 (d) 8

33. If $\left(7 - 4\sqrt{3}\right)^{x^2 - 4x + 3} + \left(7 + 4\sqrt{3}\right)^{x^2 - 4x + 3} = 14$, then the value of $x$ is given by
(a) $2, 2 \pm \sqrt{2}$ (b) $2 \pm \sqrt{3}, 3$
(c) $3 \pm \sqrt{2}, 2$ (d) None of these

34. The number of solution of $\log_{\sin x} 2^{\tan x} > 0$ in the interval $\left(0, \dfrac{\pi}{2}\right)$ is

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

35. How many numbers lying between 500 and 600 can be formed with the help of the digits 1, 2, 3, 4, 5, 6 when the digits are not be repeated?

(a) 20 (b) 40 (c) 60 (d) 80

36. The coefficient of $x^2$ term in the binomial expansion of $\left(\dfrac{1}{3} x^{1/2} + x^{-1/4}\right)^{10}$ is :

(a) $\dfrac{70}{243}$ (b) $\dfrac{60}{423}$

(c) $\dfrac{50}{13}$ (d) None of these

37. For the function
$f(x) = \dfrac{x^{100}}{100} + \dfrac{x^{99}}{99} + ... + \dfrac{x^2}{2} + x + 1,$
$f'(1) = m f'(0)$, where m is equal to
(a) 50 (b) 0 (c) 100 (d) 200

38. If the function $f : R \to A$ given by is
$f(x) = \dfrac{x^2}{x^2 + 1}$ is surjection, then A is

(a) $[0, 1)$ (b) $(0, 1)$ (c) $(0, 1]$ (d) $[0, 1]$

39. If $x^2 + y^2 + z^2 = r^2$, then
$\tan^{-1} \dfrac{xy}{zr} + \tan^{-1} \dfrac{yz}{xr} + \tan^{-1} \dfrac{xz}{yr} =$

(a) $\pi$ (b) $\dfrac{\pi}{2}$

(c) 0 (d) None of these

40. If $A = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix}$ then $\lim\limits_{n \to \infty} \dfrac{1}{n} A^n$ is

(a) a null matrix (b) an identity matrix

(c) $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$ (d) None of these

41. If a system of equation $-ax + y + z = 0$

$$x - by + z = 0$$
$$x + y - cz = 0 \quad (a, b, c \neq -1)$$

has a non-zero solution then

$$\frac{1}{1+a} + \frac{1}{1+b} + \frac{1}{1+c} =$$

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

42. The function $f(x) = [x]^2 - [x^2]$ (where [y] is the greatest integer function less than or equal to y), is discontinuous at :
    (a) all integers
    (b) all integers except 0 and 1
    (c) all integers except 0
    (d) all integers except 1

43. The maximum value of $\dfrac{\ln x}{x}$ in $(2, \infty)$ is

(a) 1    (b) e    (c) 2/e    (d) 1/e

44. If $y = f(x)$ makes +ve intercept of 2 and 0 unit on x and y axes and encloses an area of 3/4 square unit with the axes then $\displaystyle\int_0^2 xf'(x)dx$ is

(a) 3/2    (b) 1    (c) 5/4    (d) –3/4

45. For the LPP Min $z = x_1 + x_2$ such that inequalities $5x_1 + 10x_2 \geq 0$, $x_1 + x_2 \leq 1$, $x_2 \leq 4$ and $x_1, x_2 \geq 0$
    (a) There is a bounded solution
    (b) There is no solution
    (c) There are infinitie solution
    (d) None of these

46. $\displaystyle\int \frac{(x^2 - 1)}{x\sqrt{x^4 + 3x^2 + 1}} dx$ is equal to

(a) $\log\left|x + \dfrac{1}{x} + \sqrt{x^2 + \dfrac{1}{x^2} + 3}\right| + C$

(b) $\log\left|x - \dfrac{1}{x} + \sqrt{x^2 + \dfrac{1}{x^2} - 3}\right| + C$

(c) $\log\left|x + \sqrt{x^2 + 3}\right| + C$

(d) None of these

47. Two spheres of radii 3 and 4 cut orthogonally The radius of common circle is

(a) 12    (b) $\dfrac{12}{5}$    (c) $\dfrac{\sqrt{12}}{5}$    (d) $\sqrt{12}$

48. A curve passing through (2, 3) and satisfying the differential equation $\displaystyle\int_0^x ty(t)\,dt = x^2 y(x)$, $(x > 0)$ is

(a) $x^2 + y^2 = 13$    (b) $y^2 = \dfrac{9}{2}x$

(c) $\dfrac{x^2}{8} + \dfrac{y^2}{18} = 1$    (d) $xy = c$

49. $\displaystyle\int_1^{e^{37}} \frac{\pi \sin(\pi \log_e x)}{x} dx$ is equal to

(a) 2    (b) 20    (c) $\dfrac{2}{\pi}$    (c) $2\pi$

50. The vectors $\overrightarrow{AB} = 3\hat{i} + 5\hat{j} + 4\hat{k}$ and $\overrightarrow{AC} = 5\hat{i} - 5\hat{j} + 2\hat{k}$ are the sides of a triangle ABC. The length of the median through A is :

(a) $\sqrt{13}$ units    (b) $2\sqrt{5}$ units
(c) 5 units    (d) 10 units