Physics

1. If N_A, N_B and N_C are the number of significant figures in $A = 0.001204$ m, $B = 43120000$ m and $c = 1.200$ m respectively then

(a) $N_A = N_B = N_C$ (b) $N_A > N_B > N_C$
(c) $N_A < N_B < N_C$ (d) $N_A > N_B < N_C$

2. A car covers a distance at speed of 60 km h^{-1}. It returns and comes back to the original point moving at a speed of V . If the average speed for the round trip is 48 km h^{-1}, then the magnitude of V is

(a) 40kmh^{-1} (b) 36 km h^{-1}
(c) 44 km h^{-1} (d) 32 km h^{-1}

3. A car travels with a speed of 40 km h^{-1}. Rain drops are falling at a constant speed vertically. The traces of the rain on the side windows of the car make an angle of 30° with the vertical. The magnitude of the velocity of the rain with respect to the car is

(a) $40\sqrt{3}$ km h^{-1} (b) $\frac{40}{\sqrt{3}}$ km h^{-1}
(c) 80 km h^{-1} (d) $\frac{80}{\sqrt{3}}$ km h^{-1}

4. A projectile with speed 50 ms^{-1} is thrown at an angle of 60° with the horizontal. The maximum height that can be reached is

(a) 90.75 m (b) 70.00 m
(c) 85.00 m (d) 93.75 m

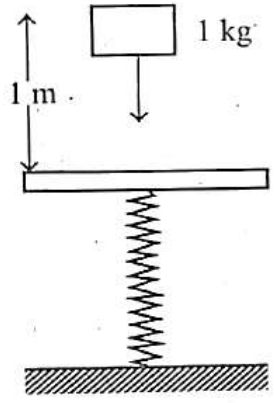
5. Two rectangular blocks of masses 40 kg and 60 kg are connected by a string and kept on a frictionless horizontal table. If a force of 1000 N is applied on 60 kg block away from 40 kg block, then the tension in string is

(a) 450 N (b) 400 N
(c) 350 N (d) 500 N

6. A ball of mass 0.5 kg moving horizontally at 10 ms^{-1} strikes a vertical wall and rebounds with speed V. The magnitude of the change in linear momentum is found to be 8.0 $kgms^{-1}$. The magnitude of V is

(a) 6.0 ms^{-1} (b) 9.0 ms^{-1}
(c) 26.0 ms^{-1} (d) 13.0 ms^{-1}

7. A mass of 1 kg falls from a height of 1 m and lands on a mass less platform supported by a spring having spring constant 15 Nm^{-1} as shown in the figure. The maximum compression of the spring is. (acceleration due to gravity = 10 ms^{-2})



(a) 2 m (b) $\sqrt{2}$ m
(c) $\left(\frac{2}{\sqrt{3}}\right)$ m (d) $\sqrt{3}$ m

8. A bead of mass 400 g is moving along a straight line under a force that delivers a constant power 1.2 W to the bead. If the bead is initially at rest, the speed it attains after 6 sec in ms^{-1}

(a) 5 (b) 4 (c) 6 (d) 3

9. Masses $m\left(\frac{1}{3}\right)^N \frac{1}{N}$ are placed at $x = N$, when $N = 2, 3, 4, \ldots\ldots \infty$. If the total mass of the system is M, then the centre of mass is

(a) $\frac{1}{6}\frac{m}{M}$ (b) $\frac{1}{5}\frac{m}{M}$

(c) $\frac{1}{3}\frac{m}{M}$ (d) $\frac{1}{2}\frac{m}{M}$

10. Consider a disc of radius R and mass M . A hole of radius $\frac{R}{3}$ is created in the disk such that the center of the hole is $\frac{R}{3}$ away from centre of the disk. The moment of inertia of the system along the axis perpendicular to the disc passing through the centre of the disc is

(a) $\frac{MR^2}{2}$ (b) $\frac{13}{27}MR^2$

(c) $\frac{1}{3}MR^2$ (d) $4MR^2$

11. A hydrometer executes simple harmonic motion when it is pushed down vertically in a liquid of density ρ. If the mass of hydrometer is m and the radius of the hydrometer tube is r , then the time period of oscillation is

(a) $T = 2\pi\sqrt{\frac{m}{\pi r^2 \rho\, g}}$ (b) $T = 2\pi\sqrt{\frac{\pi r^2 \rho\, g}{m}}$

(c) $T = \frac{1}{2\pi}\sqrt{\frac{m}{\pi r^2 \rho g}}$ (d) $T = \frac{1}{2\pi}\sqrt{\frac{\pi r^2 \rho g}{m}}$

12. An object undergoing simple harmonic motion takes 0.5 s to travel from one point of zero velocity to the next such point. The angular frequency of the motion is

(a) $\pi rads^{-1}$ (b) $2\pi rads^{-1}$

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

13. A projectile is thrown straight upward from the earth's surface with an initial speed $V = \alpha V_E$ where α is a constant and V_E is the escape speed. The projectile travels upto a height 800 km from earth's surface, before it comes to rest. The value of the constant α is (Radius of the earth = 6400 km)

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

14. Same tension is applied to the following four wires made of same material. The elongation is longest in

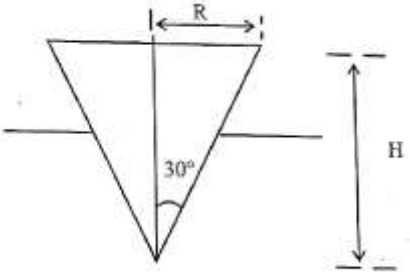
(a) Wire of length 50 cm and diameter 0.5 mm

(b) Wire of length 200 cm and diameter 2 mm

(c) Wire of length 300 cm and diameter 3 mm

(d) Wire of length 100 cm and diameter 1 mm

15. A cone with half the density of water is floating in water as shown in figure. It is depressed down by a small distance δ(≪ H) and released. The frequency of simple harmonic oscillations of the cone is



(a) $\frac{1}{2\pi}\sqrt{\frac{6\,g}{H}\frac{1}{4^{\frac{1}{3}}}}$ (b) $\frac{1}{2\pi}\sqrt{\frac{3\,g}{H}\frac{1}{4^{\frac{1}{3}}}}$

(c) $\frac{1}{2\pi}\sqrt{\frac{6\,g}{H}}$ (d) $\frac{1}{2\pi}\sqrt{\frac{g}{H}}$

16. Statement (A) : When the temperature increases the viscosity of gases increases and the viscosity of liquids decreases.

Statement (B) : Water does not wet an oily glass because cohesive force of oil is less than that of water.

Statement (C) : A liquid will wet a surface of a solid if the angle of contact is greater than $90°$.

(a) A, B, and C are false
(b) A and B false, C is true
(c) B and C false, A is true
(d) A and C false, B is true

17. A sphere of surface area $4\ m^2$ at temperature 400 K and having emissivity 0.5 is located in an environment of temperature 200 K . The net rate of energy exchange of the sphere is
(Stefan Boltzmann constant $\sigma = 5.67 \times 10^{-8} Wm^{-2}k^4$)

(a) 3260.8 W (b) 1632.4 W
(c) 2721.6 W (d) 4216.4 W

18. A Carnot engine operates between a source and a sink. The efficiency of the engine is 40% and the temperature of the sink is $27°$. If the efficiency is to be increased to 50% of then the temperature of the source must the increased by

(a) 80 K (b) 120 K
(c) 100 K (d) 160 K

19. A car engine has a power of 20 kW . The car makes a roundtrip of 1 hour. If the thermal efficiency of the engine is 40% and the ambient temperature is 300 K . The energy generated by fuel combustion is

(a) 180000 kJ K^{-1} (b) 240000 kJ K^{-1}
(c) 360000 kJ K^{-1} (d) 270000KJK^{-1}

20. The number of vibrational degrees of freedom of a diatomic molecule is

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

21. A body is suspended from a string of length 1 m and mass 2 g . The mass of the body to produce a fundamental mode of 100 Hz frequency in the string is (Acceleration due to gravity $= 10\ ms^{-2}$)

(a) 80 g (b) 4 kg
(c) 400 g (d) 8 kg

22. Electrostatic force between two identical charges placed in vacuum at distance of r is F. A slab of width $\frac{r}{5}$ and dielectric constant 9 is inserted between these two charges, then the force between the charges is

(a) F (b) $\frac{F}{g}$
(c) $\frac{25}{81}$ F (d) $\frac{25}{49}$ F

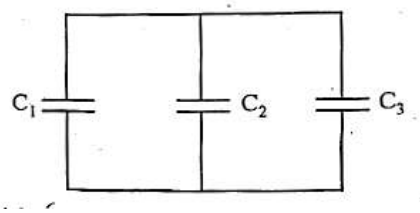
23. A ray is incident from a medium of refractive index 2 into a medium of refractive index 1 . The critical angle is

(a) $30°$ (b) $60°$ (c) $45°$ (d) $90°$

24. An electric dipole with dipole moment $5 \times 10^{-7} Cm$ is in the electric field of $2 \times 10^4 NC^{-1}$ at an angle of $60°$ with the direction of the electric field. The torque acting on the dipole is

(a) $9 \times 10^{-3} Nm$ (b) $1 \times 10^{-4} Nm$
(c) $8.66 \times 10^{-3} Nm$ (d) $2.88 \times 10^{-3} Nm$

25. A capacitor of capacitance $C_1 = 1\mu F$ is charged using a 9 V battery. C_1 is then removed from the battery & connected to capacitors C_2 and C_3 of $2\mu F$ and $3\mu F$ respectively as shown in the figure. Find the charge on C_3 after equilibrium has reached is

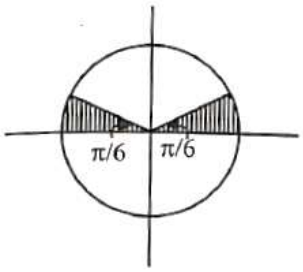


(a) $4.5 \times 10^{-6} C$ (b) $3.5 \times 10^{-6} C$
(c) $2.5 \times 10^{-6} C$ (d) $1.5 \times 10^{-5} C$

26. Two positive point charges of $10\mu C$ and $12\mu C$ are placed 10 cm apart in air. The work done to bring them 6 cm closer is

(a) 8.1 J (b) 16 .2 J
(c) 9 J (d) 13.5 J

27. Current density in a cylindrical wire of radius R varies with radial distance as $\beta(r + r_o)^2$. The current through the section of the wire shown in the figure is



(a) $\pi\beta\left[\frac{R^4}{12} + \frac{r_0^2R^2}{6} + \frac{2r_0R^3}{9}\right]$
(b) $\pi\beta\left[\frac{R^4}{6} + \frac{r_0^2R^2}{12} + \frac{r_0R^3}{9}\right]$
(c) $\pi\beta\left[\frac{R^4}{12} + \frac{r_0^2R^2}{12} + \frac{r_0R^3}{9}\right]$
(d) $\pi\beta\left[\frac{R^4}{8} + \frac{r_0^2R^2}{6} + \frac{r_0R^3}{12}\right]$

28. A cell can supply currents of 1 A and 0.5 A via resistances of 2.5Ω and 10Ω respectively. The internal resistance of the cell is

(a) 2Ω (b) 3Ω
(c) 4Ω (d) 5Ω

29. Two infinitely long wires each carrying the same current and pointing in $+y$ direction are placed in the xy-plane, at $x = -2$ cm and $x = 1$ cm. An electron is fired with speed U from the origin making an angle of $+45^\circ$ from the x-axis. The force on the electron at the instant it is fired is [B_0 is the magnitude of the field at origin due to the wire at $x = 1$ cm alone].

(a) $\frac{-eUB_0}{2\sqrt{2}}(\hat{i} - \hat{j})$ (b) $\frac{-eUB_0}{2}(\hat{i} - \hat{j})$
(c) $\frac{-eUB_0}{\sqrt{2}}(\hat{i} - \hat{j})$ (d) $-eUB_0(\hat{i} - \hat{j})$

30. Two electrons, e_1 and e_2 of mass m and charge q are injected into the perpendicular direction of the magnetic field B such that the kinetic energy of e_1 is double than that of e_2. The relation of their frequencies of rotation, f_1 and f_2 is

(a) $f_1 = f_2$ (b) $f_1 = 2f_2$
(c) $2f_1 = f_2$ (d) $4f_1 = f_2$

31. A compass needle oscillates 20 times per minute at a place where the dip is 45° and the magnetic field is B_1. The same needle oscillates 30 times per minute at a place where the dip is 30° and magnetic field is B_2. Then $B_1 : B_2$ is

(a) $9\sqrt{3} : 4\sqrt{2}$ (b) $4\sqrt{2} : 9\sqrt{3}$
(c) $3\sqrt{3} : 2\sqrt{2}$ (d) $2\sqrt{2} : 3\sqrt{3}$

32. A plane electromagnetic wave travels in free space along z-axis. At a particular point in space, the electric field along x-axis is $8.7 Vm^{-1}$. The magnetic field along y -axis is

(a) 2.9×10^{-8} T (b) 3×10^{-6} T
(c) 8.7×10^{-6} T (d) 3×10^{-5} T

33. A coil of inductance 0.1 H and resistance 110Ω is connected to a source of 110 V and 350 Hz . The phase difference between the voltage maximum and the current maximum is

(a) $\tan^{-1}(1.5)$ (b) $\tan^{-1}(0.5)$
(c) $\tan^{-1}(1.73)$ (d) $\tan^{-1}(2)$

34. If the average power per unit area delivered by an electromagnetic wave is $9240 Wm^{-2}$, then the amplitude of the oscillating magnetic field in EM wave is

(a) 4.4μ T (b) 6.6μ T
(c) 8.8μ T (d) 10.2μ T

35. A beam of light with intensity $10^{-3}Nm^{-2}$ and cross sectional area 20 cm^2 is incident on a fully reflective surface at angle 45°. Then the force exerted by the beam on the surface is

(a) 2.3×10^{-15} N
(b) 1.33×10^{-14} N
(c) 6.67×10^{-15} N
(d) 9.4×10^{-15} N

36. The metal which has the highest work function in the following is

(a) Cesium (Cs) (b) Sodium (Na)
(c) Aluminium (Al) (d) Platinum (Pt)

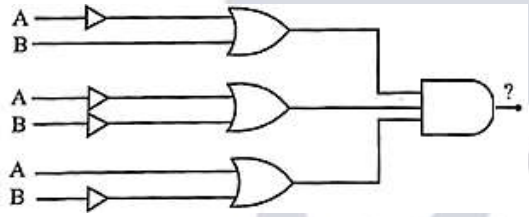
37. Energy of a stationary electron in the hydrogen atom is $E = -\frac{13.6}{n^2}$ eV then the energies required to excite the electron in hydrogen atom to (a) its second excited state and (b) ionized state respectively

(a) (i) ~ 10eV,(ii) 13.6 eV
(b) (i) ~ 12eV,(ii) 13.6 eV
(c) (i) ~ 12eV,(ii) 10.6 eV
(d) (i) ~ 8eV,(ii) 13.6 eV

38. The graph of $\ln\left(\frac{R}{R_0}\right)$ versus $\ln A$ is where R is radius of a nucleus, A is its mass number, and R_0 is constant

(a) A straight line (b) A circle of radius R
(c) A parabola (d) An ellipse

39. Output of following logic circuit is



(a) $(\bar{A} + B) + (\bar{A} + \bar{C}) + (B + \bar{C})$
(b) $(A + \bar{B}) \cdot (A + C) \cdot (\bar{B} + \bar{C})$
(c) $(\bar{A} + B) \cdot (\bar{A} + \bar{C}) \cdot (B + \bar{C})$
(d) None of these

40. The maximum number of TV signals, that can be transmitted along a co-axial cable is

(a) 100 (b) 125
(c) 140 (d) 90

Chemistry

41. If Δx is the uncertainity in position and Δv is the uncertainity in velocity of a particle are equal, the correct expression for uncertainity in momentum for the same particle is

(a) $\frac{1}{4}\sqrt{\frac{mh}{\pi}}$ (b) $\frac{1}{3}\sqrt{\frac{mh}{2}}$
(c) $\frac{1}{2}\sqrt{\frac{mh}{\pi}}$ (d) $\frac{1}{2}\sqrt{\frac{h}{m\pi}}$

42. The number of radial nodes, angular nodes of a 4f orbital are respectively

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

43. Lithium shows diagonal relationship with element ' X ' and aluminum with Y . X and Y respectively are

(a) Mg, Be (b) Be, Mg
(c) Na, Si (d) B, Be

44. The correct order of the metallic character of the elements Be, Al, Na, K is

(a) K > Na > Al > Be
(b) K > Al > Na > Be
(c) Al > K > Na > Be

(d) Na > K > Be > Al

45. Choose the correct option from the following

(a) KF is more covalent than KI

(b) $SnCl_4$ is less covalent than $SnCl_2$

(c) LiF is more covalent than KF

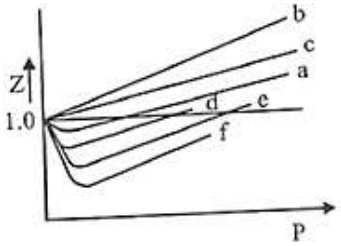
(d) $ZnCl_2$ is less covalent than NaCl

46. The bond lengths of C_2, N_2 and B_2 molecules are X_1, X_2 and X_3pm respectively. The correct order of their bond lengths is

(a) $X_3 > X_1 > X_2$ (b) $X_2 > X_3 > X_1$

(c) $X_1 > X_2 > X_3$ (d) $X_1 > X_3 > X_2$

47. Among the gases a, b, c, d, e and f, the gases that show only positive deviation from ideal behavior at all pressures in the graph are



(a) b, c only (b) b, c, a only

(c) d, e only (d) d, e, f only

48. The statement related to law of definite proportions is

(a) The ratio of oxygen in H_2O and H_2O_2 with respect to fixed mass of Hydrogen atom is a whole number

(b) % of oxygen in H_2O is constant irrespective of the source

(c) Equal volume of all gases at the same temperature and pressure should contain equal number of molecules

(d) Matter can neither be created nor destroyed.

49. What are the oxidation states of three Br atoms in Br_3O_8 molecule

(a) $+5, +6, +5$ (b) $+6, +4, +6$

(c) $+7, +2, +7$ (d) $+6, +3, +7$

50. Identify the reaction/process in which the entropy increases.

(a) $H(g) + H(g) \rightarrow H_2\ (g)$

(b) $H_2O\ (g) \rightarrow H_2O\ (s)$

(c) $H_2O\ (1) \rightarrow H_2O\ (g)$

(d) $A(g) + B(g) + C(s) \rightarrow 2D\ (s)$

51. State 1 ⇄ State 2 ⇄ State 3

$$\begin{pmatrix} \mathbf{T = 300\ K} \\ \mathbf{P = 15bar} \\ \mathbf{1mole} \end{pmatrix} \begin{pmatrix} \mathbf{T = 300\ K} \\ \mathbf{P = 10bar} \\ \mathbf{1mole} \end{pmatrix} \cdot \begin{pmatrix} \mathbf{T = 300\ K} \\ \mathbf{P = 5bar} \\ \mathbf{1mole} \end{pmatrix}$$

Above shows a cyclic process. Calculate the total work done during one complete cycle. (Assume a single step to reach the next state).

(a) $25/3$ L bar (b) $-25/3$ L bar

(c) $50/3$ L bar (d) None of these

52. The formation of ammonia from its constituent elements is an exothermic reaction. The effect of increase temperature on the reaction equilibrium is

(a) The rate of the forward reaction becomes zero

(b) No effect of temperature.

(c) Forward reaction is favored

(d) Backward reaction is favored

53. Equal volumes of 0.5 N acetic acid and 0.5 N sodium acetate are mixed. What is the pH of resultant solution? (pK_a of acetic acid $= 4.75$)

(a) 4.85 (b) 4.65

(c) 4.75 (d) 7.0

54. What are X and Y respectively in the following reactions

$\underline{X} + D_2O \rightarrow C_2D_2 + P \quad Y + D_2O \rightarrow CD_4 + Q$

(a) $AlCl_3, CaCl_2$ (b) Be_2C, Al_4C_3
(c) Al_4C_3, CaC_2 (d) CaC_2, Al_4C_3

55. Assertion (A) : $MgSO_4$ is readily soluble in water

Reason (R): The greater hydration enthalpy of Mg^{2+} ions overcome its lattice enthalpy.

(a) A and R both are correct and R is the correct explanation of A.
(b) A and R both are correct but R is not the correct explanation of A .
(c) A is correct but R is not correct.
(d) A is incorrect but R is correct.

56. Identify A and B from the following reaction

$NaNO_3 \xrightarrow{\Delta} xA + yB$

(a) $NaNO_2, O_2$ (b) Na_2O, NO_2
(c) Na_2O, NO (d) Na, NO_2

57. Identify the correct statements about Boron.

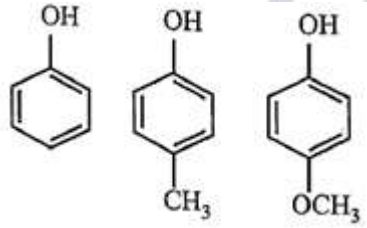
(I) It has high melting point.
(II) It has high density.
(III) It has high electrical conductivity
(IV) B-10 isotope of it has high ability to absorb neutrons

(a) I, II only (b) II, III only
(c) III, IV only (d) I, IV only

58. Which of the following tetrahalides does not exist?

(a) CCl_4 (b) $SiCl_4$
(c) $PbCl_4$ (d) PbI_4

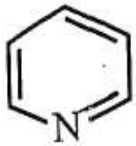
59. The correct order of acidity of the following is



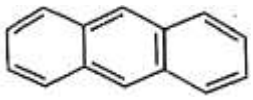
(I) (II) (III)

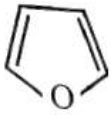
(a) III > II > I (b) II > III > I
(c) I > II > III (d) III > I > II

60. The compound or ion which is not aromatic in the following is

(a) 

(b) 

(c) 

(d) 

61. The number of network solids and ionic solids in the list given below is respectively

H_2O (ice), AlN, Cu, CaF_2, diamond, MgO, CCl_4, ZnS, Ag, NaCl, SiO_2

(a) 3,3 (b) 3,4
(c) 4,4 (d) 4,3

62. If molten NaCl contains $SrCl_2$ as impurity, crystallization can generate

(a) Anionic vacancies
(b) Cationic vacancies
(c) Metal excess defects

(d) Metal deficiency defects

63. At T(K) x g of a non-volatile solid (molar mass 78 g mol^{-1}) when added to 0.5 kg water, lowered its freezing point by 1.0°C. What is x (in g) ? (K_f of water at T(K) = 1.86 K $Kgmol^{-1}$)

(a) 10.48 (b) 20.96

(c) 41.92 (d) 5.24

64. Assertion (A) : Blood cells collapse when suspended in saline water

Reason (R): Cell membrane dissolves in saline water

(a) Both (A) and (R) are correct and R is the correct explanation of A

(b) Both (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 incorrect but (R) is correct

65. The reduction potential of hydrogen electrode at 25°C in a neutral solution is $(p_{H_2} = 1bar)$

(a) · 0.059 V (b) -0.059 V

(c) -0.413 V (d) 0.0 V

66. The rate constant for a zero -order reaction A → products is 0.0030 mol L^{-1} s^{-1}. How long it will take for the initial concentration of A to fall from 0.10 M to 0.075 M ?

(a) 10 s (b) 20 s

(c) 8.33 s (d) 1.33 s

67. The diameters range of colloidal particles is approximately.

(a) 1 to 1000 mm .

(b) 1000 to 2000 mm

(c) 2000 to 3000 mm

(d) 3000 to 4000 mm

68. Photographic plates are prepared by coating emulsion of which of the following in gelatin.

(a) AgBr (b) CuBr

(c) ZnB_2 (d) $FeBr_2$

69. What are x and y in the following reaction? $xPb_3O_4 \rightarrow yPbO + O_2$

(a) $x = 3, y = 6$ (b) $x = 2, y = 4$

(c) $x = 2, y = 5$ (d) $x = 2, y = 6$

70. Assertion (A) : HCl gas is dried by passing through concentrated H_2SO_4.

Reason (R): HCl^4 gas reacts with NH_3 that gives white fumes

(a) Both (A) and (R) are correct and (R) is the correct explanation of (A)

(b) Both (A) and (R) are correct and (R) is not the correct explanation of (A)

(c) (A) is correct but (R) is incorrect

(d) (A) is incorrect but (R) is correct

71. The catalyst used in the manufacture of polyethylene is a mixture of

(a) $Ti, Al(CH_3)_3$ (b) Ti, CH_3MgBr

(c) $TiCl_3, Si(CH_3)_4$ (d) $TiCl_4, Al(CH_3)_3$

72. Which of the following is correct related to the colours of $TiCl_3(X)[Ti(H_2O)_6]Cl_3(Y)$.

(a) X = Colourless Y = Colouored

(b) X = Colouored Y = Colouored

(c) X = Colourless Y = Colourless

(d) X = Colouored Y = Colourless

73. Which hormone tends to increase the blood glucose level in human?

(a) Insulin (b) Glucagon

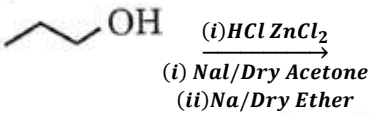
(c) Epinephrine (d) Estrogen

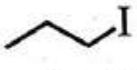
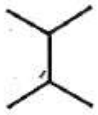
74. Which of the following molecules is eliminated during peptide bond formation?

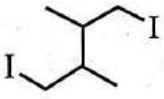
(a) H_2O (b) NH_3

(c) CH_3OH (d) CO_2

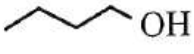
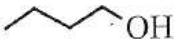
75. Identify the major product formed from the following



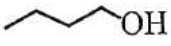
(a)  (b) 

(c)  (d) 

76. When 1-chloro butane is treated with aqueous KOH it gives P. However, when it is treated with alcoholic KOH it gives Q . Identify the products P and Q respectively

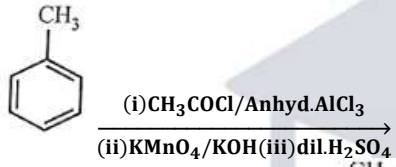
(a) P =  Q = 

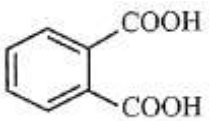
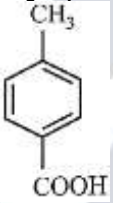
(b) P =  Q = 

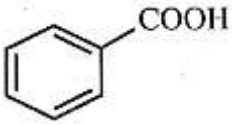
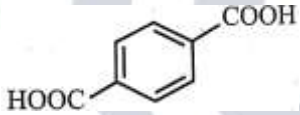
(c) P =  Q = 

(d) P =  Q = 

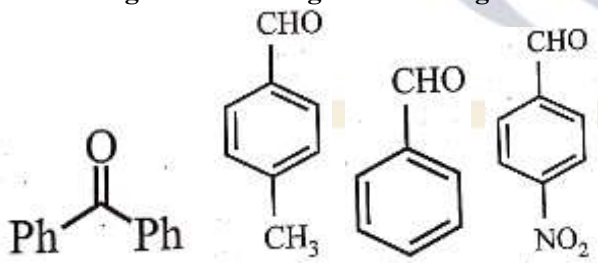
77. Identify the major product formed in the following reaction sequence



(a)  (b) 

(c)  (d) 

78. Arrange the following in increasing order of their reactivity for nucleophilic addition reaction

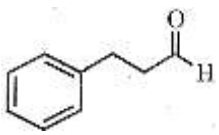
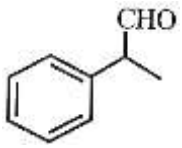


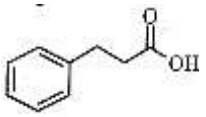
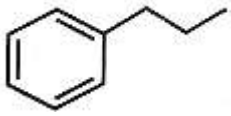
(a) (b) (c) (d)

(a) a < b < c < d (b) a < d < c < b

(c) c < b < a < d (d) c < a < b < d

79. In the presence of peroxide, styrene reacts with HBr to give X . When X reacted with magnesium in dry ether followed by CO_2 and hydrolysis gave Y . Treatment of Y with PCl_5 and then next with $H_2, Pd - BaSO_4$ gave Z . What is Z ?

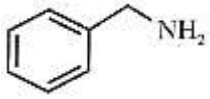
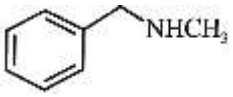
(a)  (b) 

(c)  (d) 

80. Arrange the following in decreasing order of their pK_b values

CH_3NH_2 $(CH_3)_3N$

(A) **(B)**

(c) (d)

(a) D > A > C > B (b) A > B > D > C

(c) D > C > B > A (d) A > C > D > B

Mathematics

81. The range of the real valued function $f(x) = \sqrt{\frac{x^2+2x+8}{x^2+2x+4}}$ is

(a) $\left[\sqrt{\frac{7}{3}}, \infty\right)$ (b) $(0, \infty)$

(c) $(1, \infty)$ (d) $\left(1, \sqrt{\frac{7}{3}}\right]$

82. If $f(x) = \sqrt{2-x^2}$ and $g(x) = \log(1-x)$ are two real valued functions then the domain of the function $(f+g)(x)$ is

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

(c) $(-\infty, 1)$ (d) $(1,2]$

83. For $i = 1,2,3$ and $j = 1,2,3$

If $a_i^2 + b_i^2 + c_i^2 = 1, a_1a_j + b_ib_j + c_ic_j = 0, \forall i \neq j$

and $A = \begin{bmatrix} a_1 & a_2 & a_3 \\ b_1 & b_2 & b_3 \\ c_1 & c_2 & c_3 \end{bmatrix}$ then $\det(AA^T) =$

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

84. If $A = \frac{1}{7}\begin{bmatrix} 3 & -2 & 6 \\ -6 & -3 & 2 \\ -2 & 6 & 3 \end{bmatrix}$, then

(a) $A^{-1} = A$

(b) $A^{-1} = A^T$

(c) A^{-1} does not exist

(d) $A^{-1} = -A$

85. If $A = \begin{bmatrix} \alpha^2 & 5 \\ 5 & -\alpha \end{bmatrix}$ and $\det(A^{10}) = 1024$, then $\alpha =$

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

86. Let $A = \begin{bmatrix} 5 & \sin^2\theta & \cos^2\theta \\ -\sin^2\theta & -5 & 1 \\ \cos^2\theta & 1 & 5 \end{bmatrix}$. Then maximum value of $\det(A)$ is

(a) -125 (b) 200

(c) $-\frac{255}{2}$ (d) 145

87. $iz^3 + z^2 - z + i = 0 \Rightarrow |z| =$

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

88. If $\frac{x-1}{3+i} + \frac{y-1}{3-i} = i$ then the true statement among the following is

(a) $x < 0, y < 0$ (b) $x < 0, y > 0$

(c) $x > 0, y < 0$ (d) $x > 0, y < 0$

89. If the identity $\cos^4\theta = a\cos 4\theta + b\cos 2\theta + c$ holds for some $a, b, c \in \mathbb{Q}$, then $(a, b, c) =$

(a) $\left(\frac{1}{8}, \frac{3}{8}, \frac{1}{2}\right)$ (b) $\left(\frac{1}{8}, \frac{1}{2}, \frac{3}{8}\right)$

(c) $\left(\frac{1}{2}, \frac{1}{8}, \frac{3}{8}\right)$ (d) $\left(\frac{1}{2}, \frac{3}{8}, \frac{1}{8}\right)$

90. The number of integer solutions of the equation $|1 - i|^x = 2^x$ is

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

91. If $f(x) = ax^2 + bx + c$ for some $a, b, c \in \mathbb{R}$ with $a + b + c = 3$ and $F(x + y) = F(x) + F(y) + xy \forall x, y \in R$. The $\sum_{n=1}^{10} F(n) =$

(a) 330 (b) 255

(c) 165 (d) 190

92. The number of positive real roots of the equation $3^{x+1} + 3^{-x+1} = 10$ is

(a) 3 (b) 2

(c) 1 (d) Infinitely many

93. The number of real roots of the equation $\sqrt{\frac{x}{1-x}} + \sqrt{\frac{1-x}{x}} = \frac{13}{6}$ is

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

94. If $4^x - 3^{x-\frac{1}{2}} = 3^{x+\frac{1}{2}} - 2^{2x-1}$ then the value of x is

(a) $\frac{7}{2}$ (b) $\frac{5}{2}$ (c) $\frac{1}{2}$ (d) $\frac{3}{2}$

95. The total number of permutations of n different things taken not more than r at a time, when each thing may be repeated any number of times is

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

(c) $\frac{n(n^r-1)}{n-1}$ (d) $\frac{(n^r-1)}{n-1}$

96. How many chords can be drawn through 21 points on a circle?

(a) 105 (b) 210

(c) 420 (d) 840

97. If a polygon of n sides has 560 diagonals, then $n =$

(a) 35 (b) 36 (c) 37 (d) 38

98. A person writes letters to 6 friends and addresses the corresponding envelopes. In how many ways can the letters be placed in the envelopes so that at least two of them are in the wrong envelopes? Notation: $D_n = n!\left(\sum_{i=0}^{n} \frac{(-1)^i}{i!}\right)$

(a) ${}^6C_4 \cdot D_2$ (b) $\sum_{r=3}^{6} {}^6C_{6-r} \cdot D_r$

(c) $\sum_{r=2}^{6} {}^6C_{6-r} \cdot D_r$ (d) ${}^6C_1 D_5 + {}^6C_0 \cdot D_6$

99. If $\frac{x^4+24x^2+28}{(x^2+1)^3} = \frac{Ax+B}{x^2+1} + \frac{Cx+D}{(x^2+1)^2} + \frac{Ex+F}{(x^2+1)^3}$ th the value of $A + B + C + D + E + F =$

(a) 21 (b) 22 (c) 28 (d) 29

100. The value of $\frac{\sin\theta + \sin 3\theta}{\cos\theta + \cos 3\theta}$ is

(a) $\cos 2\theta$ (b) $\cot 2\theta$

(c) $\tan 2\theta$ (d) $\operatorname{cosec}\theta + \sin\theta$

101. If $(1 + \tan 1^\circ)(1 + \tan 2^\circ) \ldots (1 + \tan 45^\circ) = 2^n$, then $n =$

(a) 0 (b) 32 (c) 23 (d) 2

102. $\frac{\cos\theta}{1-\tan\theta} + \frac{\sin\theta}{1-\cot\theta} =$

(a) $\cos\theta - \sin\theta$ (b) $\sin\theta - \cos\theta$

(b) $\cos\theta + \sin\theta$ (d) $(1 - \tan\theta)\sin\theta$

103. In a triangle ABC , if $a \neq b$, $\frac{a\cos A - b\cos B}{a\cos B - b\cos A} + \cos C =$

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

104. If $\operatorname{cosec} hx = \frac{4}{5}$, then $\sin hx =$

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

105. The value of $\frac{1+\tan hx}{1-\tan hx}$ is

(a) e^x (b) e^{-2x}

(c) e^{2x} (d) e^{-x}

106. If in a triangle ABC, $a = 2$, $b = 3$ and $c = 4$, then $\tan\left(\frac{A}{2}\right) =$

(a) $\sqrt{\frac{3}{15}}$ (b) $\sqrt{\frac{4}{15}}$

(c) $\sqrt{\frac{2}{15}}$ (d) $\sqrt{\frac{1}{15}}$

107. If the angles of a triangle ABC are in the ratio $1:2:3$, then the corresponding sides are in the ratio

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

(c) $1:\sqrt{3}:2$ (d) $1:2:\sqrt{3}$

108. In a triangle ABC, $r_1\cot\frac{A}{2} + r_2\cot\frac{B}{2} + r_3\cot\frac{C}{2} =$

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

109. The point of intersection of the lines $\bar{r} = 2\bar{b} + t(\bar{6c} - \bar{a})$ and $\bar{r} = \bar{a} + s(\bar{b} - 3\bar{c})$ is

(a) $\bar{a} + \bar{b} + \bar{c}$ (b) $\bar{b} - \bar{c} - 6\bar{a}$

(c) $2\bar{a} - \bar{b} + \bar{c}$ (d) $\bar{a} + 2\bar{b} - 6\bar{c}$

110. In quadrilateral ABCD, $\overline{AB} = \bar{a}, \overline{BC} = \bar{b}, \overline{DA} = \bar{a} - \bar{b}$, M is the midpoint of BC and X is a point on DM such that $\overline{DX} = \frac{4}{5}\overline{DM}$. Then the points A, X and C

(a) form an equilateral triangle

(b) are collinear

(c) form an isosceles triangle

(d) form a right- angled triangle

111. The vectors $3\bar{a} - 5\bar{b}$ and $2\bar{a} + \bar{b}$ are mutually perpendicular and the vectors $\bar{a} + 4\bar{b}$ and $-\bar{a} + \bar{b}$ are also mutually perpendicular then the acute angle between $\bar{a}$ and $\bar{b}$ is

(a) $\cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$

(b) $\cos^{-1}\left(\frac{9}{5\sqrt{43}}\right)$

(c) $\pi - \cos^{-1}\left(\frac{19}{5\sqrt{43}}\right)$

(d) $\pi - \cos^{-1}\left(\frac{9}{5\sqrt{43}}\right)$

112. Let $\bar{a} = x\bar{i} + y\bar{j} + z\bar{k}$ and $x = 2y$. If $|\bar{a}| = 5\sqrt{2}$ and $\bar{a}$ makes and angle of $135°$ with the z-axis then $\bar{a} =$

(a) $2\sqrt{3}\bar{i} + \sqrt{3}\bar{j} - 3\bar{k}$ (b) $2\sqrt{6}\bar{i} + \sqrt{6}\bar{j} - 6\bar{k}$

(c) $2\sqrt{5}\bar{i} + \sqrt{5}\bar{j} + 5\bar{k}$ (d) $2\sqrt{5}\bar{i} + \sqrt{5}\bar{j} + 5\bar{k}$

113. Let $\bar{a}, \bar{b}, \bar{c}$ be the position vectors of the vertices of a triangle ABC . Through the vertices, lines are drawn parallel to the sides to form the triangle $A'B'C'$. Then the centroid of $\Delta A'B'C'$ is

(a) $\frac{\bar{a}+\bar{b}+\bar{c}}{9}$ (b) $\frac{\bar{a}+\bar{b}+\bar{c}}{6}$

(c) $\frac{\bar{a}+\bar{b}+\bar{c}}{3}$ (d) $\frac{2(\bar{a}+\bar{b}+\bar{c})}{3}$

114. The mean deviation about the mean for the following data: $5, 6, 7, 8, 6, 9, 13, 12, 15$ is

(a) 1.55 (b) 2.88

(c) 3.89 (d) 5

115. A box contains 100 balls, numbered from 1 to 100 . If 3 balls are selected one after the other at random with replacement from the box, then the probability that the sum of the three numbers on the balls selected

from the box is an odd number, is

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

116. In a lotery, containing 35 tickets, exactly 10 tickets bear a prize. If a ticket is drawn at random, then the probability of not getting a prize is

(a) $\frac{1}{10}$ (b) $\frac{2}{5}$ (c) $\frac{2}{7}$ (d) $\frac{5}{7}$

117. A bag contains 7 green and 5 black balls. 3 balls are drawn then the prone after the other. If the balls are not replaced, then the probability of all three balls being green is

(a) $\frac{343}{1720}$ (b) $\frac{21}{36}$

(c) $\frac{12}{35}$ (d) $\frac{7}{44}$

118. If x is chosen at random from the set $\{1, 2, 3, 4\}$ and y is chosen at random from the set $\{5, 6, 7\}$, then the probability that xy will be even is

(a) $\frac{5}{6}$ (b) $\frac{1}{6}$ (c) $\frac{1}{2}$ (d) $\frac{2}{3}$

119. The discrete random variables X and Y are independent from one another and are defined as $X \sim B(16, 0.25)$ and $Y \sim P(2)$. Then the sum of the variances of X and Y is

(a) 4 (b) 5 (c) 6 (d) 2

120. If 6 is the mean of a Poisson distribution, then $P(X \geq 3) =$

(a) $\frac{1-25}{e^6}$ (b) $e^{-6} - 25$

(c) $24 - 25e^6$ (d) e^{-3}

121. A stick of length r units slides with its ends on coordinate axes. Then the locus of the midpoint of the stick is a curve whose length is

(a) $2\pi r$ (b) πr^2

(c) $\frac{1}{2}\pi r$ (d) πr

122. The least distance from origin to a point on the line $y = x + 3$ which lies at a distance of 2 units from $(0, 3)$ is

(a) $13 + 6\sqrt{2}$ (b) $10 + 6\sqrt{2}$

(c) $10 - 6\sqrt{2}$ (d) $13 - 6\sqrt{2}$

123. Starting from the point $A(-3, 4)$, a moving object touches $2x + y - 7 = 0$ at B and reaches the point C $(0, 1)$. If the object travels along the shortest path, the distance between A and B is

(a) $\frac{68}{\sqrt{170}}$ (b) $\frac{9}{\sqrt{5}}$

(c) $3\sqrt{2}$ (d) $\frac{6}{\sqrt{5}}$

124. Suppose a triangle is formed by $x + y = 10$ and the coordinate axes. Then the number of points (x, y) where x and y are natural numbers, lying inside the triangle is

(a) 36 (b) 55 (c) 45 (d) 30

125. If the lines represented by $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ intersect on the x -axis, which of the following is in general incorrect

(a) $abc = 2fgh$ (b) $g^2 = ac$

(c) $af^2 = ch^2$ (d) $af^2 + ch^2 = 2fgh$

126. For $\alpha \in \left[0, \frac{\pi}{2}\right]$, the angle between the lines represented by $[x\cos\theta - y][(\cos\theta + \tan\alpha)x - (1 - \cos\theta \cdot \tan\alpha)y] = 0$ is

(a) α (b) θ

(c) $\theta + \alpha$ (d) $\theta - \alpha$

127. The Locus of centers of the circles, possessing the same area and having $3x - 4y + 4 = 0$ and $6x - 8y - 7 = 0$ as their common tangent, is

(a) $12x - 16y - 15 = 0$
(b) $3x - 4y + \frac{11}{2} = 0$
(c) $12x - 16y + 15 = 0$
(d) None of these

128. For any two nonzero real numbers a and b if this line $\frac{x}{a} + \frac{y}{b} = 1$ is a tangent to the circle $x^2 + y^2 = 1$, then which of the following is true?

(a) $\left(\frac{1}{a}, \frac{1}{b}\right)$ lies inside the circle
(b) (a, b) lies inside the circle
(c) $\left(\frac{1}{a}, \frac{1}{b}\right)$ lies on the circle
(d) (a, b) lies on the circle

129. The length of the intercept on the line $4x - 3y - 10 = 0$ by the circle $x^2 + y^2 - 2x + 4y - 26 = 0$ is

(a) 5 (b) 2 (c) 10 (d) None of these

130. The pole of the line $\frac{x}{a} + \frac{y}{b} = 1$ with respect of the circle $x^2 + y^2 = c^2$ is

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

131. If the tangent at the point P on the circle $x^2 + y^2 + 6x + 6y = 2$ meets the straight line $5x - 2y + 6 = 0$ at a point Q on the y-axis, then the length of PQ is

(a) 5 (b) 6 (c) 4 (d) 3

132. Suppose a parabola with focus at $(0, 0)$ has $x - y + 1 = 0$ as its tangent at the vertex. Then the equation of its directrix is

(a) $x - y + 2 = 0$ (b) $x - y - 2 = 0$
(c) $x - y + 3 = 0$ (d) $x - y + 4 = 0$

133. The eccentric angle of a point on the ellipse $x^2 + 3y^2 = 6$ lying at a distance of 2 units from its centre is

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

134. Let origin be the centre, $(\pm 3, 0)$ be the foci and $\frac{3}{2}$ be the eccentricity of a hyperbola. Then the line $2x - y - 1 = 0$

(a) intersects the hyperbola at two points
(b) does not intersect the hyperbola
(c) touches the hyperbola
(d) passes through the vertex of the hyperbola

135. The locus of a variable point whose chord of contact w.r.t the hyperbola $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ subtends a right angle at the origin is

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

136. If the point $(a, 8, -2)$ divides the line segment joining the points $(1, 4, 6)$ and $(5, 2, 10)$ in the ratio m : n then $\frac{2m}{n} - \frac{a}{3} =$

(a) -7 (b) 1 (c) -2 (d) 3

137. If (a, b, c) are the direction ratios of a linint $P(a, 3b, 2c)$ points $(4, 3, -5)$ and $(-2, 1, -8)$ then the point $P(a, 3\,b, 2c$ lies on the plane

(a) $x + y + z = 0$ (b) $x + y - 2z = 0$
(c) $x + 2y + 3z = 0$ (d) $x - 2y + 3z = 0$

138. The x-intercept of a plane π passing through the point $(1, 1, 1)$ is $\frac{5}{2}$ and the perpendicular distance from the origin to the plane π is $\frac{5}{7}$. If the y-intercept of the plane π is negative and the z-intercept is positive then

its y-intercept is

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

139. **Let $f: R^+ \to R^+$ be a function satisfying $f(x) - x = \lambda$ (constant), $\forall x \in R^+$ and $f(xf(y)) = f(xy) + x$, $\forall x, y \in R^+$. Then $\lim_{x\to 0} \frac{(f(x))^{\frac{1}{3}}-1}{(f(x))^{\frac{1}{2}}-1} =$**

(a) $\frac{1}{3}$ (b) 0 (c) $\frac{2}{3}$ (d) 1

140. **If $\lim_{x\to 0} \frac{|x|}{\sqrt{x^4+4x^2+5}} = k$, $\lim_{x\to 0} x^4 \sin\left(\frac{1}{3\sqrt{x}}\right) = l$, Then $k + 1 =$**

(a) 0 (b) 1 (c) -1 (d) 5

141. **If $\lim_{n\to\infty} x^n \log_e x = 0$, then $\log_x 12 =$**

(a) Negative

(b) Positive

(c) Zero

(d) any value between -1 and 1

142. **If $f(x) = \cot^{-1}\left(\frac{x^2+x^{-x}}{2}\right)$, then $f'(1) =$**

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

143. **If $f(x) = \text{Max}\{3 - x, 3 + x, 6\}$ is not differentiable at $x = a$, and $x = b$, then $|a| + |b| =$**

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

144. **If $x^3 - 2x^2y^2 + 5x + y - 5 = 0$, then at $(1, 1) y''(1) =$**

(a) $\frac{-197}{27}$ (b) $\frac{125}{31}$

(c) 12 (d) $\frac{-238}{27}$

145. **If the curves $y = x^3 - 3x^2 - 8x - 4$ and $y = 3x^2 + 7x + 4$ touch each other at a point P then the equation of common tangent at P is**

(a) $x - y + 1 = 0$ (b) $2x - y + 1 = 0$

(c) $x + y + 1 = 0$ (d) $2x + y + 1 = 0$

146. **If $ax + by = 1$ is a normal to the parabola $y^2 = 4px$ then the condition is**

(a) $4ab = a^2 + b^2$

(b) $4pab + ab^3 = a^2 b^2$

(c) $pa^3 = b^2 - 2pab^2$

(d) $pa^2 + 4pa = a + b$

147. **The maximum value of $f(x) = \frac{x}{1+4x+x^2}$ is**

(a) $\frac{1}{4}$ (b) $\frac{1}{5}$ (c) $\frac{1}{6}$ (d) $\frac{1}{7}$

148. **The minimum value of $f(x) = x + \frac{4}{x+2}$ is**

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

149. **The condition that $f(x) = ax^3 + bx^2 + cx + d$ has n_0 extreme value is**

(a) $b^2 - 4ac$ (b) $b^2 = 3ac$

(c) $b^2 < 3ac$ (d) $b^2 > 3ac$

150. **Assertion (A) :** if $I_n = \int \cot^n x dx$, then $I_6 + I_4 = \frac{-\cot^5 x}{5}$

Reason (R): $\int \cot^n x dx = \frac{-\cot^{n-1} x}{n} - \int \cot^{n-2} x dx$

(a) A is false, R is false

(b) A is true, R is true

(c) A is true, R is false

(d) A is false, R is true

151. If $I_n = \int \tan^n x dx$, and $I_0 + I_1 + 2I_2 + 2I_3 + 2I_4 + I_5 + I_6 = \sum_{K=1}^{n} \frac{\tan^K x}{K}$, then $n =$

(a) 6 (b) 5 (c) 4 (d) 3

152. $\int \frac{e^{\cot x}}{\sin^2 x}(2\log \operatorname{cosec} x + \sin 2x)dx =$

(a) $-2e^{\cot x}\log(\operatorname{cosec}^2 x) + C$

(b) $-2e^{\cot x}\log(\operatorname{cosec} x) + C$

(c) $-2e^{\cot x}\log(\operatorname{cosec} x + \sin x) + C$

(d) $-2e^{\cot x}\log(\operatorname{cosec} x - \cot x) + C$

153. The parametric form of a curve is $x = \frac{t^3}{t^2-1}, y = \frac{t}{t^2-1}$, then $\int \frac{dx}{x-3y} =$

(a) $\frac{1}{2}\log(t^2 - 1) + C$

(b) $2\log\left(t(t^2 - 1)\right) + C$

(c) $\frac{1}{4}\log\left(\frac{t}{t^2-3}\right) + C$

(d) $\frac{5}{2}\log\left(t + \frac{1}{t^2}\right) + C$

154. $\int_0^1 a^k x^k dx =$

(a) $\lim_{n\to\infty} \frac{a^k(1+2^k+3^k\ldots+n^k)}{n^{k+1}}$

(b) $\lim_{n\to\infty} \frac{a^k+a^k+\cdots+a^k}{n^{k+1}}$

(c) $\lim_{n\to\infty} \frac{1}{n}\sum\left(\frac{r}{n}\right)^k$

(d) $\lim_{n\to\infty} \frac{1}{n}\sum\left(\frac{2r}{n}\right)^k$

155. Let α and $\beta(\alpha < \beta)$ are roots of $18x^2 - 9\pi x + \pi^2 = 0$, $f(x) = x^2, g(x) = \cos x$. Then $\int_a^\beta x(g \circ f(x))dx =$

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

(c) $\frac{2+\sqrt{3}}{2}$ (d) $\frac{1}{2}\left(\sin\frac{\pi^2}{9} - \sin\frac{\pi^2}{36}\right)$

156. $\int_0^\pi x\left(\sin^2(\sin x) + \cos^2(\cos x)\right)dx =$

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

157. $\lim_{n\to\infty}\left(\frac{1}{1+n^5} + \frac{2^4}{2^5+n^5} + \frac{3^4}{3^5+n^5} + \cdots + \frac{n^4}{n^5+n^5}\right) =$

(a) $-\log 3$ (b) $\frac{1}{3}\log 5$

(c) $\frac{1}{2}\log 5$ (d) $\log\sqrt[5]{2}$

158. If the solution of $\frac{dy}{dx} - y\log_e 0.5 = 0, y(0) = 1$, and $y(x) \to k$, as $x \to \infty$ then $k =$

(a) ∞ (b) -1 (c) 1 (d) 0

159. At any point (x, y) on a curve if the length of the subnormal is $(x - 1)$ and the curve passes through $(1, 2)$ then the curve is a conic. A vertex of the curve is

(a) (1,0) (b) (0,1)

(c) $(\sqrt{5}, 0)$ (d) $(0, \sqrt{5})$

160. $y = Ae^x + Be^{-2x}$ satisfies which of the following differential equations?

(a) $\frac{d^2y}{dx^2} - \frac{dy}{dx} + 2y = 0$ (b) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} - y = 0$

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