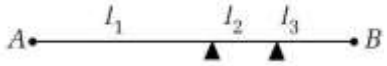
## Physics

1. **The moment of intertia of a solid cylinder of mass M, length 2R and radius R about an axis passing through the centre of mass and perpendicular to the axis of the cylinder is $I_1$ and about an axis passing through one end of the cylinder and perpendicular to the axis of the cylinder is $I_2$, then**
   (a) $I_2 < I_1$ (b) $I_2 - I_1 = MR^2$
   (c) $\frac{I_2}{I_1} = \frac{19}{12}$ (d) $\frac{I_2}{I_1} = \frac{7}{6}$
2. **A body mass of 1 kg , initially at rest explodes and breaks into three parts. The masses of the parts are in the ratio $1:1:3$. The two pieces of equal mass fly off perpendicular to each other with a speed of $30\ m/s$ each. The velocity of the heavier part in $m/s$ is**
   (a) $10\sqrt{2}$ (b) 6
   (c) 3 (d) $6\sqrt{2}$
3. **A particle of mass 4 kg is executing SHM. Its displacement is given by the equation $y = 8\cos[100t + \pi/4]$ cm. Its maximum kinetic energy is**
   (a) 128 J (b) 64 J
   (c) 16 J (d) 32 J
4. **Infinite number of spheres, each of mass m are placed on the X-axis at distances $1, 2, 4, 8, 16$ ... ... metres from origin. The magnitude of the gravitational field at the origin is**
   (a) $\frac{2}{3}$Gm (b) $\frac{4}{3}$Gm
   (c) Gm (d) 6 Gm
5. **When a force $F_1$ is applied on a metallic wire, the length of the wire is $L_1$. If a force $F_2$ is applied on the same wire, the length of the wire is $L_2$. The original length of the wire L is**
   (a) $\frac{L_1F_1+L_2F_2}{F_1+F_2}$ (b) $\frac{L_2-L_1}{F_1+F_2}$
   (c) $\frac{F_1L_2-F_2L_1}{F_1-F_2}$ (d) $\frac{F_1L_1-F_2L_2}{F_1-F_2}$
6. **1000 spherical drops of water each $10^{-8}$ m in diameter coalesce to form one large spherical drop. The amount of energy liberated in this process (in joule) is (surface tension of water is $0.075\ N/m$ ).**
   (a) $10.75\pi \times 10^{-15}$ (b) $6.75\pi \times 10^{-15}$
   (c) $8.65\pi \times 10^{-15}$ (d) $3.88\pi \times 10^{-15}$
7. **A thermos flask contains 250 g of coffee at $90^\circ C$. To this 20 g of milk at $5^\circ C$ is added. After equilibrium is established, the temperature of the liquid is (Assume no heat loss to the thermos bottle. Take specific heat of coffee and milk as $1.00 cal/g^\circ C$)**
   (a) $3.23^\circ C$ (b) $3.15^\circ C$
   (c) $83.7^\circ C$ (d) $37.8^\circ C$
8. **A copper rod of length 75 cm and an iron rod of length 125 cm are joined together end to end. Both are of circular cross-section with diameter 2 cm . The free ends of the copper and iron are maintained at $100^\circ C$ and $0^\circ C$ respectively. The surfaces of the bars are insulated thermally. The temperature of the copper-iron junction is [Thermal conductivity of copper is 386.4 W/m-K and thermal conductivity of iron is $48.46\ W/m-K$]**
   (a) $100^\circ C$ (b) $0^\circ C$
   (c) $93^\circ C$ (d) $50^\circ C$
9. **1 g of water at $100^\circ C$ is completely converted into steam at $100^\circ C$. 1 g of steam occupies a volume of 1650 cc . (Neglect the volume of 1 g of water at $100^\circ C$ ). At the pressure of $10^5\ N/m^2$, latent heat of steam is $540 cals/g$ ( 1 calorie $= 4.2$ joule). The increase in the internal energy (in joule) is**
   (a) 2310 (b) 2203
   (c) 1650 (d) 2150
10. **RMS velocity of oxygen molecules at NTP is $0.5\ km/s$. The RMS velocity for the hydrogen molecule at NTP is**
   (a) 4 km/s (b) 2 km/s
   (c) 3 km/s (d) 1 km/s
11. **A thin wire of length of 99 cm is fixed at both ends as shown in the figure. The wire is kept under a tension and is divided into three segments of lengths $l_1, l_2$ and $l_3$ as shown in figure. When the wire is made to vibrate, the segments vibrate respectively with their fundamental frequencies in the ratio $1:2:3$. Then, the lengths $l_1, l_2$ and $l_3$ of the segments respectively are (in cm )**




(a) 27,54,18 (b) 18,27,54
(c) 54,27,18 (d) 27,9,14

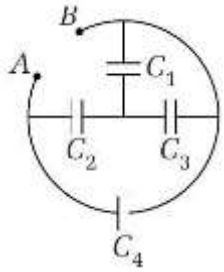
**12. Three thin lenses are combined by placing them in contact with each other to get more magnification in an optical instrument. Each lens has a focal length of 3 cm . If the least distance of distinct vision is taken as 25 cm , the total magnification of the lens combination in normal adjustment is**
(a) 9 (b) 26
(c) 300 (d) 3

**13. A convex lens of glass ( $\mu_g = 1.45$ ) has a focal length $f_a$ in air. The lens is immersed in a liquid of refractive index ($\mu_l$) 1.3. The ratio of the $f_l/f_a$ is**
(a) 3.9 (b) 0.23
(c) 0.43 (d) 0.39

**14. Through a narrow slit of width 2 mm , diffraction pattern is formed on a screen kept at a distance 2 m from the slit. The wavelength of the light used is 6330Å and falls normal to the slit and screen. Then, the distance between the two minima on either side of the central maximum is**
(a) 12.6 mm (b) 1.27 mm
(c) 2.532 mm (d) 25.3 mm

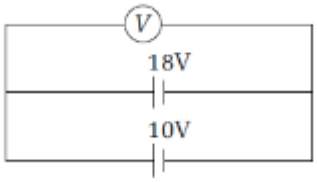
**15. Charges Q are placed at the ends of a diagonal of a square and charges q are placed at the other two corners. The condition for the net electric force on Q to be zero is**
(a) $Q = -2\sqrt{2}q$, q being negative
(b) $Q = -\frac{q}{2}$, q being negative
(c) $Q = 2\sqrt{2}q$, q being negative
(d) $Q = 2q$, q being negative

**16. In the arrangement of capacitors shown in the figure, if each capacitor is 9 pF , then the effective capacitance between the points A and B is**




(a) 10 pF (b) 15 pF
(c) 20 pF (d) 5 pF

**17. A battery of the emf 18 V and internal resistance of 3Ω and another battery of emf 10 V and internal resistance of 1Ω are connected as shown in figure. Then, the voltmeter reading is**




(a) 10 V (b) 12 V
(c) 16 V (d) 8 V

**18. A wire of aluminium and a wire of germanium are cooled to a temperautre of 77 K . Then**
(a) resistance of each of them decreases
(b) resistance of each of them increases
(c) resistance of aluminium wire increases and that of germanium wire decreases
(d) resistance of aluminium wire decreases and that of germanium wire increases

**19. A voltmeter of 250 mV range having a resistance of 10Ω is converted into an ammeter of 250 mA range. The value of necessary shunt is (nearly)**
(a) 2Ω (b) 0.1Ω
(c) 1Ω (d) 10Ω

**20. A circular loop and a square loop are formed from two wires of same length and cross section. Same current is passed through them. Then, the ratio of their dipole moments is**

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

**21. At a certain place, a magnet makes 30 oscillations per minute. At another place where the magnetic field is doubled, its time period will be**

(a) $\sqrt{2}$ s (b) 2 s
(c) 4 s (d) 1/2 s

**22. Match the following :**

| A | B |
|---|---|
| (A) Rocket propolusion | (P) Bernoulli's principle in fluid dynamics |
| (B) Aeroplane | (Q) Total internal reflection of light |
| (C) Optical fibres | (R) Newton's laws of motion |
| (D) Fusion test reactor | (S) Magnetic confinement of plasma |
| | (T) Photoelectric effect |

| | A | B | C | D |
|---|---|---|---|---|
| (a) | R | Q | P | S |
| (b) | R | P | Q | T |
| (c) | T | P | Q | R |
| (d) | R | P | Q | S |

**23. Force F is given by the equation $F = \frac{X}{\text{Linear density}}$. Then dimensions of X are**

(a) $[M^2L^0T^{-2}]$ (b) $[M^0\ L^0\ T^{-1}]$
(c) $[L^2T^{-2}]$ (d) $[M^0L^2T^{-2}]$

**24. The displacement of a particle moving in a straight line is given by the expression $x = At^3 + Bt^2 + Ct + D$ in metres, where t is in seconds and A, B, C and D are constants. The ratio between the initial acceleration and initial velocity is**

(a) $\frac{2C}{B}$ (b) $\frac{2B}{C}$ (c) 2C (d) $\frac{C}{2B}$

**25. A, B, C are points in a vertical line such that AB = BC. If a body falls freely from rest at A, $t_1$ and $t_2$ are times taken to travel distances AB and BC, then ratio $(t_2/t_1)$ is**

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

**26. Sum of magnitude of two forces is 25 N . The resultant of these forces is normal to the smaller force and has a magnitude of 10 N . Then the two forces are**

(a) 14.5 N, 10.5 N (b) 16 N, 9 N
(c) 13 N, 12 N (d) 20 N, 5 N

**27. A body of mass m thrown up vertically with velocity $v_1$ reaches a maximum height $h_1$ in $t_1$ seconds. Another body of mass 2 m is projected with a velocity $v_2$ at an angle θ. The second body reaches a maximum height $h_2$ in time $t_2$ seconds. If $t_1 = 2t_2$, then ratio $\left(\frac{h_1}{h_2}\right)$ is**

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

**28. Hammer of mass M strikes a nail of mass m with a velocity 20 m/s into a fixed wall. The nail penetrates into the wall to a depth of 1 cm . The average resistance of the wall to the penetration of the nail is**

(a) $\left(\frac{M^2}{M+m}\right) \times 10^3$ (b) $\frac{2M^2}{M+m} \times 10^4$

(c) $\frac{M+m}{M^2} \times 10^2$ (d) $\frac{M^2}{M+m} \times 10^2$

**29. A body of mass 10 kg is acted upon by a force given by equation $F = (3t^2 - 30)$ newtons. The initial velocity of the body is $10\ m/s$. The velocity of the body after 5 s is**

(a) 4.5 m/s (b) 6 m/s

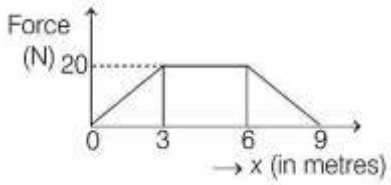
(c) 7.5 m/s (d) 5 m/s

**30. A ball (initially at rest) is released from the top of a tower. The ratio of work done by the force of gravity, in the first, second and third seconds is**

(a) 1:3:5 (b) 1:4:16

(c) 1:9:25 (d) 1:2:3

**31. A body of mass 2.4 kg is subjected to a force which varies with distance as shown in figure. The body starts from rest at $x = 0$. Its velocity at $x = 9$ m is**




(a) $5\sqrt{3}$ m/s (b) $20\sqrt{3}$ m/s

(c) 10 m/s (d) 40 m/s

**32. A carrier wave of peak voltage 12 V is used to transmit a signal. If the modulation index is 75%, the peak voltage of the modulating signal is**

(a) 18 V (b) 22 V

(c) 16 V (d) 9 V

**33. If $n_e$ and $n_h$ are electron and hole concentrations in an extrinsic semiconductor and $n_i$ is electron concentrations in an intrinsic semiconductor, then**

(a) $\left(\frac{n_e}{n_h}\right) = n_i$ (b) $(n_e + n_h) = n_i$

(c) $(n_e - n_h) = n_i^2$ (d) $n_e n_h = n_i^2$

**34. In a half wave rectifier, the AC input source of frequency 50 Hz is used. The fundamental frequency of the output is**

(a) 50 Hz (b) 150 Hz

(c) 200 Hz (d) 75 Hz

**35. A radioactive nucleus can decay by two different processes. The half -lives of the first and second decay processes are $5 \times 10^3$ and $10^5$ years respectively. Then, the effective half-life of the nucleus is**

(a) $105 \times 10^5$yr (b) 4762 yr

(c) $10^4$yr (d) 47.6 yr

**36. The following statements are given about hydrogen atom.**

**(A) The wavelengths of the spectral lines of Lyman series are greater than the wavelength of the second spectral line of Balmer series.**

**(B) The orbits correspond to circular standing waves in which the circumference of the orbit equals a whole number of wavelengths.**

(a) A is false, B is true

(b) A is true, B is false

(c) A is false, B is false

(d) A is true, B is true

**37. If an electron has an energy such that its de-Broglie wavelength is 5500Å, then the energy value of that electron is $(h = 6.6 \times 10^{-34} Js, m_C = 9.1 \times 10^{-31}\ kg)$**

(a) $8 \times 10^{-20}$ J (b) $8 \times 10^{-10}$ J

(c) 8 J (d) $8 \times 10^{-25}$ J

**38. Suppose that the electric flux inside a parallel plate capacitor changes at a rate of $7 \times 10^{14}$ unit/s, then the magnetic induction field density at any point inside the capacitor is**

**[Area of the plate of the capacitor $= 1\ m^2$**

**Permittivity of free space**

**$= 8.8 \times 10^{-12} Nm^2C^{-2}$**

**Permeability of free space**
**$= 4\pi \times 10^{-7}$ tesla m/amp**
(a) $7.79 \times 10^{-3}$ T (b) $2 \times 10^{-3}$ T
(c) $8.85 \times 10^{-4}$ T (d) $88.5 \times 10^{-12}$ T

**39. In a circuit L, C and R are connected in series with an alternating voltage source of frequency f. When current in the circuit leads the voltage by 45°, the value of C is**
(a) $\frac{1}{2\pi f(2\pi fL+R)}$ (b) $\frac{1}{2\pi f(2\pi fR+L)}$
(c) $\frac{2}{2\pi f(R+L)}$ (d) $\frac{2}{2\pi f\left(R+\frac{1}{L}\right)}$

**40. A small square loop of wire of side l is placed inside a large square loop of side L(L > l). If the loops are coplanar and their centres coincide, the mutual induction of the system is directly proportional to**
(a) I/L (b) $I^2/L$
(c) $//L^2$ (d) $I^2/L^2$

## Chemistry

**41. When one mole of A and one mole of B were heated in one litre flask at T( K), 0. 5 mole of C was formed in the equilibrium,**
**$A + B \rightleftharpoons C + D$**
**the equilibrium constant, $K_C$ is**
(a) 0.25 (b) 0.5
(c) 1 (d) 2

**42. If the solubility of $Ca_3(PO_4)_2$ in water is x mol $L^{-1}$, its solubility product in $mol^5$ $L^{-5}$ is**
(a) $6x^5$ (b) $36x^5$
(c) $64x^5$ (d) $108x^5$

**43. Which one of the following is not a method to remove permanent hardness of water?**
(a) Clark's method
(b) Calgon method
(c) lon-exchange method
(d) Synthetic resins method

**44. White metal is an alloy of**
(a) Na and Mg (b) Na and Pb
(c) Li and Mg (d) Li and Pb

**45. Which one of the following elements does not form triiodide on reacting with iodine?**
(a) B (b) TI (c) Al (d) Ga

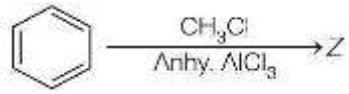
**46. The buffer system which helps to maintain the pH of blood between 7.26 to 7.42 , is**
(a) $H_2CO_3/HCO_3^-$ (b) $NH_4OH/NH_4Cl$
(c) $CH_3COOH/CH_3COO^-$ (d) $CH_3COONH_4$

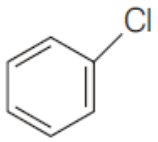
**47. In municipal sewage, BOD values (in ppm) are**
(a) 1-5 (b) 100-4000
(c) 50 − 90 (d) 20-40

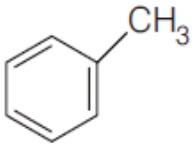
**48. Two bonds N = O and N − O in $H_3CNO_2$ are of same bond length due to**
(a) inductive effect
(b) hyperconjugation
(c) electromeric effect
(d) resonance effect

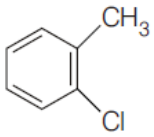
**49. Assertion (A) Reaction of 1-butene with HBr gives 1-bromobutane as major product.**
**Reason (R) Addition of hydrogen halides to alkenes proceeds according to Markownikoff's rule.**
**The correct answer is**
(a) A and R are correct and R is the correct explanation of A
(b) A and R are correct but R is not the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

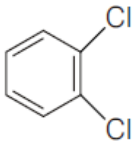
**50. The product (Z) of the following reaction is**




(a) 


(b) 


(c) 


(d) 


**51. An example of covalent solid is**

(a) MgO (b) Mg
(c) SiC (d) $CaF_2$

**52. What is the weight (in gram) of $Na_2CO_3$ (molar mass $= 106$ ) present in 250 mL of its 0.2 M solution?**

(a) 0.53 (b) 5.3
(c) 1.06 (d) 10.6

**53. An aqueous dilute solution containing non-volatile solute boils at $100.52^{\circ}C$. What is the molality of solution? ( $K_b = 0.52\ kg\ mol^{-1}$ K, boiling temperature of water $= 100^{\circ}C$ )**

(a) 0.1 m (b) 0.01 m
(c) 0.001 m (d) 1.0 m

**54. A lead storage battery is discharged. During the charging of this battery, the reaction that occurs at anode, is**

(a) $PbSO_4(s) + 2e^- \longrightarrow Pb(s) + SO_4^{2-}(aq)$
(b) $PbSO_4(s) + 2H_2O(l) \longrightarrow PbO_2(s) + SO_4^{2-}(aq) + 4H^+(aq) + 2e^-$
(c) $PbSO_4(s) \longrightarrow Pb^{2+}(aq) + SO_4^{2-}(aq)$
(d) $PbSO_4(s) + 2H_2O(l) + 2e^- \longrightarrow PbO_2(s) + SO_4^{2-}(aq) + 2H^+(aq)$

**55. For the reaction,**

$$5Br^-(aq) + BrO_3^-(aq) + 6H^+(aq) \longrightarrow 3Br_2(aq) + 3H_2O(l)$$

**If, $-\frac{\Delta[Br^-]}{\Delta t} = 0.05\ mol\ L^{-1}\ min^{-1}$, $-\frac{\Delta[BrO_3^-]}{\Delta t}$ in $molL^{-1}\ min^{-1}$ is**

(a) 0.005 (b) 0.05
(c) 0.5 (d) 0.01

**56. Which one of the following is used in the hardening of leather?**

(a) Light sensitive silver bromide in gelatin
(b) Sodium lauryl sulphate
(c) Alum
(d) Tannin

**57. German silver contains which of the following metals?**

(a) Cu, Zn (b) Fe, Zn
(c) Zn, Fe, Ni (d) Cu, Zn, Ni

**58. The key step in the manufacturing of $H_2SO_4$ by contact process is**

(a) absorption of $SO_3$ in $H_2SO_4$ to give oleum
(b) dilution of oleum with water
(c) burning of sulphur in air to generate $SO_2$
(d) catalytic oxidation of $SO_2$ with $O_2$ to give $SO_3$

**59. Ammonia on reaction with chlorine forms an explosive $NCl_3$. What is the mole ratio of $NH_3$ and $Cl_2$ required for this reaction?**

(a) 8:3 (b) 1:1
(c) 1:3 (d) 10:1

**60. Which one of the following lanthanide ions does not exhibit paramagnetism?**

(a) $Lu^{3+}$ (b) $Ce^{3+}$

(c) $Eu^{3+}$ (d) $Yb^{3+}$

**61. The increasing order of field strength of ligands is**

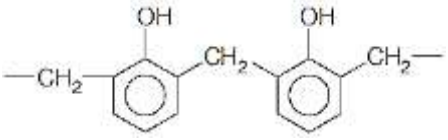
(a) $NH_3 < H_2O < Cl^- < CO < CN^-$

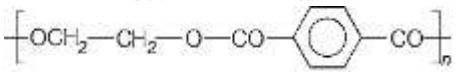
(b) $Cl^- < H_2O < NH_3 < CN^- < CO$

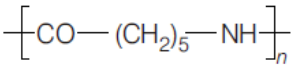
(c) $Cl^- < CO < CN^- < H_2O < NH_3$

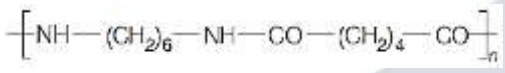
(d) $CN^- < CO < NH_3 < Cl^- < H_2O$

**62. Identify condensation homopolymer from the following:**

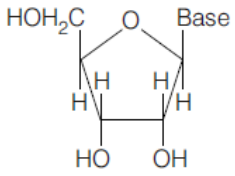
(a) 

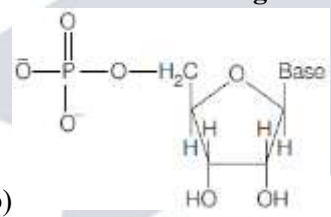
(b) 

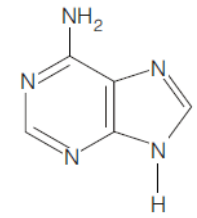
(c) 

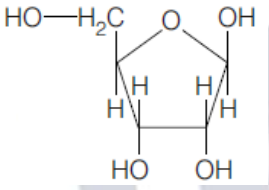
(d) 

**63. Identify the nucleoside from the following :**

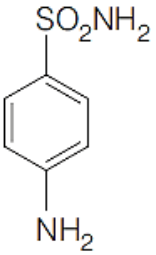
(a) 

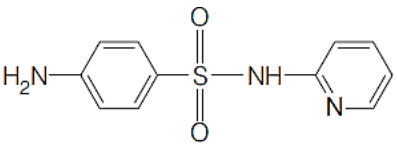
(b) 

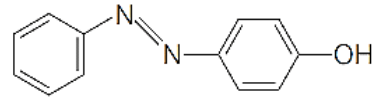
(c) 

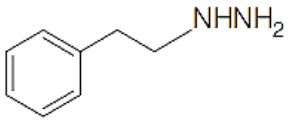
(d) 

**64. Which one of the following is the correct structure of sulphapyridine?**

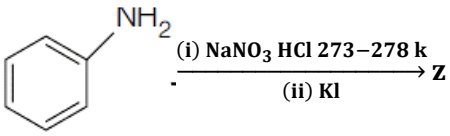
(a) 

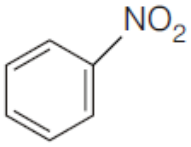
(b) 

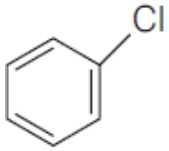
(c) 

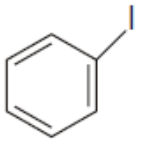
(d) 

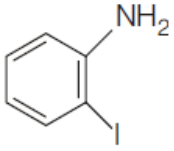
**65. Identify Z in the following reaction:**




(a) 

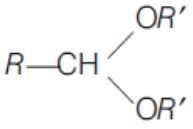

(b) 

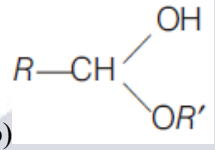

(c) 

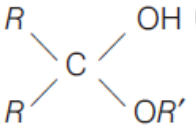

(d) 

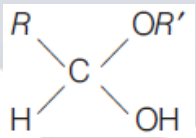

**66. Which intermediate is formed in the Reimer-Tiemann reaction?**
(a) Aldehyde
(b) Carbocation
(c) Carbanion
(d) Substituted benzal chloride

**67. Which one of the following is an acetal?**

(a) 


(b) 


(c) 


(d) 


**68.** $H_3CCH_2CO_2H \xrightarrow[\Delta]{P_2O_5} X \xrightarrow{H_2O} Y \xrightarrow{SOCl_2} Z$ **Identify X, Y and Z.**

| | X | Y | Z |
|---|---|---|---|
| (a) | $H_2C=CHCO_2H$ | $HOH_2CCHOH$ $CO_2H$ | $HOH_2CCHOH$ $COCl$ |
| (b) | $(H_3CCH_2CO)_2O$ | $H_3CCH_2CO_2H$ | $H_3CCH_2COCl$ |
| (c) | $(H_3CCO)_2O$ | $H_3CCO_2H$ | $ClCH_2COCl$ |
| (d) | $(H_3CCH_2CO)_2O$ | $H_3CCO_2H$ | $H_3CCOCl$ |

**69.** $H_3CCONH_2 + Br_2 + 4NaOH \longrightarrow Y + Na_2CO_3 + 2NaBr + 2H_2O$ **What is Y in the above reaction?**
(a) $H_3CCH_2NH_2$ (b) $H_3CNH_2$
(c) $H_3CCOBr$ (d) $HCONH_2$

**70. The number of radial nodes present in 3p orbital is**
(a) 0 (b) 1 (c) 2 (d) 3

**71. The radiation with maximum frequency is**
(a) X-rays (b) radio waves
(c) UV rays (d) IR rays

**72. The equation used to represents the electron gain enthalpy is**
(a) $X(g) + e^- \longrightarrow X^-(g)$
(b) $X(s) + e^- \longrightarrow X^-(g)$
(c) $X(g) \longrightarrow X^+(g) + e^-$
(d) $X(s) \longrightarrow X^+(g) + e^-$

**73. An element in +2 oxidation state has 24 electrons. The atomic number of the element and the number of unpaired electrons in it respectively are**

(a) 24 and 4 (b) 26 and 4
(c) 24 and 2 (d) 26 and 5

**74. Number of bonding electron pairs and number of lone pairs of electrons in $ClF_3, SF_4, BrF_5$ respectively are**
(a) 3,2; 4,2; 5,2 (b) 3,1; 4,1; 5,2
(c) 3,1; 4,2; 5,1 (d) 3,2; 4,1; 5,1

**75. What is the bond order of $N_2$ ?**
(a) 3 (b) 4 (c) 2 (d) 1

**76. Match the following:**

| List I | | | List II |
|---|---|---|---|
| (A) | Viscosity | (I) | Critical temperature |
| (B) | Ideal gas behaviour | (II) | Isobar |
| (C) | Liquefaction of gases | (III) | Compressibility factor |
| (D) | Charles' law | (IV) | $kgs^{-2}$ |
| | | (V) | $kgm^{-1}s^{-1}$ |

**The correct answer is**
(a) A-IV, B-III, C-I, D-II (b) A-V, B-III, C-I, D-II
(c) A-V, B-III, C-II, D-I (d) A-IV, B-III, C-II, D-I

**77. The most probable speed of $O_2$ molecules at T( K) is**
(a) $\sqrt{\frac{RT}{4\pi}}$ (b) $\sqrt{\frac{RT}{16\pi}}$
(c) $\sqrt{\frac{RT}{16}}$ (d) $\sqrt{\frac{3RT}{32}}$

**78. According to significant figure convention, the result obtained by adding $12.11, 18.0$ and $1.012$ is**
(a) 31.12 (b) 31.1
(c) 31 (d) 31.122

**79. An organic compound having C, H and O has $13.13\%$H, $52.14\%$C and $34.73\%$O. Its molar mass is 46.068 g . What are its empirical and molecular formulae?**
(a) $C_2H_6O, C_4H_{12}O_2$ (b) $CH_3O, C_2H_6O_2$
(c) $C_2H_6O, C_2H_6O$ (d) $C_2H_6O_2, C_3H_9O_4$

**80. Which one of the following is not a state function?**
(a) Internal energy (b) Work
(c) Entropy (d) Free energy

## Mathematics

**81. An equation of a line whose segment between the coordinate axes is divided by the point $\left(\frac{1}{2},\frac{1}{3}\right)$ in the ratio 2:3, is**
(a) $6x + 9y = 5$ (b) $9x + 6y = 5$
(c) $4x + 9y = 5$ (d) $9x + 4y = 5$

**82. The value of k$(> 0)$, such that the angle between the lines $4x - y + 7 = 0$ and $kx - 5y - 9 = 0$ is $45°$, is**
(a) $\frac{25}{3}$ (b) $\frac{5}{3}$ (c) 3 (d) 5

**83. The combined equation of the straight lines passing through the point $(4, 3)$ and each line making intercepts on the coordinate axes whose sum is -1 , is**
(a) $(3x - 2y - 6)(x - 2y + 2) = 0$
(b) $(3x - 2y + 6)(x - 2y + 2) = 0$
(c) $(3x - 2y - 6)(x - 2y - 2) = 0$
(d) $(3x - 2y + 6)(x - 2y - 2) = 0$

**84.** If the origin of a coordinate system is shifted to $(-\sqrt{2}, \sqrt{2})$ and the coordinate system is rotated anti-clockwise through an angle $45°$, then the point $P(1, -1)$ in the original system has new coordinates

(a) $(\sqrt{2}, -2\sqrt{2})$ (b) $(0, -2\sqrt{2})$
(c) $(0, -2-\sqrt{2})$ (d) $(0, -2+\sqrt{2})$

**85.** The locus of the point P which is equidistant from $3x + 4y + 5 = 0$ and $9x + 12y + 7 = 0$, is

(a) a hyperbola (b) an ellipse
(c) a parabola (d) a straight line

**86.** The probability of a coin showing head is p and then 100 such coins are tossed. If the probability of 50 coins showing head is same as the probability of 51 coins showing head, then p equals

(a) $\frac{1}{2}$ (b) $\frac{49}{100}$ (c) $\frac{51}{101}$ (d) $\frac{50}{101}$

**87.** Let X be binomial variate with parameters $n = 6$ and p. If $4P(X = 4) = P(X = 2)$, then p equals

(a) $1/2$ (b) $1/3$
(c) $1/4$ (d) $1/6$

**88.** In a certain college, $4\%$ of men and $1\%$ of women are taller than 1.8 m . Also, $60\%$ of students are women. If a student selected at random is found to be taller than 1.8 m , then the probability that the student being a woman is

(a) $3/11$ (b) $5/11$
(c) $6/11$ (d) $8/11$

**89.** If A and B are two events such that $P(A/B) = 0.6, P(B/A) = 0.3$ and $P(A) = 0.1$, then $P(\bar{A} \cap \bar{B})$ equals

(a) 0.88 (b) 0.12
(c) 0.6 (d) 0.4

**90.** If A and B are events such that $P(A \cup B) = \frac{5}{6}, P(\bar{A}) = \frac{1}{4}$ and $P(B) = \frac{1}{3}$, then A and B are

(a) mutually exclusive
(b) independent events
(c) exhaustive events
(d) exhaustive and independent events

**91.** Two teams A and B have the same mean and their coefficients of variation are 4,2 , respectively. If $\sigma_A, \sigma_B$ are the standard deviations of teams A, B respectively, then the relation between them is

(a) $\sigma_A = \sigma_B$ (b) $\sigma_B = 2\sigma_A$
(c) $\sigma_A = 2\sigma_B$ (d) $\sigma_B = 4\sigma_A$

**92.** In a data, if the number i is repeated i times for $i = 1, 2, \ldots, n$, then the mean of the data is

(a) $\frac{2n+1}{6}$ (b) $\frac{2n+1}{4}$
(c) $\frac{2n+1}{3}$ (d) $\frac{2n+1}{2}$

**93.** If $\mathbf{a} = 2\hat{i} - 3\hat{j} + 5\hat{k}$, $\mathbf{b} = 3\hat{i} - 4\hat{j} + 5\hat{k}$ and $\mathbf{c} = 5\hat{i} - 3\hat{j} - 2\hat{k}$, then the volume of the parallelopiped with coterminous edges $\mathbf{a} + \mathbf{b}, \mathbf{b} + \mathbf{c}, \mathbf{c} + \mathbf{a}$, is

(a) 1 (b) 5 (c) 8 (d) 16

**94.** The shortest distance between the skew-lines $\frac{x-3}{-1} = \frac{y-4}{2} = \frac{z+2}{1}, \frac{x-1}{1} = \frac{y+7}{3} = \frac{z+2}{2}$ is

(a) 6 (b) 7 (c) $3\sqrt{3}$ (d) $\sqrt{35}$

**95.** If the position vectors of the vertices of $\triangle ABC$ are $3\hat{i} + 4\hat{j} - \hat{k}, \hat{i} + 3\hat{j} + \hat{k}$ and $5(\hat{i} + \hat{j} + \hat{k})$, respectively. Then, the magnitude of the altitude from A onto the side BC is

(a) $\frac{4}{3}\sqrt{5}$ (b) $\frac{5}{3}\sqrt{5}$
(c) $\frac{7}{3}\sqrt{5}$ (d) $\frac{8}{3}\sqrt{5}$

**96.** ABCD is a parallelogram and P is a point on the segment AD dividing it internally in the ratio 3 :1. If the line BP meets the diagonal AC in Q, then AQ: QC equals

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

**97.** If M and N are the mid-points of the sides BC and CD respectively of a parallelogram ABCD, then AM + AN equals

(a) $\frac{4}{3}$AC (b) $\frac{5}{3}$AC
(c) $\frac{3}{2}$AC (d) $\frac{6}{5}$AC

**98.** P is the point of intersection of the diagonals of the parallelogram ABCD. If S is any point in space and $SA + SB + SC + SD = \lambda SP$, then $\lambda$ equals
(a) 2 (b) 4 (c) 6 (d) 8

**99.** In $\triangle ABC$, if $r_1 = 2r_2 = 3r_3$, then $b : c$ equals
(a) 4: 3 (b) 5: 4
(c) 2: 1 (d) 3: 2

**100.** $\frac{1}{r^2} + \frac{1}{r_1^2} + \frac{1}{r_2^2} + \frac{1}{r_3^2}$ equals
(a) $\frac{a^2+b^2+c^2}{\Delta}$ (b) $\frac{a^2+b^2+c^2}{\Delta^2}$
(c) $\frac{\Delta^2}{a^2+b^2+c^2}$ (d) $\frac{\Delta}{a^2+b^2+c^2}$

**101.** The angle of $\triangle ABC$ are in an arithmetic progression. If the larger sides a, b satisfy the relation $\frac{\sqrt{3}}{2} < \frac{b}{a} < 1$, then the possible values of the smallest side are
(a) $\frac{a\pm\sqrt{4b^2-3a^2}}{2a}$ (b) $\frac{a\pm\sqrt{4b^2-3a^2}}{2b}$
(c) $\frac{a\pm\sqrt{4b^2-3a^2}}{2c}$ (d) $\frac{a\pm\sqrt{4b^2-3a^2}}{2}$

**102.** If $\cosh 2x = 199$, then $\coth x$ equals
(a) $\frac{5}{3\sqrt{11}}$ (b) $\frac{5}{6\sqrt{11}}$
(c) $\frac{7}{3\sqrt{11}}$ (d) $\frac{10}{3\sqrt{11}}$

**103.** If $\cos\cot^{-1}\left(\frac{1}{2}\right) = \cot(\cos^{-1} x)$, then the value of x is
(a) $\frac{1}{\sqrt{6}}$ (b) $\frac{-1}{\sqrt{12}}$ (c) $\frac{2}{\sqrt{6}}$ (d) $\frac{-2}{\sqrt{6}}$

**104.** The number of solutions of $\sec x \cos 5x + 1 = 0$ in the interval $[0, 2\pi]$ is
(a) 5 (b) 8 (c) 10 (d) 12

**105.** In $\triangle ABC$, if $\angle C = \frac{\pi}{3}$, then $\frac{3}{a+b+c} - \frac{1}{a+c}$ equals
(a) $\frac{1}{a+b}$ (b) $\frac{1}{b+c}$
(c) $\frac{1}{2a+b}$ (d) $\frac{1}{b+2c}$

**106.** If $A = \sin^2\theta + \cos^4\theta$, then for all values of $\theta$, A lies in the interval
(a) [1,2] (b) $\left[\frac{3}{4}, 1\right]$
(c) $\left[\frac{1}{2}, \frac{3}{4}\right]$ (d) $\left[\frac{3}{4}, \frac{19}{16}\right]$

**107.** If $f(x)$ is a real function defined on $[-1, 1]$, then the function $g(x) = f(5x + 4)$ is defined on the interval
(a) $[-4,9]$ (b) $[-1,9]$
(c) $[-2,9]$ (d) None of these

**108.** If $f: N \to R$ is defined by $f(1) = -1$ and $f(n + 1) = 3f(n) + 2$ for $n \geq 1$, then f is
(a) one-one
(b) onto
(c) a constant function
(d) $f(n) > 0$ for $n > 1$

**109.** The remainder of $n^4 - 2n^3 - n^2 + 2n - 26$ when divided by 24 , is
(a) 20 (b) 21 (c) 22 (d) 23

**110.** If $A(x) = \begin{vmatrix} 1 & 2 & 3 \\ x+1 & 2x+1 & 3x+1 \\ x^2+1 & 2x^2+1 & 3x^2+1 \end{vmatrix}$, then $\int_0^1 A(x)dx$ equals
(a) 0 (b) 1 (c) 2 (d) 4

**111.** Let $\begin{vmatrix} x^2+x+1 & x+1 & 2x-3 \\ 3x^2-1 & x+2 & x-1 \\ x^2+5x+1 & 2x+3 & x+4 \end{vmatrix}$
$= ax^4 + bx^3 + cx^2 + dx + e$ be an identity in x. If a, b, c, d are known, then the value of e is
(a) 29 (b) 24 (c) 16 (d) 9

**112.** The system of equations $4x + y + 2z = 5, x - 5y + 3z = 10, 9x - 3y + 7z = 20$ has
(a) no solution
(b) unique solution
(c) two solutions
(d) infinite number of solutions

**113.** If $1, \omega, \omega^2$ are the cube roots of unity and $\alpha = \omega + 2\omega^2 - 3$, then $\alpha^3 + 12\alpha^2 + 48\alpha + 3$ equals
(a) -63 (b) -62 (c) -61 (d) -60

**114.** If $\alpha, \beta$ are the roots of $1 + x + x^2 = 0$, then the value of $\alpha^4 + \beta^4 + \alpha^{-4}\beta^{-4}$ is
(a) 0 (b) 1 (c) -1 (d) 2

**115.** If $\alpha, \beta$ are the roots of the equation $x^2 - 4x + 8 = 0$, then for any $n \in N$, $\alpha^{2n} + \beta^{2n}$ equals
(a) $2^{2n+1}\cos\frac{n\pi}{2}$ (b) $2^{3n}\cos\frac{n\pi}{2}$
(c) $2^{3n+1}\cos\frac{n\pi}{2}$ (d) $2^{3n}\cos\frac{n\pi}{4}$

**116.** If $\alpha, \beta$ are non-real cube roots of 2 , then $\alpha^6 + \beta^6$ equals
(a) 8 (b) 4 (c) 2 (d) 1

**117.** Let $\alpha \neq \beta$ satisfy $\alpha^2 + 1 = 6\alpha, \beta^2 + 1 = 6\beta$. Then, the quadratic equation whose roots are $\frac{\alpha}{\alpha+1}, \frac{\beta}{\beta+1}$, is
(a) $8x^2 + 8x + 1 = 0$
(b) $8x^2 - 8x - 1 = 0$
(c) $8x^2 - 8x + 1 = 0$
(d) $8x^2 + 8x - 1 = 0$

**118.** The solution set of $|x|^2 - 5|x| + 4 < 0$ is
(a) $(-4, -1)$ (b) $(1,4)$
(c) $(-4, -1) \cup (1,4)$ (d) $(-4,4)$

**119.** Let $\alpha, \beta, \gamma$ be the roots of $x^3 + x + 10 = 0$ and $\alpha_1 = \frac{\alpha+\beta}{\gamma^2}, \beta_1 = \frac{\beta+\gamma}{\alpha^2}, \gamma_1 = \frac{\gamma+\alpha}{\beta^2}$. Then, the value of $(\alpha_1^3 + \beta_1^3 + \gamma_1^3) - \frac{1}{10}(\alpha_1^2 + \beta_1^2 + \gamma_1^2)$ is
(a) $\frac{1}{10}$ (b) $\frac{1}{5}$ (c) $\frac{3}{10}$ (d) $\frac{1}{2}$

**120.** Suppose $\alpha, \beta, \gamma$ are the roots of $x^3 + x^2 + x + 2 = 0$. Then, the value of $\left(\frac{\alpha+\beta-2\gamma}{\gamma}\right)\left(\frac{\beta+\gamma-2\alpha}{\alpha}\right)\left(\frac{\gamma+\alpha-2\beta}{\beta}\right)$ is
(a) $-\frac{47}{2}$ (b) $\frac{47}{2}$
(c) -47 (d) 47

**121.** $\sum_{r=0}^{10} {}^{40-r}C_5$ is equal to
(a) ${}^{41}C_5 - {}^{30}C_5$ (b) ${}^{41}C_6 - {}^{30}C_6$
(c) ${}^{41}C_5 + {}^{30}C_5$ (d) ${}^{41}C_6$

**122.** If the number of diagonals of a regular polygon is 35 , then the number of sides of the polygon is
(a) 12 (b) 9 (c) 10 (d) 11

**123.** If $x = 1 + \frac{3}{1!} \times \frac{1}{6} + \frac{3\times7}{2!}\left(\frac{1}{6}\right)^2 + \frac{3\times7\times11}{3!}\left(\frac{1}{6}\right)^3 + \cdots$, then $x^4$ equals
(a) 81 (b) 54 (c) 27 (d) 8

**124.** If x is so small that $x^2$ and higher powers of x may be neglected, then the approximate value of $\frac{\left(1+\frac{2}{3}x\right)^{-3}(1-15x)^{-1/5}}{(2-3x)^4}$ is
(a) $\frac{1}{8}(1 + 7x)$ (b) $\frac{1}{16}(1 - 7x)$
(c) $1 - 7x$ (d) $\frac{1}{16}(1 + 7x)$

**125.** The coefficient of $x^n$ in the expansion of $\frac{1}{x^2-5x+6}$ for $|x| < 1$ is

(a) $\frac{1}{2^{n-1}} - \frac{1}{3^{n-1}}$ (b) $\frac{1}{2^{n+2}} - \frac{1}{3^{n+2}}$

(c) $\frac{1}{2^{n+1}} - \frac{1}{3^{n+1}}$ (d) $\frac{1}{2^n} - \frac{1}{3^n}$

**126.** In $\triangle ABC$, the value of $\angle A$ is obtained from the equation $3\cos A + 2 = 0$. The quadratic equation, whose roots are $\sin A$ and $\tan A$, is

(a) $3x^2 + \sqrt{5}x - 5 = 0$

(b) $6x^2 - \sqrt{5}x - 5 = 0$

(c) $6x^2 + \sqrt{5}x - 5 = 0$

(d) $6x^2 + \sqrt{5}x + 5 = 0$

**127.** Match the differential equations in List I to their integrating factors in List II.

| Differential equation | Integrating factor |
|---|---|
| (P) $(x^3+1)\frac{dy}{dx} + x^2y = 3x^2$ | (1) $x^3$ |
| (Q) $x^2\frac{dy}{dx} + 3xy = x^6$ | (2) $(x^3+1)^2$ |
| (R) $(x^3+1)^2\frac{dy}{dx} + 6x^2(x^3+1)y = x^2$ | (3) $(x^2+1)^2$ |
| (S) $(x^2+1)\frac{dy}{dx} + 4xy = \ln x$ | (4) $x^2+1$ |
| | (5) $(x^3+1)^{1/3}$ |
| | (6) $(x^3+1)^{1/2}$ |

The correct match is

| | P | Q | R | S |
|---|---|---|---|---|
| (a) | 4 | 1 | 2 | 3 |
| (b) | 5 | 1 | 2 | 3 |
| (c) | 5 | 2 | 3 | 6 |
| (d) | 5 | 1 | 3 | 4 |

**128.** The solution of the differential equation $xy' = 2xe^{-y/x} + y$ is

(a) $e^{y/x} + \log|Cx| = 0$

(b) $e^{-y/x} = x + C$

(c) $e^{y/x} = \log|Cx|$

(d) $e^{y/x} = 2\log|Cx|$

**129.** The differential equation of the family of curves $y = ax + \frac{1}{a}$, where $a(\neq 0)$ is an arbitrary constant, has the degree

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

**130.** The area of the region bounded by the curves $y = 9x^2$ and $y = 5x^2 + 4$ (in sq units) is

(a) 64 (b) $\frac{64}{3}$ (c) $\frac{32}{3}$ (d) $\frac{16}{3}$

**131.** $\int_0^{\pi/2} \frac{16x\sin x\cos x}{\sin^4 x+\cos^4 x}dx$ is equal to

(a) $\frac{\pi^2}{4}$ (b) $\frac{\pi^2}{2}$

(c) $\pi^2$ (d) $2\pi^2$

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

(a) $\frac{\pi}{2}-1$ (b) $\frac{\pi}{2}+1$

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

**133.** **If** $\int \frac{x+5}{x^2+4x+5}dx = a\log(x^2+4x+5)+b\tan^{-1}(x+k)+C$, **then** $(a,b,k)$ **equals**

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

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

**134.** $\int \sqrt{e^x-4}dx$ **equals**

(a) $\tan^{-1}\left(\frac{\sqrt{e^x-4}}{2}\right)+\sqrt{e^x-4}+C$

(b) $2\sqrt{e^x-4}-4\tan^{-1}\left(\frac{\sqrt{e^x-4}}{2}\right)+C$

(c) $2\sqrt{e^x-4}-4\cot^{-1}\left(\frac{\sqrt{e^x-4}}{2}\right)+C$

(d) $\sqrt{e^x-4}-4\tan^{-1}\left(\sqrt{e^x-4}\right)+C$

**135.** **If** $\int e^{-x}\tan^{-1}(e^x)dx = f(x)-\frac{1}{2}\log(1+e^{2x})+C$, **then** $f(x)$ **equals**

(a) $e^x-e^{-x}\tan^{-1}(e^x)$

(b) $x^2+e^{-x}\tan^{-1}(e^x)$

(c) $-e^{-x}\tan^{-1}(e^x)$

(d) $x-e^{-x}\tan^{-1}(e^x)$

**136.** $\int \sqrt{\frac{2+x}{2-x}}dx$ **is equal to**

(a) $2\sin^{-1}\left(\frac{x}{2}\right)+\sqrt{4-x^2}+C$

(b) $\cos^{-1}\left(\frac{x}{2}\right)-\sqrt{4-x^2}+C$

(c) $\sin^{-1}\left(\frac{x}{2}\right)-\sqrt{4-x^2}+C$

(d) $2\sin^{-1}\left(\frac{x}{2}\right)-\sqrt{4-x^2}+C$

**137.** **Two particles P and Q located at the points with coordinates** $P(t,t^3-16t-3)$, $Q(t+1,t^3-6t-6)$ **are moving in a plane. The minimum distance between them in their motion is**

(a) 1 (b) 5 (c) 169 (d) 49

**138.** **If** $f(x)=\begin{cases} x, & 0\le x\le 1 \\ 2-x, & 1\le x\le 2 \end{cases}$, **then Rolle's theorem is not applicable to** $f(x)$ **because**

(a) f(x) is not defined everywhere on [0,2]

(b) f(x) is not continuous on [0,2]

(c) f(x) is not differentiable on (1,2)

(d) f(x) is not differentiable on (0,2)

**139.** **An equilateral triangle is of side 10 units. In measuring the side, if an error of 0.05 unit is made. Then, the percentage error in the area of the triangle is**

(a) 5 (b) 4 (c) 1 (d) 0.5

**140.** **If the line** $y=-4x+b$ **is tangent to the curve** $y=\frac{1}{x}$, **then b equals**

(a) $\pm 4$ (b) $\pm 2$

(c) $\pm 1$ (d) $\pm 8$

**141.** **If** $x=\frac{1-\sqrt{y}}{1+\sqrt{y}}$, **then** $(x+1)\frac{d^2y}{dx^2}+\left(\frac{3\sqrt{y}+1}{\sqrt{y}}\right)\frac{dy}{dx}$ **equals**

(a) $-2y$ (b) 0

(c) $-y$ (d) $y$

**142.** If $x^2 + y^2 = t + \frac{2}{t}$ and $x^4 + y^4 = t^2 + \frac{4}{t^2}$, then $x^3 y \frac{dy}{dx}$ equals

(a) -1 (b) -2 (c) $\frac{y}{x}$ (d) xy

**143.** If $y = \tan^{-1}\left(\frac{3x - x^3}{1 - 3x^2}\right) + \tan^{-1}\left(\frac{4x - 4x^3}{1 - 6x^2 + x^4}\right)$ then $\frac{dy}{dx}$ is equal to

(a) $\frac{2}{1+x^2}$ (b) $\frac{4}{1+x^2}$

(c) $\frac{6}{1+x^2}$ (d) $\frac{7}{1+x^2}$

**144.** The value that should be assigned to $f(0)$ so that the function $f(x) = (x + 1)^{\cot x}$ is continuous at $x = 0$, is

(a) e (b) 1

(c) 2 (d) $e^{-1}$

**145.** $\lim_{x \to 0} \left[\tan\left(x + \frac{\pi}{4}\right)\right]^{1/x}$ is equal to

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

**146.** A plane meets the coordinate axes at P, Q, R respectively. If the centroid of $\triangle$ PQR is $\left(1, \frac{1}{2}, \frac{1}{3}\right)$, then the equation of the plane is

(a) $2x + 4y + 3z = 5$

(b) $x + 2y + 3z = 3$

(c) $x + 4y + 6z = 5$

(d) $2x - 2y + 6z = 3$

**147.** If the extremities of a diagonal of a square are $(1, 2, 3)$ and $(2, -3, 5)$, then its side is of length

(a) $\sqrt{6}$ (b) 15 (c) $\sqrt{15}$ (d) 3

**148.** If $A(4, 3, 5)$, $B(0, -2, 2)$ and $C(3, 2, 1)$ are three points. Then, the coordinates of the point in which the bisector of $\angle BAC$ meets the side BC, is

(a) $\left(\frac{15}{8}, \frac{4}{8}, \frac{11}{8}\right)$ (b) $\left(\frac{12}{7}, \frac{2}{7}, \frac{10}{7}\right)$

(c) $\left(\frac{9}{5}, \frac{2}{5}, \frac{7}{5}\right)$ (d) $\left(\frac{3}{2}, 0, \frac{3}{2}\right)$

**149.** The product of lengths of perpendicular from any point on the hyperbola $x^2 - y^2 = 16$ to its asymptotes, is

(a) 2 (b) 4 (c) 8 (d) 16

**150.** The centre of the ellipse $\frac{(x+y-3)^2}{9} + \frac{(x-y+1)^2}{16} = 1$, is

(a) $(-1,2)$ (b) $(1, -2)$

(c) $(-1, -2)$ (d) $(1,2)$

**151.** For the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, a list of lines given in List I are to be matched with their equation given in List II.

| Line | | Equation | |
|---|---|---|---|
| (P) | Directrix corresponding to the focus $(-3, 0)$ | (1) | $y = 4$ |
| (Q) | Tangent at the vertex (0, 4) | (2) | $3x = 25$ |
| (R) | Latusrectum through ( 3,0 ) | (3) | $x = 3$ |
| | | (4) | $y + 4 = 0$ |
| | | (5) | $x + 3 = 0$ |
| | | (6) | $3x + 25 = 0$ |

The correct matching is

| | P | Q | R |
|---|---|---|---|
| (a) | 2 | 1 | 5 |

(b) 6 1 3
(c) 2 4 3
(d) 6 1 5

**152. If P is a point on the parabola $y^2 = 8x$ and A is the point $(1, 0)$, then the locus of the mid-point of the line segment AP is**

(a) $y^2 = 4\left(x - \frac{1}{2}\right)$
(b) $y^2 = 2(2x + 1)$
(c) $y^2 = x - \frac{1}{2}$
(d) $y^2 = 2x + 1$

**153. The equation of the parabola with focus $(1, -1)$ and directrix $x + y + 3 = 0$, is**

(a) $x^2 + y^2 - 10x - 2y - 2xy - 5 = 0$
(b) $x^2 + y^2 + 10x - 2y - 2xy - 5 = 0$
(c) $x^2 + y^2 + 10x + 2y - 2xy - 5 = 0$
(d) $x^2 + y^2 + 10x + 2y + 2xy - 5 = 0$

**154. The equation of the circle passing through $(1, 2)$ and the points of intersection of the circles $x^2 + y^2 - 8x - 6y + 21 = 0$ and $x^2 + y^2 - 2x - 15 = 0$, is**

(a) $x^2 + y^2 + 6x - 2y + 9 = 0$
(b) $x^2 + y^2 - 6x - 2y + 9 = 0$
(c) $x^2 + y^2 - 6x - 4y + 9 = 0$
(d) $x^2 + y^2 - 6x + 4y + 9 = 0$

**155. The length of the common chord of the two circles $(x - a)^2 + y^2 = a^2$ and $x^2 + (y - b)^2 = b^2$, is**

(a) $\frac{ab}{\sqrt{a^2+b^2}}$ (b) $\frac{2ab}{\sqrt{a^2+b^2}}$
(c) $\frac{a+b}{\sqrt{a^2+b^2}}$ (d) $\sqrt{a^2 + b^2}$

**156. If $(4, 2)$ and $(k, -3)$ are conjugate points with respect to $x^2 + y^2 - 5x + 8y + 6 = 0$, then k equals**

(a) $\frac{28}{3}$ (b) $-\frac{28}{3}$ (c) $\frac{3}{28}$ (d) $-\frac{3}{28}$

**157. The area (in sq units) of the triangle formed by the tangent, normal at $(1, \sqrt{3})$ to the circle $x^2 + y^2 = 4$ and the X-axis, is**

(a) $4\sqrt{3}$ (b) $\frac{7}{2}\sqrt{3}$
(c) $2\sqrt{3}$ (d) $\frac{1}{2}\sqrt{3}$

**158. The value of a, such that the power of the point $(1, 6)$ with respect to the circle $x^2 + y^2 + 4x - 6y - a = 0$, is -16 , is**

(a) 7 (b) 11 (c) 13 (d) 21

**159. The line $x + y = k$ meets the pair of straight lines $x^2 + y^2 - 2x - 4y + 2 = 0$ at two points A and B. If O is the origin and $\angle AOB = 90^\circ$, then the value of $k(> 1)$ is**

(a) 5 (b) 4 (c) 3 (d) 2

**160. If two pairs of straight lines with combined equations $xy + 4x - 3y - 12 = 0$ and $xy - 3x + 4y - 12 = 0$ form a square. Then, the combined equation of its diagonals is**

(a) $x^2 - 2xy + y^2 + x - y = 0$
(b) $x^2 + 2xy + y^2 + x + y = 0$
(c) $x^2 - y^2 + x - y = 0$
(d) $x^2 - y^2 + x + y = 0$