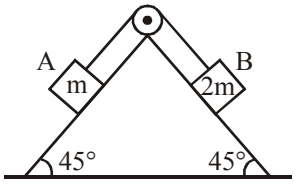
BITSAT 2020 PAPER
(memory based)

PHYSICS

1. What should be the velocity of rotation of earth due to rotation about its own axis so that the weight of a person becomes $\frac{3}{5}$ of the present weight at the equator. Equatorial radius of the earth is 6400 km.

(a) 8.7×10^{-7} rad/s (b) 7.8×10^{-4} rad/s
(c) 6.7×10^{-4} rad/s (d) 7.4×10^{-3} rad/s

2. Block A of mass m and block B of mass 2m are placed on a fixed triangular wedge by means of a massless, inextensible string and a frictionless pulley as shown in figure.



The wedge is inclined at 45° to the horizontal on both the sides. If the coefficient of friction between the block A and the wedge is 2/3 and that between the block B and the wedge is 1/3 and both the blocks A and B are released from rest, the acceleration of A will be

(a) -1 ms^{-2} (b) 1.2 ms^{-2}
(c) 0.2 ms^{-2} (d) zero

3. The surface charge density of a thin charged disc of radius R is σ. The value of the electric field at the centre of the disc is $\frac{\sigma}{2\epsilon_0}$. With respect to the field at the centre, the electric field along the axis at a distance R from the centre of the disc

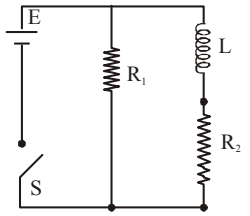
(a) reduces by 70.7% (b) reduces by 29.3%
(c) reduces by 9.7% (d) reduces by 14.6%

4. The molecules of a given mass of a gas have r.m.s. velocity of 200 ms^{-1} at 27°C and 1.0×10^5 Nm^{-2} pressure. When the temperature and pressure of the gas are respectively, 127°C and 0.05×10^5 Nm^{-2}, the r.m.s. velocity of its molecules in ms^{-1} is :

(a) $100\sqrt{2}$ (b) $\frac{400}{\sqrt{3}}$
(c) $\frac{100\sqrt{2}}{3}$ (d) $\frac{100}{3}$

5. An inductor of inductance L = 400 mH and resistors of resistance $R_1 = 2\Omega$ and $R_2 = 2\Omega$ are connected to a battery of emf 12 V as shown in the figure. The internal resistance of the battery is negligible. The switch S is closed at $t = 0$. The potential drop across L as a function of time is

(a) $\frac{12}{t}e^{-3t}$ V
(b) $6\left(1-e^{-t/0.2}\right)$ V
(c) $12e^{-5t}$ V
(d) $6e^{-5t}$ V

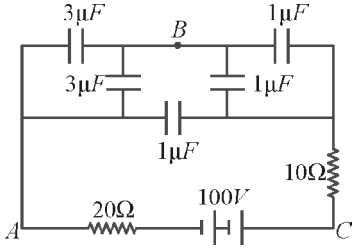


6. Two wires are made of the same material and have the same volume. However wire 1 has cross-sectional area A and wire 2 has cross-sectional area $3A$. If the length of wire 1 increases by Δx on applying force F, how much force is needed to stretch wire 2 by the same amount?
(a) $4F$ (b) $6F$ (c) $9F$ (d) F

7. Two spheres of different materials one with double the radius and one-fourth wall thickness of the other are filled with ice. If the time taken for complete melting of ice in the larger sphere is 25 minute and for smaller one is 16 minute, the ratio of thermal conductivities of the materials of larger spheres to that of smaller sphere is
(a) 4 : 5 (b) 5 : 4 (c) 25 : 8 (d) 8 : 25

8. A biconvex lens has a radius of curvature of magnitude 20 cm. Which one of the following options best describe the image formed of an object of height 2 cm placed 30 cm from the lens?
(a) Virtual, upright, height = 1 cm
(b) Virtual, upright, height = 0.5 cm
(c) Real, inverted, height = 4 cm
(d) Real, inverted, height = 1cm

9. In the figure below, what is the potential difference between the point A and B and between B and C respectively in steady state



(a) $V_{AB} = V_{BC} = 100V$
(b) $V_{AB} = 75\,V, V_{BC} = 25V$
(c) $V_{AB} = 25V, V_{BC} = 75V$
(d) $V_{AB} = V_{BC} = 50V$

10. A radioactive element X converts into another stable element Y. Half life of X is 2 hrs. Initially only X is present. After time t, the ratio of atoms of X and Y is found to be 1 : 4, then t in hours is
(a) 2 (b) 4
(c) between 4 and 6 (d) 6

11. The approximate depth of an ocean is 2700 m. The compressibility of water is 45.4×10^{-11} Pa^{-1} and density of water is 10^3 kg/m^3. What fractional compression of water will be obtained at the bottom of the ocean ?
(a) 1.0×10^{-2} (b) 1.2×10^{-2}
(c) 1.4×10^{-2} (d) 0.8×10^{-2}

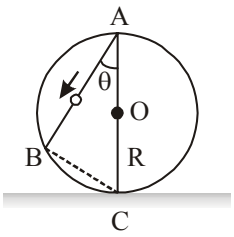
12. A frictionless wire AB is fixed on a sphere of radius R. A very small spherical ball slips on this wire. The time taken by this ball to slip from A to B is

(a) $\dfrac{\sqrt{2gR}}{g\cos\theta}$

(b) $2\sqrt{gR}.\dfrac{\cos\theta}{g}$

(c) $2\sqrt{\dfrac{R}{g}}$

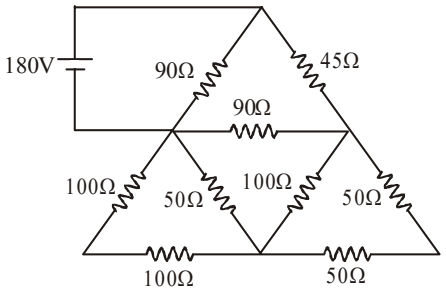
(d) $\dfrac{gR}{\sqrt{g\cos\theta}}$



13. A string of length ℓ is fixed at both ends. It is vibrating in its 3rd overtone with maximum amplitude 'a'. The amplitude at a distance $\ell/3$ from one end is
(a) a (b) 0 (c) $\dfrac{\sqrt{3}a}{2}$ (d) $\dfrac{a}{2}$

14. A deuteron of kinetic energy 50 keV is describing a circular orbit of radius 0.5 metre in a plane perpendicular to the magnetic field B. The kinetic energy of the proton that describes a circular orbit of radius 0.5 metre in the same plane with the same B is
(a) 25 keV (b) 50 keV
(c) 200 keV (d) 100 keV

15. In the circuit shown in the figure, find the current in 45 Ω.



(a) 4 A (b) 2.5A
(c) 2 A (d) None of these

16. Kepler's third law states that square of period of revolution (T) of a planet around the sun, is proportional to third power of average distance r

between sun and planet i.e. $T^2 = Kr^3$ here K is constant. If the masses of sun and planet are M and m respectively then as per Newton's law of gravitation force of attraction between them is $F = \frac{GMm}{r^2}$, here G is gravitational constant. The relation between G and K is described as

(a) $GMK = 4\pi^2$ (b) $K = G$

(c) $K = \frac{1}{G}$ (d) $GK = 4\pi^2$

17. Find the number of photon emitted per second by a 25 watt source of monochromatic light of wavelength 6600 Å. What is the photoelectric current assuming 3% efficiency for photoelectric effect ?

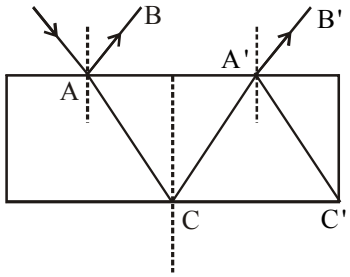
(a) $\frac{25}{3} \times 10^{19}\,\text{J}, 0.4\,\text{amp}$

(b) $\frac{25}{4} \times 10^{19}\,\text{J}, 6.2\,\text{amp}$

(c) $\frac{25}{2} \times 10^{19}\,\text{J}, 0.8\,\text{amp}$

(d) None of these

18. A ray of light of intensity I is incident on a parallel glass slab at point A as shown in diagram. It undergoes partial reflection and refraction. At each reflection, 25% of incident energy is reflected. The rays AB and A'B' undergo interference. The ratio of I_{max} and I_{min} is :



(a) 49 : 1 (b) 7 : 1 (c) 4 : 1 (d) 8 : 1

19. A capillary tube of radius r is immersed vertically in a liquid such that liquid rises in it to height h (less than the length of the tube). Mass of liquid in the capillary tube is m. If radius of the capillary tube is increased by 50%, then mass of liquid that will rise in the tube, is

(a) $\frac{2}{3}$m (b) m (c) $\frac{3}{2}$m (d) $\frac{9}{4}$m

20. The drift velocity of electrons in silver wire with cross-sectional area 3.14×10^{-6} m^2 carrying a current of 20 A is. Given atomic weight of Ag = 108, density of silver $= 10.5 \times 10^3$ kg/m^3.

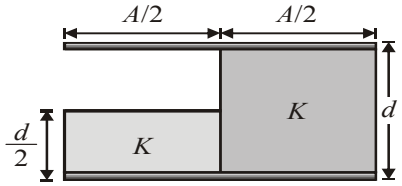
(a) 2.798×10^{-4} m/sec.

(b) 67.98×10^{-4} m/sec.

(c) 0.67×10^{-4} m/sec.

(d) 6.798×10^{-4} m/sec.

21. A parallel plate capacitor of area 'A' plate separation 'd' is filled with two dielectrics as shown. What is the capacitance of the arrangement ?



(a) $\frac{3K\varepsilon_0 A}{4d}$ (b) $\frac{4K\varepsilon_0 A}{3d}$

(c) $\frac{(K+1)\varepsilon_0 A}{2d}$ (d) $\frac{K(K+3)\varepsilon_0 A}{2(K+1)d}$

22. In the Young's double-slit experiment, the intensity of light at a point on the screen where the path difference is λ is K, (λ being the wave length of light used). The intensity at a point where the path difference is λ/4, will be :

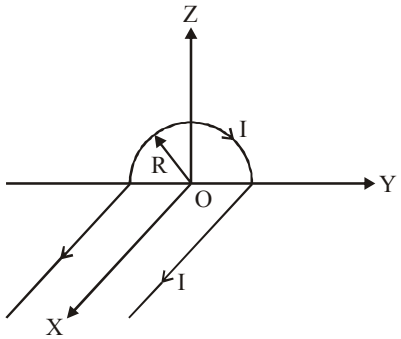
(a) K (b) K/4 (c) K/2 (d) Zero

23. The mass of $_7N^{15}$ is 15.00011 amu, mass of $_8O^{16}$ is 15.99492 amu and $m_P = 1.00783$ amu. Determine binding energy of last proton of $_8O^{16}$.

(a) 2.13 MeV (b) 0.13 MeV

(c) 10 MeV (d) 12.13 MeV

24. A wire carrying current I has the shape as shown in adjoining figure. Linear parts of the wire are very long and parallel to X-axis while semicircular portion of radius R is lying in Y-Z plane. Magnetic field at point O is :



(a) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\mu\hat{i} \times 2\hat{k}\right)$

(b) $\vec{B} = -\frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

(c) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} - 2\hat{k}\right)$

(d) $\vec{B} = \frac{\mu_0}{4\pi}\frac{I}{R}\left(\pi\hat{i} + 2\hat{k}\right)$

25. A stone projected with a velocity u at an angle θ with the horizontal reaches maximum height H_1. When it is projected with velocity u at an angle $\left(\frac{\pi}{2} - \theta\right)$ with the horizontal, it reaches maximum height H_2. The relation between the horizontal range R of the projectile, heights H_1 and H_2 is

(a) $R = 4\sqrt{H_1 H_2}$ (b) $R = 4(H_1 - H_2)$

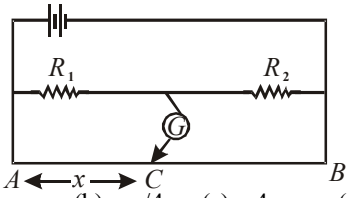
(c) $R = 4(H_1 + H_2)$ (d) $R = \frac{H_1^2}{H_2^2}$

26. If the series limit wavelength of Lyman series for the hydrogen atom is 912 Å, then the series limit wavelength for Balmer series of hydrogen atoms is

(a) 912 Å (b) 912×2 Å

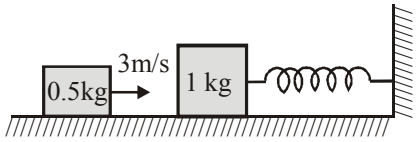
(c) 912×4 Å (d) $\frac{912}{2}$ Å

27. In the shown arrangement of the experiment of the meter bridge if *AC* corresponding to null deflection of galvanometer is x, what would be its value if the radius of the wire AB is doubled?



(a) x (b) $x/4$ (c) $4x$ (d) $2x$

28. A 1 kg mass is attached to a spring of force constant 600 N/m and rests on a smooth horizontal surface with other end of the spring tied to wall as shown in figure. A second mass of 0.5 kg slides along the surface towards the first at 3m/s. If the masses make a perfectly inelastic collision, then find amplitude and time period of oscillation of combined mass.



(a) 5cm, $\frac{\pi}{10}$s (b) 5cm, $\frac{\pi}{5}$s

(c) 4cm, $\frac{2\pi}{5}$s (d) 4cm, $\frac{\pi}{3}$s

29. The frequency of vibration of string is given by

$$v = \frac{p}{2l}\left[\frac{F}{m}\right]^{1/2}$$

Here p is number of segments in the string and *l* is the length. The dimensional formula for m will be

(a) $[M^0LT^{-1}]$ (b) $[ML^0T^{-1}]$

(c) $[ML^{-1}T^0]$ (d) $[M^0L^0T^0]$

30. For the angle of minimum deviation of a prism to be equal to its refracting angle, the prism must be made of a material whose refractive index :

(a) lies between $\sqrt{2}$ and 1

(b) lies between 2 and $\sqrt{2}$

(c) is less than 1

(d) is greater than 2

31. Consider elastic collision of a particle of mass m moving with a velocity u with another particle of the same mass at rest. After the collision the projectile and the struck particle move in directions making angles θ_1 and θ_2 respectively with the initial direction of motion. The sum of the angles $\theta_1 + \theta_2$, is :

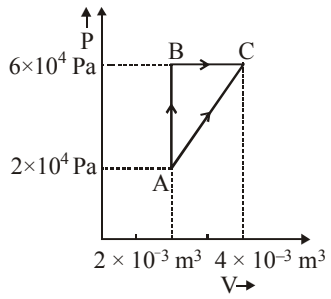
(a) 45° (b) 90° (c) 135° (d) 180°

32. A conducting circular loop is placed in a uniform magnetic field of 0.04 T with its plane perpendicular to the magnetic field. The radius of the loop starts shrinking at 2 mm/s. The induced emf in the loop when the radius is 2 cm is

(a) $4.8\pi\mu$V (b) $0.8\pi\mu$V

(c) $1.6\pi\mu$V (d) $3.2\pi\mu$V

33. Figure below shows two paths that may be taken by a gas to go from a state A to a state (c)



In process AB, 400 J of heat is added to the system and in process BC, 100 J of heat is added to the system. The heat absorbed by the system in the process AC will be

(a) 500 J (b) 460 J (c) 300 J (d) 380 J

34. Two resistances at 0° C with temperature coefficient of resistance α_1 and α_2 joined in series act as a single resistance in a circuit. The temperature coefficient of their single resistance will be

(a) $\alpha_1 + \alpha_2$ (b) $\frac{\alpha_1\alpha_2}{\alpha_1+\alpha_2}$

(c) $\frac{\alpha_1-\alpha_2}{2}$ (d) $\frac{\alpha_1+\alpha_2}{2}$

35. Two identical charged spheres suspended from a common point by two massless strings of lengths l, are initially at a distance d (d << 1) apart because of their mutual repulsion. The charges begin to leak from both the spheres at a constant rate. As a result, the spheres approach each other with a velocity v. Then v varies as a function of the distance x between the spheres, as :

(a) $v \propto x^{\frac{1}{2}}$ (b) $v \propto x$

(c) $v \propto x^{-\frac{1}{2}}$ (d) $v \propto x^{-1}$

36. A point particle of mass 0.1 kg is executing S.H.M. of amplitude of 0.1 m. When the particle passes through the mean position, its kinetic energy is 8×10^{-3} Joule. Obtain the equation of motion of this particle if this initial phase of oscillation is 45°.

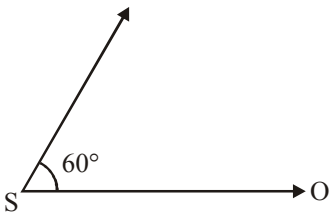
(a) $y = 0.1\sin\left(\pm 4t + \frac{\pi}{4}\right)$

(b) $y = 0.2\sin\left(\pm 4t + \frac{\pi}{4}\right)$

(c) $y = 0.1\sin\left(\pm 2t + \frac{\pi}{4}\right)$

(d) $y = 0.2\sin\left(\pm 2t + \frac{\pi}{4}\right)$

37. A source of sound S emitting waves of frequency 100 Hz and an observor O are located at some distance from each other. The source is moving with a speed of 19.4 ms^{-1} at an angle of 60° with the source observer line as shown in the figure. The observor is at rest. The apparent frequency observed by the observer is (velocity of sound in air 330 ms^{-1})



(a) 103 Hz (b) 106 Hz
(c) 97 Hz (d) 100 Hz

38. A resistor of resistance *R*, capacitor of capacitance *C* and inductor of inductance *L* are connected in parallel to AC power source of voltage $\varepsilon_0 \sin \omega t$. The maximum current through the resistance is half of the maximum current through the power source. Then value of R is

(a) $\frac{\sqrt{3}}{\left|\omega C - \frac{1}{\omega L}\right|}$ (b) $\sqrt{3}\left|\frac{1}{\omega C} - \omega L\right|$

(c) $\sqrt{5}\left|\frac{1}{\omega C} - \omega L\right|$ (d) None of these

39. A lens having focal length *f* and aperture of diameter *d* forms an image of intensity *I*. Aperture of diameter $\frac{d}{2}$ in central region of lens is covered by a black paper. Focal length of lens and intensity of image now will be respectively:

(a) *f* and $\frac{I}{4}$ (b) $\frac{3f}{4}$ and $\frac{I}{2}$

(c) *f* and $\frac{3I}{4}$ (d) $\frac{f}{2}$ and $\frac{I}{2}$

40. A circular disc of radius R and thickness $\frac{R}{6}$ has moment inertia I about an axis passing through its centre perpendicular to its plane. It is melted and recasted into a solid sphere. The moment of inertia of the sphere about its diameter is

(a) *I* (b) $\frac{2I}{8}$ (c) $\frac{I}{5}$ (d) $\frac{I}{10}$

CHEMISTRY

41. In PO_4^{3-}, the formal charge on each oxygen atom and the P - O bond order respectively are

(a) –0.75, 0.6 (b) –0.75, 1.0
(c) –0.75, 1.25 (d) –3, 1.25

42. The decreasing order of the ionization potential of the following elements is
(a) Ne > Cl > P > S > Al > Mg
(b) Ne > Cl > P > S > Mg > Al
(c) Ne > Cl > S > P > Mg > Al
(d) Ne > Cl > S > P > Al > Mg

43. Knowing that the chemistry of lanthanoids(Ln) is dominated by its + 3 oxidation state, which of the following statements is incorrect?
(a) The ionic size of Ln (III) decrease in general with increasing atomic number
(b) Ln (III) compounds are generally colourless.
(c) Ln (III) hydroxide are mainly basic in character.
(d) Because of the large size of the Ln (III) ions the bonding in its compounds is predominantly ionic in character.

44. Which of the following arrangements does not represent the correct order of the property stated against it ?
(a) $V^{2+} < Cr^{2+} < Mn^{2+} < Fe^{2+}$:paramagnetic behaviour
(b) $Ni^{2+} < Co^{2+} < Fe^{2+} < Mn^{2+}$: ionic size
(c) $Co^{3+} < Fe^{3+} < Cr^{3+} < Sc^{3+}$: stability in aqueous solution
(d) Sc < Ti < Cr < Mn : number of oxidation states

45. Which of the following is paramagnetic ?
(a) $[Fe(CN)_6]^{4-}$ (b) $[Ni(CO)_4]$
(c) $[Ni(CN)_4]^{2-}$ (d) $[CoF_6]^{3-}$

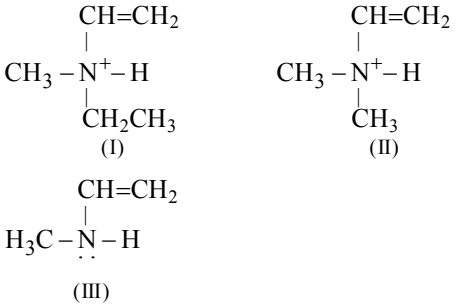
46. The hypothetical complex chloro-diaquatriamminecobalt (III) chloride can be represented as
(a) $[CoCl(NH_3)_3(H_2O)_2]Cl_2$
(b) $[Co(NH_3)_3(H_2O)Cl_3]$
(c) $[Co(NH_3)_3(H_2O)_2Cl]$
(d) $[Co(NH_3)_3(H_2O)_3]Cl_3$

47. The normality of 26% (wt/vol) solution of ammonia (density = 0.855) is approximately :
(a) 1.5 (b) 0.4 (c) 15.3 (d) 4

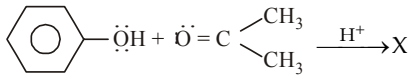
48. 1.25 g of a sample of Na_2CO_3 and Na_2SO_4 is dissolved in 250 ml solution. 25 ml of this solution neutralises 20 ml of 0.1N H_2SO_4. The % of Na_2CO_3 in this sample is
(a) 84.8% (b) 8.48% (c) 15.2% (d) 42.4%

49. Which of the following compound has all the four types (1°, 2°, 3° and 4°) of carbon atoms?
(a) 2, 3, 4-Trimethylpentane
(b) *neo*-Pentane
(c) 2, 2, 4-Trimethylpentane
(d) None of the three

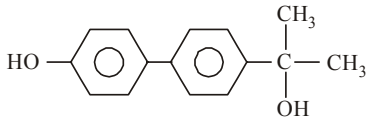
50. Which of the following has two stereoisomers?

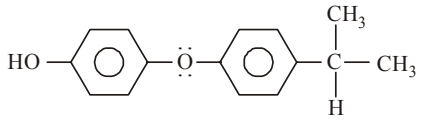


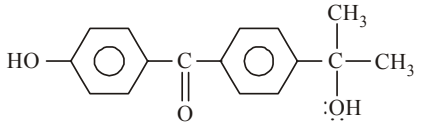
(a) None of these (b) Only I
(c) Only III (d) I and III

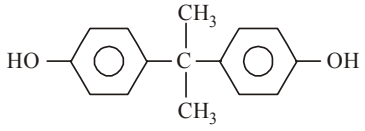
51. 

[X] is

(a) 

(b) 

(c) 

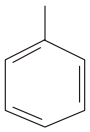
(d) 

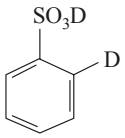
52. $CH_3C \equiv CCH_3 \xrightarrow{H_2/Pt} A \xrightarrow{D_2/Pt} B$
The compounds A and B, respectively are
(a) *cis*-butene-2 and *rac*-2, 3-dideuterobutane
(b) *trans*-butene-2 and *rac*-2, 3-dideuterobutane
(c) *cis*-butene-2 and *meso*-2, 3-dideuterobutane
(d) *trans*-butene-2 and *meso*-2, 3-dideuterobutane

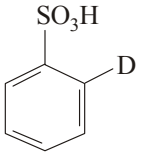
53. Give the possible structure of X in the following reaction :

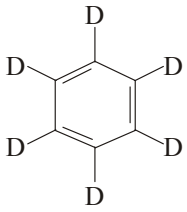
$$C_6H_6 + D_2SO_4 \xrightarrow{D_2O} X$$

S O_3D

(a) 

(b) 

(c) 

(d) 

54. An aromatic compound has molecular formula C_7H_7Br. Give the possible isomers and the appropriate method to distinguish them.
(a) 3 isomers; by heating with $AgNO_3$ solution
(b) 4 isomers; by treating with $AgNO_3$ solution
(c) 4 isomers; by oxidation
(d) 5 isomers; by oxidation

55. Which of the following method gives better yield of *p*-nitrophenol?
(a) Phenol $\xrightarrow[20°C]{\text{dil.}HNO_3}$ *p*-Nitrophenol
(b) Phenol $\xrightarrow[(ii)\ HNO_3]{(i)\ NaNO_2 + H_2SO_4, 7-8°C}$ *p*-Nitrophenol
(c) Phenol $\xrightarrow[(ii)\ \text{Conc. } HNO_3]{(i)\ NaOH}$
(d) None of the three.

56. Formation of polyethylene from calcium carbide takes place as follows

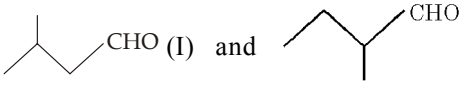
$$CaC_2 + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2$$

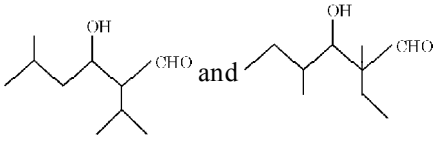
$$C_2H_2 + H_2 \longrightarrow C_2H_4$$

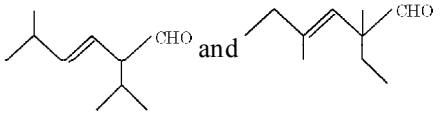
$$nC_2H_4 \longrightarrow (-CH_2 - CH_2-)_n$$

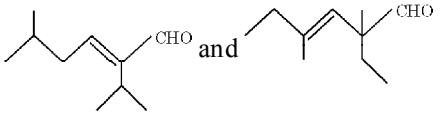
The amount of polyethylene obtained from 64.1 kg of CaC_2 is
(a) 7 kg (b) 14 kg (c) 21 kg (d) 28 kg

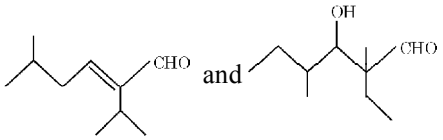
57. The most likely acid-catalysed aldol condensation products of each of the two aldehydes I and II will respectively be



(a) 

(b) 

(c) 

(d) 

58. Sometimes, the colour observed in Lassaigne's test for nitrogen is green. It is because
(a) of green colour of ferrous sulphate
(b) ferric ferrocyanide is also green
(c) of green colour of copper sulphate
(d) of excess of Fe^{3+} ions whose yellow colour makes the blue colour of ferric ferrocyanide to appear green.

59. Fructose on reduction gives a mixture of two alcohols which are related as
(a) diastereomers (b) epimers
(c) both (a) and (b) (d) anomers.

60. What will happen when D-(+)-glucose is treated with methanolic —HCl followed by Tollens' reagent ?
(a) A black ppt. will be formed
(b) A red ppt. will be formed
(c) A green colour will appear
(d) No characteristic colour or ppt. will be formed.

61. Which of the followings forms the base of talcum powder?
(a) Zine stearate
(b) Sodium aluminium silicate
(c) Magnesium hydrosilicate
(d) Chalk

62. The important antioxidant used in food is
(a) BHT (b) BHC
(c) BTX (d) All the three

63. The first emission line in the atomic spectrum of hydrogen in the Balmer series appears at
(a) $\frac{9R}{400}\text{cm}^{-1}$ (b) $\frac{7R}{144}\text{cm}^{-1}$
(c) $\frac{3R}{4}\text{cm}^{-1}$ (d) $\frac{5R}{36}\text{cm}^{-1}$

64. An e^- has magnetic quantum number as –3, what is its principal quantum number?
(a) 1 (b) 2 (c) 3 (d) 4

65. At what temperature, the rate of effusion of N_2 would be 1.625 times than that of SO_2 at 50^oC ?
(a) 110 K (b) 173 K (c) 373 K (d) 273 K

66. The average kinetic energy of an ideal gas per molecule in SI unit at 25° C will be
(a) 6.17×10^{-21} kJ (b) 6.17×10^{-21} J
(c) 6.17×10^{-20} J (d) 7.16×10^{-20} J

67. The degree of dissociation of $PCl_5(\alpha)$ obeying the equilibrium $PCl_5 \rightleftharpoons PCl_3 + Cl_2$ is related to the equilibrium pressure by
(a) $\alpha \propto \frac{1}{P^4}$ (b) $\alpha \propto \frac{1}{\sqrt{P}}$
(c) $\alpha \propto \frac{1}{P^2}$ (d) $\alpha \propto P$

68. In a closed system, $A(s) \rightleftharpoons 2B(g) + 3C(g)$, if partial pressure of C is doubled, then partial pressure of B will be
(a) $2\sqrt{2}$ times the original value
(b) $\frac{1}{2}$ times the original value
(c) 2 times the original value
(d) $\frac{1}{2\sqrt{2}}$ times the original value

69. For a particular reversible reaction at temperature T, ΔH and ΔS were found to be both +ve. If T_e is the temperature at equilibrium, the reaction would be spontaneous when
(a) $T_e > T$ (b) $T > T_e$
(c) T_e is 5 times T (d) $T = T_e$

70. Given

Reaction	**Energy Change (in kJ)**
$Li(s) \rightarrow Li(g)$	161
$Li(g) \rightarrow Li^+(g)$	520
$\frac{1}{2}F_2(g) \rightarrow F(g)$	77
$F(g) + e^- \rightarrow F^-(g)$	(Electron gain enthalpy)
$Li^+(g) + F^-(g) \rightarrow LiF(s)$	–1047
$Li(s) + \frac{1}{2}F_2(g) \rightarrow LiF(s)$	–617

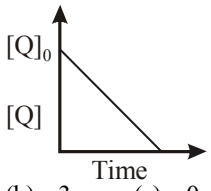
Based on data provided, the value of electron gain enthalpy of fluorine would be :
(a) -300 kJ mol^{-1} (b) -350 kJ mol^{-1}
(c) -328 kJ mol^{-1} (d) -228 kJ mol^{-1}

71. The percentage hydrolysis of 0.15 M solution of ammonium acetate, K_a for CH_3COOH is 1.8×10^{-5} and K_b for NH_3 is 1.8×10^{-5}
(a) 0.556 (b) 4.72 (c) 9.38 (d) 5.56

72. For a sparingly soluble salt A_pB_q, the relationship of its solubility product Ls $\rightarrow K_{sp}$ with its solubility (S) is
(a) Ls $\rightarrow K_{sp} = S^{pq}(pq)^{p+q}$
(b) Ls $= S^{p+q} \cdot p^p q^q$
(c) Ls $\rightarrow K_{sp} = S^{p+q} \cdot p^q q^p$
(d) Ls $\rightarrow K_{sp} = S^{pq} p^p q^q$

73. Consider the reaction :
$Cl_2(aq) + H_2S(aq) \rightarrow$
$S(s) + 2H^+(aq) + 2Cl^-(aq)$
The rate equation for this reaction is
rate $= k[Cl_2][H_2S]$
Which of these mechanisms is/are consistent with this rate equation?
A. $Cl_2 + H_2S \rightarrow H^+ + Cl^- + Cl^+ + HS^-$ (slow)
$Cl^+ + HS^- \rightarrow H^+ + Cl^- + S$ (fast)
B. $H_2S \rightleftharpoons H^+ + HS^-$ (fast equilibrium)
$Cl_2 + HS^- \rightarrow 2Cl^- + H^+ + S$ (Slow)
(a) B only (b) Both A and B
(c) Neither A nor B (d) A only

74. In the reaction,
$P + Q \longrightarrow ?R + S$
The time taken for 75% reaction of P is twice the time taken for 50% reaction of P. The concentration of Q varies with reaction time as shown in the figure. The overall order of the reaction is



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

75. The EMF of the cell Tl/Tl^+ (0.001M) || Cu^{2+} (0.01M) /Cu is 0.83. The cell EMF can be increased by
(a) Increasing the concentration of Tl^+ ions.
(b) Increasing the concentration of Cu^{2+} ions.
(c) Increasing the concentration of Tl^+ and Cu^{2+} ions.
(d) None of these

76. Electrolysis is carried out in three cells
(A) 1.0 M $CuSO_4$ Pt electrode
(B) 1.0 M $CuSO_4$ copper electrodes
(C) 1.0 M KCl Pt electrodes
If volume of electrolytic solution is maintained constant in each of the cell, which is correct set of pH changes in (A), (B) and (C) cell respectively?
(a) decrease in all the three
(b) increase in all the three
(c) decrease, constant, increase
(d) increase, constant, increase

77. The equilibrium constant for the disproportionation reaction
$2Cu^+(aq) \longrightarrow Cu(s) + Cu^{2+}(ag)$ at 25°C
$(E^oCu^+/Cu = 0.52V,\ E^oCu^{2+}/Cu = 0.16V)$ is
(a) 6×10^4 (d) 6×10^6
(c) 1.2×10^6 (d) 1.2×10^{-6}

78. The non stoichiometric compound $Fe_{0.94}O$ is formed when x % of Fe^{2+} ions are replaced by as many $\frac{2}{3}Fe^{3+}$ ions, x is
(a) 18 (b) 12 (c) 15 (d) 6

79. Al (at. wt 27) crystallizes in the cubic system with a cell edge of 4.05 Å. Its density is 2.7 g per cm^3. Determine the unit cell type calculate the radius of the Al atom
(a) fcc, 2.432 Å (b) bcc, 2.432 Å
(c) bcc, 1.432 Å (d) fcc, 1.432 Å

80. A compound of Xe and F is found to have 53.5% of Xe. What is oxidation number of Xe in this compound ?
(a) –4 (b) 0 (c) +4 (d) +6

ENGLISH PROFICIENCY

DIRECTIONS (Qs. 81 & 82) : Choose the word which best expresses the meaning of the given word.

81. CORPULENT
(a) Lean (b) Gaunt
(c) Emaciated (d) Obese

82. EMBEZZLE
(a) Misappropriate (b) Balance
(c) Remunerate (d) Clear

DIRECTIONS (Qs. 83 & 84) : Choose the word which is the exact OPPOSITE of the given words.

83. ARROGANT
(a) Humble (b) Cowardly
(c) Egotistic (d) Gentlemanly

84. EXODUS
(a) Influx (b) Home-coming
(c) Return (d) Restoration

DIRECTIONS (Qs. 85-88) : Read the following passage and answer the questions that follows.

At this stage of civilisation, when many nations are brought in to close and vital contact for good and evil, it is essential, as never before, that their gross ignorance of one another should be diminished, that they should begin to understand a little of one another's historical experience and resulting mentality. It is the fault of the English to expect the people of other countries to react as they do, to political and international situations. Our genuine goodwill and good intentions are often brought to nothing, because we expect other people to be like us. This would be corrected if we knew the history, not necessarily in detail but in broad outlines, of the social and political conditions which have given to each nation its present character.

85. According to the author of 'Mentality' of a nation is mainly product of its
(a) History
(b) international position
(c) Politics
(d) present character

86. The need for a greater understanding between nations
(a) was always there
(b) is no longer there
(c) is more today than ever before
(d) will always be there

87. The character of a nation is the result of its
(a) Mentality
(b) cultural heritage
(c) gross ignorance
(d) socio-political conditions

88. According to the author his countrymen should
(a) read the story of other nations
(b) have a better understanding of other nations
(c) not react to other actions
(d) have vital contacts with other nations

DIRECTIONS (Qs. 89-90) : In questions below, each passage consist of six sentences. The first and sixth sentence are given in the begining. The middle four sentences in each have been removed and jumbled up. These are labelled as P, Q, R and S. Find out the proper order for the four sentences.

89. S1 : A force of exists between everybody in the universe.
P : Normally it is very small but when the one of the bodies is a planet, like earth, the force is considerable.

Q: It has been investigated by many scientists including Galileo and Newton.
R: Everything on or near the surface of the earth is attracted by the mass of earth.
S: This gravitational force depends on the mass of the bodies involved.
S6: The greater the mass, the greater is the earth's force of attraction on it. We can call this force of attraction gravity.
The Proper sequence should be:
(a) PRQS (b) PRSQ
(c) QSRP (d) QSPR

90. S1: Calcutta unlike other cities kepts its trams.
P: As a result there horrendous congestion.
Q: It was going to be the first in South Asia.
R: They run down the centre of the road
S: To ease in the city decided to build an underground railway line.
S6: The foundation stone was laid in 1972.
The Proper sequence should be:
(a) PRSQ (b) PSQR
(c) SQRP (d) RPSQ

DIRECTIONS (Qs. 91-92) : Pick out the most effective word from the given words to fill in the blank to make the sentence meaningfully complete.

91. The miser gazed ..... at the pile of gold coins in front of him.
(a) Avidly (b) Admiringly
(c) Thoughtfully (d) Earnestly

92. I saw a ..... of cows in the field.
(a) Group (b) Herd
(c) Swarm (d) Flock

DIRECTIONS (93-95) : Read the each sentence to find out whether there is any grammatical error in it. The error, if any will be in one part of the sentence. The letter of that part is the answer. If there is no error, the answer is 'd'. (Ignore the errors of punctuation, if any).

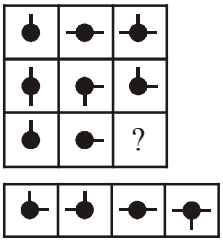
93. (a) We discussed about the problem so thoroughly
(b) on the eve of the examination
(c) that I found it very easy to work it out.
(d) No error.

94. (a) An Indian ship
(b) laden with merchandise
(c) got drowned in the Pacific Ocean.
(d) No error.

95. (a) I could not put up in a hotel
(b) because the boarding and lodging charges
(c) were exorbitant.
(d) No error.

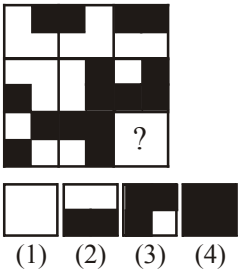
LOGICAL REASONING

96. Select a suitable figure from the four alternatives that would complete the figure matrix.



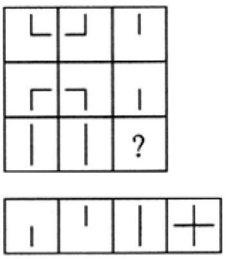
(1) (2) (3) (4)
(a) 1 (b) 2 (c) 3 (d) 4

97. Select a suitable figure from the four alternatives that would complete the figure matrix.



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

98. Select a suitable figure from the four alternatives that would complete the figure matrix.



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

DIRECTION (Q. 99) : Choose the correct alternative that will continue the same pattern and replace the question mark in the given series.

99. 3, 4, 7, 7, 13, 13, 21, 22, 31, 34, ?
(a) 42 (b) 43 (c) 51 (d) 52

100. Introducing a boy, a girl said, "He is the son of the daughter of the father of my uncle." How is the boy related to the girl?
(a) Brother (b) Nephew
(c) Uncle (d) Son-in-law

DIRECTIONS (Qs. 101-102) : In these series, you will be looking at both the letter pattern and the number pattern. Fill the blank in the middle of the series or end of the series.

101. QAR, RAS, SAT, TAU, _____
(a) UAV (b) UAT (c) TAS (d) TAT

102. DEF, DEF_2, $DE2F_2$, _____, $D_2E_2F_3$
(a) DEF_3 (b) D_3EF_3
(c) D_2E_3F (d) $D_2E_2F_2$

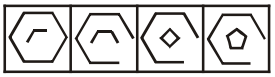
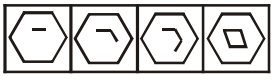
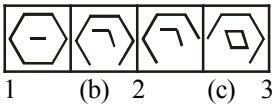
DIRECTIONS (Qs. 103-104) : In each question below are given two statements followed by two conclusions numbered I and II. You have to take the given two statements to be true even if they seem to be at variance from commonly known facts. Read the conclusion and then decide which of the given conclusions logically follows from the two given statements, disregarding commonly known facts.

Give answer:
(a) If only conclusion I follows
(b) If only conclusion II follows
(c) If neither I nor II follows and
(d) If both I and II follow.

103. Statements : Raman is always successful. No fool is always successful.
Conclusions :
I. Raman is a fool.
II. Raman is not a fool.

104. Statements : Some desks are caps. No cap is red.
Conclusions :
I. Some caps are desks.
II. No desk is red.

105. Choose the set of figures which follows the given rule.
Rule : Closed figures losing their sides and open figures gaining their sides.

(1) 
(2) 
(3) 
(4) 

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

MATHEMATICS

106. Let $f(x) = \frac{ax+b}{cx+d}$, then $f\circ f(x) = x$, provided that :
(a) $d = -a$ (b) $d = a$
(c) $a = b = 1$ (d) $a = b = c = d = 1$

107. Two finite sets have *m* and *n* elements. The number of subsets of the first set is 112 more than that of the second set. The values of *m* and *n* respectively are,
(a) 4, 7 (b) 7, 4 (c) 4, 4 (d) 7, 7

108. If A and B are positive acute angles satisfying $3\cos^2 A + 2\cos^2 B = 4$ and $\frac{3\sin A}{\sin B} = \frac{2\cos B}{\cos A}$, Then the value of $A + 2B$ is equal to :
(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{2}$ (c) $\frac{\pi}{3}$ (d) $\frac{\pi}{4}$

109. If $\sin\theta_1 + \sin\theta_2 + \sin\theta_3 = 3$, then $\cos\theta_1 + \cos\theta_2 + \cos\theta^3 =$
(a) 0 (b) 1 (c) 2 (d) 3

110. If $\tan(\cot x) = \cot(\tan x)$, then $\sin 2x$ is equal to :
(a) $\frac{2}{(2n+1)\pi}$ (b) $\frac{4}{(2n+1)\pi}$
(c) $\frac{2}{n(n+1)\pi}$ (d) $\frac{4}{n(n+1)\pi}$

111. The general solution of the equation $\sin 2x + 2\sin x + 2\cos x + 1 = 0$ is
(a) $3n\pi - \frac{\pi}{4}$
(b) $2n\pi + \frac{\pi}{4}$
(c) $2n\pi + (-1)^n \sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$
(d) $n\pi - \frac{\pi}{4}$

112. In a ΔABC, if $\frac{\cos A}{a} = \frac{\cos B}{b} = \frac{\cos C}{c}$, and the side $a = 2$, then area of the triangle is
(a) 1 (b) 2 (c) $\frac{\sqrt{3}}{2}$ (d) $\sqrt{3}$

113. If $\sin^{-1}\left(\frac{2a}{1+a^2}\right) - \cos^{-1}\left(\frac{1-b^2}{1+b^2}\right) = \tan^{-1}\left(\frac{2x}{1-x^2}\right)$, then what is the value of *x*?
(a) a / b (b) ab
(c) b / a (d) $\frac{a-b}{1+ab}$

114. The arithmetic mean of numbers a, b, c, d, e is M. What is the value of $(a-M)+(b-M)+(c-M)+(d-M)+(e-M)$?

(a) M (b) $a+b+c+d+e$

(c) 0 (d) 5 M

115. The fourth term of an A.P. is three times of the first term and the seventh term exceeds the twice of the third term by one, then the common difference of the progression is

(a) 2 (b) 3 (c) $\frac{3}{2}$ (d) –1

116. The sum to n terms of the series

$\frac{1}{2}+\frac{3}{4}+\frac{7}{8}+\frac{15}{16}+\ldots\ldots\ldots\ldots$ is

(a) $n-1-2^{-n}$ (b) 1

(c) $n-1+2^{-n}$ (d) $1+2^{-n}$

117. If log a, log b, and log c are in A.P. and also log a – log 2b, log 2b – log 3c, log 3c – log a are in A.P., then

(a) a, b, c, are in H.P.

(b) a, 2b, 3c are in A.P.

(c) a, b, c are the sides of a triangle

(d) none of the above

118. $\left(x+\frac{1}{x}\right)^2+\left(x^2+\frac{1}{x^2}\right)^2+\left(x^3+\frac{1}{x^3}\right)^2$ ....upto n terms is

(a) $\frac{x^{2n}-1}{x^2-1}\times\frac{x^{2n+2}+1}{x^{2n}}+2n$

(b) $\frac{x^{2n}+1}{x^2+1}\times\frac{x^{2n+2}-1}{x^{2n}}-2n$

(c) $\frac{x^{2n}-1}{x^2-1}\times\frac{x^{2n}-1}{x^{2n}}-2n$

(d) None of these

119. If $z_1=\sqrt{3}+i\sqrt{3}$ and $z_2=\sqrt{3}+i$, then the complex number $\left(\frac{z_1}{z_2}\right)^{50}$ lies in the :

(a) first quadrant (b) second quadrant

(c) third quadrant (d) fourth quadrant

120. If the matrix $\begin{bmatrix}1 & 3 & \lambda+2\\ 2 & 4 & 8\\ 3 & 5 & 10\end{bmatrix}$ is singular, then λ =

(a) –2 (b) 4 (c) 2 (d) –4

121. Let α_1, α_2 and β_1, β_2 be the roots of $ax^2+bx+c=0$ and $px^2+qx+r=0$ respectively. If the system of equations $\alpha_1 y+\alpha_2 z=0$ and $\beta_1 y+\beta_2 z=0$ has a non-trivial solution, then

(a) $\frac{b^2}{q^2}=\frac{ac}{pr}$ (b) $\frac{c^2}{r^2}=\frac{ab}{pq}$

(c) $\frac{a^2}{p^2}=\frac{bc}{qr}$ (d) None of these

122. If [ ] denotes the greatest integer less than or equal to the real number under consideration and $-1\le x<0; 0\le y<1; 1\le z<2$, then the value of the determinant

$\begin{vmatrix}[x]+1 & [y] & [z]\\ [x] & [y]+1 & [z]\\ [x] & [y] & [z]+1\end{vmatrix}$ is

(a) [z] (b) [y]

(c) [x] (d) None of these

123. If α, β are the roots of the equations $x^2-2x-1=0$, then what is the value of $\alpha^2\beta^{-2}+\alpha^{-2}\beta^2$

(a) –2 (b) 0 (c) 30 (d) 34

124. If *a*, *b* and *c* are real numbers then the roots of the equation $(x-a)(x-b)+(x-b)(x-c)+(x-c)(x-a)=0$ are always

(a) real (b) imaginary

(c) positive (d) negative

125. $\lim_{n\to\infty}\frac{a^n+b^n}{a^n-b^n}$, where $a>b>1$, is equal to

(a) –1 (b) 1 (c) 0 (d) None

126. The number of points at which the function $f(x)=\frac{1}{\log|x|}$ is discontinuous is :

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

127. If $f(x)=\begin{cases}\frac{x\log\cos x}{\log(1+x^2)} & ,x\neq 0\\ 0 & ,x=0\end{cases}$ then f(x) is

(a) continuous as well as differentiable at x = 0

(b) continuous but not differentiable at x = 0

(c) differentiable but not continuous at x = 0

(d) neither continuous nor differentiable at x = 0

128. For any differentiable function y of x,

$$\frac{d^2x}{dy^2}\left(\frac{dy}{dx}\right)^3 + \frac{d^2y}{dx^2} =$$

(a) 0 (b) y (c) $-y$ (d) x

129. The set of all values of a for which the function $f(x) = (a^2 - 3a + 2)(\cos^2 x/4 - \sin^2 x/4) + (a-1)x + \sin 1$ does not possess critical points is

(a) $[1, \infty)$ (b) $(0, 1) \cup (1, 4)$
(c) $(-2, 4)$ (d) $(1, 3) \cup (3, 5)$

130. Match List I with List II and select the correct answer using the code given below the lists:

List I	List II
(A) $f(x) = \cos x$	1. The graph cuts y-axis in infinite number of points
(B) $f(x) = \ln x$	2. The graph cuts x -axis in two points
(C) $f(x) = x^2 - 5x + 4$	3. The graph cuts y-axis in only one point
(D) $f(x) = e^x$	4. The graph cuts x-axis in only one point
	5. The graph cuts x-axis in infinite number of points

Codes:

	(A)	(B)	(C)	(D)
(a)	1	4	5	3
(b)	1	3	5	4
(c)	5	4	2	3
(d)	5	3	2	4

131. What is the x-coordinate of the point on the curve $f(x) = \sqrt{x}(7x - 6)$, where the tangent is parallel to x-axis?

(a) $-\frac{1}{3}$ (b) $\frac{2}{7}$ (c) $\frac{6}{7}$ (d) $\frac{1}{2}$

132. A wire 34 cm long is to be bent in the form of a quadrilateral of which each angle is 90°. What is the maximum area which can be enclosed inside the quadrilateral?

(a) 68 cm^2 (b) 70 cm^2
(c) 71.25 cm^2 (d) 72. 25 cm^2

133. Consider the following statements in respect of the function $f(x) = x^3 - 1, x \in [-1, 1]$

I. $f(x)$ is increasing in $[-1, 1]$
II. $f(x)$ has no root in $(-1, 1)$.

Which of the statements given above is/are correct?

(a) Only I (b) Only II
(c) Both I and II (d) Neither I nor II

134. At an extreme point of a function $f(x)$, the tangent to the curve is

(a) parallel to the x-axis
(b) perpendicular to the x-axis
(c) inclined at an angle 45° to the x-axis
(d) inclined at an angle 60° to the x-axis

135. The curve $y = xe^x$ has minimum value equal to

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

136. A ray of light coming from the point (1, 2) is reflected at a point A on the x-axis and then passes through the point (5, 3). The co-ordinates of the point A is

(a) $\left(\frac{13}{5}, 0\right)$ (b) $\left(\frac{5}{13}, 0\right)$
(c) $(-7, 0)$ (d) None of these

137. The equation

$x^2 - 2\sqrt{3}xy + 3y^2 - 3x + 3\sqrt{3}y - 4 = 0$ represents

(a) a pair of intersecting lines
(b) a pair of parallel lines with distance between them $\frac{5}{2}$
(c) a pair of parallel lines with distance between them $5\sqrt{2}$
(d) a conic section, which is not a pair of straight lines

138. The line joining (5, 0) to $((10\cos\theta, 10\sin\theta)$ is divided internally in the ratio 2 : 3 at P. If θ varies, then the locus of P is

(a) a pair of straight lines
(b) a circle
(c) a straight line
(d) None of these

139. The number of integral values of λ for which $x^2 + y^2 + \lambda x + (1 - \lambda)y + 5 = 0$ is the equation of a circle whose radius cannot exceed 5, is

(a) 14 (b) 18 (c) 16 (d) None

140. The lengths of the tangent drawn from any point on the circle $15x^2 + 15y^2 - 48x + 64y = 0$ to the two circles $5x^2 + 5y^2 - 24x + 32y + 75 = 0$ and $5x^2 + 5y^2 - 48x + 64y + 300 = 0$ are in the ratio of

(a) 1 : 2 (b) 2 : 3 (c) 3 : 4 (d) None

141. The length of the chord $x + y = 3$ intercepted by the circle $x^2 + y^2 - 2x - 2y - 2 = 0$ is

(a) $\frac{7}{2}$ (b) $\frac{3\sqrt{3}}{2}$ (c) $\sqrt{14}$ (d) $\frac{\sqrt{7}}{2}$

142. The locus of the point of intersection of two tangents to the parabola $y^2 = 4ax$, which are at right angle to one another is

(a) $x^2 + y^2 = a^2$ (b) $ay^2 = x$
(c) $x + a = 0$ (d) $x + y \pm a = 0$

143. The parabola having its focus at (3, 2) and directrix along the y-axis has its vertex at

(a) $(2, 2)$ (b) $\left(\frac{3}{2}, 2\right)$
(c) $\left(\frac{1}{2}, 2\right)$ (d) $\left(\frac{2}{3}, 2\right)$

144. The number of values of r satisfying the equation ${}^{39}C_{3r-1} - {}^{39}C_{r^2} = {}^{39}C_{r^2-1} - {}^{39}C_{3r}$ is

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

145. If $\sum_{r=0}^{n} \frac{r+2}{r+1} {}^{n}C_r = \frac{2^8 - 1}{6}$, then $n =$

(a) 8 (b) 4 (c) 6 (d) 5

146. All the words that can be formed using alphabets A, H, L, U and R are written as in a dictionary (no alphabet is repeated). Rank of the word RAHUL is

(a) 71 (b) 72 (c) 73 (d) 74

147. If the sum of odd numbered terms and the sum of even numbered terms in the expansion of $(x + a)^n$ are A and B respectively, then the value of $(x^2 - a^2)^n$ is

(a) $A^2 - B^2$ (b) $A^2 + B^2$
(c) 4AB (d) None

148. If the third term in the expansion of $[x + x^{\log_{10} x}]^5$ is 10^6, then x may be

(a) 1 (b) $\sqrt{10}$ (c) 10 (d) $10^{-2/5}$

149. If three vertices of a regular hexagon are chosen at random, then the chance that they form an equilateral triangle is :

(a) $\frac{1}{3}$ (b) $\frac{1}{5}$ (c) $\frac{1}{10}$ (d) $\frac{1}{2}$

150. A man takes a step forward with probability 0.4 and backward with probability 0.6. The probability that at the end of eleven steps he is one step away from the starting point is

(a) $\frac{2^5 . 3^5}{5^{10}}$ (b) $462 \times \left(\frac{6}{25}\right)^5$
(c) $231 \times \frac{3^5}{5^{10}}$ (d) none of these

Physics							
Question No	Answer Key	Question No	Answer Key	Question No	Answer Key	Question No	Answer Key
1	b	11	b	21	d	31	b
2	d	12	c	22	c	32	d
3	a	13	c	23	d	33	b
4	b	14	d	24	b	34	d
5	c	15	c	25	a	35	c
6	c	16	a	26	c	36	a
7	d	17	a	27	a	37	a
8	c	18	a	28	a	38	a
9	c	19	c	29	c	39	c
10	c	20	d	30	b	40	c

Chemistry							
Question No	Answer Key	Question No	Answer Key	Question No	Answer Key	Question No	Answer Key
41	c	51	d	61	c	71	a
42	b	52	c	62	a	72	b
43	b	53	d	63	d	73	d
44	a	54	c	64	d	74	d
45	d	55	b	65	c	75	b
46	a	56	d	66	b	76	c
47	c	57	d	67	b	77	c
48	a	58	d	68	d	78	a
49	c	59	c	69	b	79	d
50	b	60	d	70	c	80	d

English Proficiency & Logical Reasoning							
Question No	Answer Key	Question No	Answer Key	Question No	Answer Key		
81	d	91	a	101	a		
82	a	92	b	102	d		
83	a	93	a	103	b		
84	a	94	c	104	a		
85	a	95	a	105	c		
86	c	96	a				
87	d	97	d				
88	b	98	c				
89	d	99	b				
90	d	100	a				

Mathematics							
Question No	Answer Key	Question No	Answer Key	Question No	Answer Key		
106	a	121	a	136	a		
107	b	122	a	137	b		
108	b	123	d	138	b		
109	a	124	a	139	c		
110	b	125	b	140	a		
111	d	126	c	141	c		
112	d	127	a	142	c		
113	d	128	a	143	b		
114	c	129	b	144	b		
115	a	130	c	145	d		

116	c	131	b	146	d		
117	c	132	d	147	a		
118	a	133	a	148	c		
119	a	134	a	149	c		
120	b	135	a	150	b		