Physics

1. **A force F is applied on a square plate of length L. If the percentage error in the determination of L is 3% and in F is 4%, then permissible error in the calculation of pressure is**
(a) 13% (b) 10%
(c) 7% (d) 12%

2. **A positive charge Q is placed on a conducting spherical shell with inner radius R_1 and outer radius R_2. A particle with charge q is placed at the center of the spherical cavity. The magnitude of the electric field at a point in the cavity, a distance r from center is**
(a) zero (b) $\frac{Q}{4\pi\varepsilon_0 r^2}$
(c) $\frac{q}{4\pi\varepsilon_0 r^2}$ (d) $\frac{(q+Q)}{4\pi\varepsilon_0 r^2}$

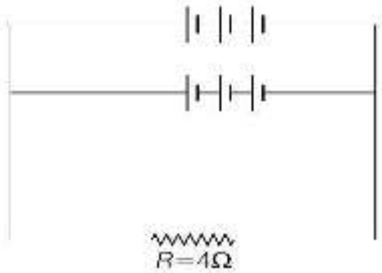
3. **A swimmer wants to cross a 200 m wide river which is flowing at a speed of 2 m/s. The velocity of the swimmer with respect to the river is 1 m/s. How far from the point directly opposite to the starting point does the swimmer reach the opposite bank?**
(a) 200 m (b) 400 m
(c) 600 m (d) 800 m

4. **A coil having n turns and resistance RΩ is connected with a galvanometer of resistance 4RΩ. This combination is moved in time t seconds from a magnetic flux ϕ_1 Weber to ϕ_2 Weber. The induced current in the circuit is**
(a) $\frac{\phi_2-\phi_1}{5Rnt}$ (b) $-\frac{n(\phi_2-\phi_1)}{5Rt}$
(c) $-\frac{(\phi_2-\phi_1)}{Rnt}$ (d) $-\frac{n(\phi_2-\phi_1)}{Rt}$

5. **A simple pendulum of length 1 m is freely suspended from the ceiling of an elevator. The time period of small oscillations as the elevator moves up with an acceleration of $2\ m/s^2$ is (use $g = 10\ m/s^2$)**
(a) $\frac{\pi}{\sqrt{5}}$ s (b) $\sqrt{\frac{2}{5}}\pi$ s
(c) $\frac{\pi}{\sqrt{2}}$ s (d) $\frac{\pi}{\sqrt{3}}$ s

6. **Consider a metal ball of radius r moving at a constant velocity v in a uniform magnetic field of induction $\bar{B}$. Assuming that the direction of velocity forms an angle α with the direction of $\bar{B}$, the maximum potential difference between points on the ball is**
(a) $r|\bar{B}||\bar{v}|\sin\alpha$ (b) $|\bar{B}||\bar{v}|\sin\alpha$
(c) $2r|\bar{B}||\bar{v}|\sin\alpha$ (d) $2r|\bar{B}||\bar{v}|\cos\alpha$

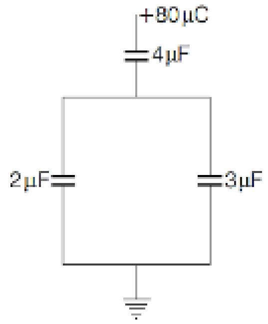
7. **Each of the six ideal batteries of emf 20 V is connected to an external resistance of 4Ω as shown in the figure. The current through the resistance is**



(a) 6 A (b) 3 A
(c) 4 A (d) 15 A

8. **The energy that should be added to an electron to reduce its de-Broglie wavelength from 1 nm to 0.5 nm is**
(a) four-times the initial energy
(b) equal to the initial energy
(c) two-times the initial energy
(d) three-times the initial energy

9. **In the given circuit, a charge of +80μC is given to upper plate of a 4μ F capacitor. At steady state, the charge on the upper plate of the 3μ F capacitor is**



(a) 60μC (b) 48μC
(c) 80μC (d) 0μC

10. The Young's modulus of a material is $2 \times 10^{11}\ \mathrm{N/m^2}$ and its elastic limit is $1 \times 10^{8}\ \mathrm{N/m^2}$. For a wire of 1 m length of this material, the maximum elongation achievable is
(a) 0.2 mm (b) 0.3 mm
(c) 0.4 mm (d) 0.5 mm

11. A wooden box lying at rest on an inclined surface of a wet wood is held at static equilibrium by a constant force F applied perpendicular to the incline. If the mass of the box is 1 kg, the angle of inclination is 30° and the coefficient of static friction between the box and the inclined plane is 0.2, the minimum magnitude of F is (Use $g = 10\ \mathrm{m/s^2}$)
(a) 0 N, as 30° is less than angle of repose
(b) ≥ 1 N
(c) ≥ 3.3 N
(d) ≥ 16.3 N

12. A meter scale made of steel, reads accurately at 25°C. Suppose in an experiment an accuracy of 0.06 mm in 1 m is required, the range of temperature in which the experiment can be performed with this meter scale is (Coefficient of linear expansion of steel is $11 \times 10^{-6}/{}^\circ\mathrm{C}$)
(a) 19°C to 31°C (b) 25°C to 32°C
(c) 18°C to 25°C (d) 18°C to 32°C

13. Consider a solenoid carrying current supplied by a DC source with a constant emf containing iron core inside it. When the core is pulled out of the solenoid, the change in current will
(a) remain same (b) decrease
(c) increase (d) modulate

14. A parallel beam of light of intensity I_0 is incident on a coated glass plate. If 25% of the incident light is reflected from the upper surface and 50% of light is reflected from the lower surface of the glass plate, the ratio of maximum to minimum intensity in the interference region of the reflected light is
(a) $\left(\dfrac{\frac{1}{2}+\sqrt{\frac{3}{8}}}{\frac{1}{2}-\sqrt{\frac{3}{8}}}\right)^2$ (b) $\left(\dfrac{\frac{1}{4}+\sqrt{\frac{3}{8}}}{\frac{1}{2}-\sqrt{\frac{3}{8}}}\right)^2$
(c) $\frac{5}{8}$ (d) $\frac{8}{5}$

15. A thermocol box has a total wall area (including the lid) of $1.0\ \mathrm{m^2}$ and wall thickness of 3 cm. It is filled with ice at 0°C. If the average temperature outside the box is 30°C throughout the day, the amount of ice that melts in one day is [Use $K_{\text{thermocol}} = 0.03\ \mathrm{W/mK}$, $L_{\text{fusion (ice)}} = 3.00 \times 10^5\ \mathrm{J/kg}$]
(a) 1 kg (b) 2.88 kg
(c) 25.92 kg (d) 8.64 kg

16. Which of the following is emitted, when ${}^{239}_{94}\mathrm{Pu}$ decays into ${}^{235}_{92}\mathrm{U}$?
(a) Gamma ray (b) Neutron
(c) Electron (d) Alpha particle

17. An AC generator 10 V (rms) at 200rad/s is connected in series with a 50Ω resistor, a 400 mH inductor and a 200μ F capacitor. The rms voltage across the inductor is
(a) 2.5 V (b) 3.4 V
(c) 6.7 V (d) 10.8 V

18. A wire has resistance of 3.1Ω at 30°C and 4.5Ω at 100°C. The temperature coefficient of resistance of the wire is

(a) $0.008^{\circ}C^{-1}$ (b) $0.0024^{\circ}C^{-1}$
(c) $0.0032^{\circ}C^{-1}$ (d) $0.0064^{\circ}C^{-1}$

19. An object is thrown vertically upward with a speed of $30\ m/s$. The velocity of the object half-a-second before it reaches the maximum height is
(a) $4.9\ m/s$ (b) $9.8\ m/s$
(c) $19.6\ m/s$ (d) $25.1\ m/s$

20. An electron collides with a hydrogen atom in its ground state and excites it to $n = 3$ state. The energy given to the hydrogen atom in this inelastic collision (neglecting the recoil of hydrogen atom) is
(a) 10.2 eV (b) 12.1 eV
(c) 12.5 eV (d) 13.6 eV

21. Consider the motion of a particle described by $x = a\cos t, y = a\sin t$ and $z = t$. The trajectory traced by the particle as a function of time is
(a) helix (b) circular
(c) elliptical (d) straight line

22. Consider a reversible engine of efficiency $\frac{1}{6}$. When the temperature of the sink is reduced by $62^{\circ}C$, its efficiency gets doubled. The temperature of the source and sink respectively are
(a) 372 K and 310 K (b) 273 K and 300 K
(c) 99°C and 10°C (d) 200°C and 37°C

23. Consider a light source placed at a distance of 1.5 m along the axis facing the convex side of a spherical mirror of radius of curvature 1 m . The position (s'), nature and magnification (m) of the image are
(a) $s' = 0.375$ m, virtual, upright, $m = 0.25$
(b) $s' = 0.375$ m, real, inverted, $m = 0.25$
(c) $s' = 3.75$ m, virtual, inverted, $m = 2.5$
(d) $s' = 3.75$ m, real, upright, $m = 2.5$

24. An office room contains about 2000 moles of air. The change in the internal energy of this much air when it is cooled from $34^{\circ}C$ to $24^{\circ}C$ at a constant pressure of 1.0 atm is [Use $\gamma_{air} = 1.4$ and universal gas constant $= 8.314\ J/mol - K$]
(a) -1.9×10^{5} J (b) $+1.9 \times 10^{5}$ J
(c) -4.2×10^{5} J (d) $+0.7 \times 10^{5}$ J

25. A ball is thrown at a speed of $20\ m/s$ at an angle of 30° with the horizontal. The maximum height reached by the ball is (Use $g = 10\ m/s^2$)
(a) 2 m (b) 3 m
(c) 4 m (d) 5 m

26. A horizontal pipeline carrying gasoline has a cross-sectional diameter of 5 mm . If the viscosity and density of the gasoline are 6×10^{-3} Poise and $720\ kg/m^3$ respectively, the velocity after which the flow becomes turbulent is
(a) $> 1.66\ m/s$ (b) $> 3.33\ m/s$
(c) $> 1.6 \times 10^{-3}\ m/s$ (d) $> 0.33\ m/s$

27. A piece of copper and a piece of germanium are cooled from room temperature to 80 K . Then, which one of the following is correct?
(a) Resistance of each will increase
(b) Resistance of each will decrease
(c) Resistance of copper will decrease while that of germanium will increase
(d) Resistance of copper will increase while that of germanium will decrease

28. A beam of light propagating at an angle α_1 from a medium 1 through to another medium 2 at an angle α_2. If the wavelength of light in medium 1 is λ_1, then the wavelength of light in medium 2, (λ_2), is
(a) $\frac{\sin\alpha_2}{\sin\alpha_1}\lambda_1$ (b) $\frac{\sin\alpha_1}{\sin\alpha_2}\lambda_2$
(c) $\left(\frac{\alpha_1}{\alpha_2}\right)\lambda_1$ (d) λ_1

29. An amplitude modulated signal consists of a message signal of frequency 1 KHz and peak voltage of 5 V , modulating a carrier frequency of 1 MHz and peak voltage of 15 V . The correct description of this signal is
(a) $5[1 + 3\sin(2\pi 10^6 t)]\sin(2\pi 10^3 t)$
(b) $15\left[1 + \frac{1}{3}\sin(2\pi 10^3 t)\right]\sin(2\pi 10^6 t)$

(c) $[5+15\sin(2\pi 10^3 t)]\sin(2\pi 10^6 t)$
(d) $[15+5\sin(2\pi 10^6 t)]\sin(2\pi 10^3 t)$

30. Which of the following principles is being used in Sonar Technology?
(a) Newton's laws of motion
(b) Reflection of electromagnetic waves
(c) Law's of thermodynamics
(d) Reflection of ultrasonic waves

31. A particle of mass M is moving in a horizontal circle of radius R with uniform speed v. When the particle moves from one point to a diametrically opposite point, its
(a) momentum does not change
(b) momentum changes by 2 MV
(c) kinetic energy changes by $\frac{Mv^2}{4}$
(d) kinetic energy changes by Mv^2

32. A billiard ball of mass M, moving with velocity v_1 collides with another ball of the same mass but at rest. If the collision is elastic, the angle of divergence after the collision is
(a) 0° (b) 30° (c) 90° (d) 45°

33. A planet of mass m moves in a elliptical orbit around an unknown star of mass M such that its maximum and minimum distances from the star are equal to r_1 and r_2 respectively. The angular momentum of the planet relative to the centre of the star is
(a) $m\sqrt{\frac{2GMr_1r_2}{r_1+r_2}}$ (b) 0
(c) $m\sqrt{\frac{2GM(r_1+r_2)}{r_1r_2}}$ (d) $\sqrt{\frac{2GMmr_1}{(r_1+r_2)r_2}}$

34. Consider a frictionless ramp on which a smooth object is made to slide down from an initial height h. The distance d necessary to stop the object on a flat track (of coefficient of friction μ), kept at the ramp end is
(a) h/μ (b) μh
(c) $\mu^2 h$ (d) $h^2\mu$

35. A generator with a circular coil of 100 turns of area 2×10^{-2} m^2 is immersed in a 0.01 T magnetic field and rotated at a frequency of 50 Hz . The maximum emf which is produced during a cycle is
(a) 6.28 V (b) 3.44 V
(c) 10 V (d) 1.32 V

36. A sound wave of frequency v Hz initially travels a distance of 1 km in air. Then, it gets reflected into a water reservoir of depth 600 m . The frequency of the wave at the bottom of the reservoir is (V_{air} = 340 m/sV_{water} = 1484 m/s)
(a) > v Hz
(b) < vHz
(c) v Hz
(d) 0 (the sound wave gets attenuated by water completely)

37. Which of the following statement is not true?
(a) the resistance of an intrinsic semiconductor decreases with increase in temperature
(b) doping pure Si with trivalent impurities gives p-type semiconductor
(c) the majority carriers in n-type semiconductors are holes
(d) a p-njunction can act as a semiconductor diode

38. The deceleration of a car traveling on a straight highway is a function of its instantaneous velocity v given by $\omega = a\sqrt{v}$, where a is a constant. If the initial velocity of the car is 60 km/h, the distance of the car will travel and the time it takes before it stops are
(a) $\frac{2}{3}$m, $\frac{1}{2}$s (b) $\frac{3}{2a}$m, $\frac{1}{2a}$s
(c) $\frac{3a}{2}$ m, $\frac{a}{2}$ s (d) $\frac{2}{3a}$m, $\frac{2}{a}$s

39. A current carrying wire in its neighbourhood produces
(a) electric field
(b) electric and magnetic fields
(c) magnetic field
(d) no field

40. Consider a particle on which constant forces $F_1 = \hat{i} + 2\hat{j} + 3\hat{k}$ N and $F_2 = 4\hat{i} - 5\hat{j} - 2\hat{k}$ N act together resulting in a displacement from position $r_1 = 20\hat{i} + 15\hat{j}$ cm to $r_2 = 7\hat{k}$ cm. The total work done on the particle is

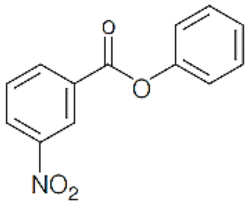
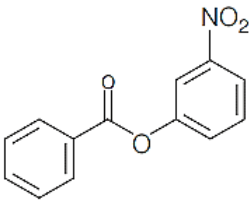
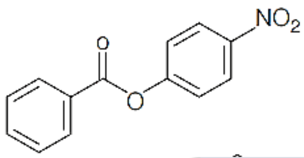
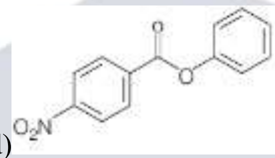
(a) -0.48 J (b) +0.48 J
(c) -4.8 J (d) +4.8 J

Chemistry

41. Which of the following conditions are correct for real solutions showing negative deviation from Raoult's law?

(a) $\Delta H_{Mix} < 0; \Delta V_{Mix} > 0$
(b) $\Delta H_{Mix} > 0; \Delta V_{Mix} > 0$
(c) $\Delta H_{Mix} > 0; \Delta V_{Mix} < 0$
(d) $\Delta H_{Mix} < 0; \Delta V_{Mix} < 0$

42. Nitration of phenyl benzoate yields the product

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

43. The electronic configuration of $_{59}$Pr (praseodimium) is

(a) $[[_{54}Xe]]4f^2 5d^1 6s^2$ (b) $[_{54}Xe]4f^1 5d^2 6s^2$
(c) $[[_{54}Xe]]4f^3 6s^2$ (d) $[[_{54}Xe]]4f^3 5d^2$

44. Which of the following is the most basic oxide ?

(a) SO_3 (b) SeO_3
(c) PoO (d) TeO

45. The element that forms stable compounds in low oxidation state is

(a) Mg (b) Al (c) Ga (d) TI

46. Atomic radius (pm) of Al, Si, N and F respectively is

(a) 117,143,64,74 (b) 143,117,74,64
(c) 143,47,64,74 (d) 64,74,117,143

47. Reaction of calgon with hard water containing Ca^{2+} ions produce

(a) $[Na_2CaP_6O_{18}]^{2-}$ (b) $Ca_2(PO_4)_3$
(c) $CaCO_3$ (d) $CaSO_4$

48. Which of the following statement(s) is/are true

(a) The pressure of a fixed amount of an ideal gas is proportional to its temperature only
(b) Frequency of collisions increases in proportion to the square root of temperature
(c) The value of van der Waal's constant ' a ' is smaller for ammonia than for nitrogen
(d) If a gas is expanded at constant temperature, the kinetic energy of the molecules decrease

49. Conversion of esters to aldehydes can be accomplished by

(a) Stephen reduction
(b) Rosenmund reduction
(c) Reduction with lithium aluminium hydride
(d) Reduction with diisobutyl aluminium hydride

50. Consider the following electrode processes of a cell,

$$Cl^- \rightarrow \frac{1}{2}Cl_2 + e^- \; [MCl + e^- \rightarrow M + Cl^-]$$

If EMF of this cell is -1.140 V and E° value of the cell is -0.55 V at 298 K , the value of the equilibrium constant of the sparingly soluble salt MCl is in the order of

(a) 10^{-10} (b) 10^{-8}
(c) 10^{-7} (d) 10^{-11}

51. Which of the following is true for spontaneous adsorption of H_2 gas without dissociation on solid surface

(a) Process is exothermic and $\Delta S < 0$
(b) Process is endothermic and $\Delta S > 0$
(c) Process is exothermic and $\Delta S > 0$
(d) Process is endothermic and $\Delta S < 0$

52. Consider the single electrode process $4H^+ + 4e^- \rightleftharpoons 2H_2$ catalysed by platinum black electrode in HCl electrolyte. The potential of the electrode is -0.059 V . SHE. What is the concentration of the acid in the hydrogen half cell if the H_2 pressure is 1 bar ? $4H^+ + 4e^- \rightleftharpoons 2H_2$

(a) 1 M (b) 10 M
(c) 0.1 M (d) 0.01 M

53. Which of the following elements has the lowest melting point?

(a) Sn (b) Pb (c) Si (d) Ge

54. The number of complementary hydrogen bond(s) between a guanine and cytosine pair is

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

55. Given $\Delta H_f{}^\circ$ for $CO_2(g)$, $CO(g)$ and $H_2O(g)$ are -393.5, -110.5 and -241.8 kJ mol^{-1}, respectively. The $\Delta H_f{}^\circ$[in kJ mol^{-1}] for the reaction $CO_2(g) + H_2(g) \longrightarrow CO(g) + H_2O(g)$ is

(a) 524.1 (b) -262.5
(c) -41.7 (d) 41.2

56. Which among the following is the strongest acid?

(a) HF (b) HCl
(c) HBr (d) HI

57. The species having pyramidal shape according to VSEPR theory is

(a) SO_3 (b) BrF_3
(c) SiO_3^{2-} (d) OsF_2

58. The bonding in diborane (B_2H_6) can be described by

(a) 4 two centre - two electron bonds and 2 three centre - two electron bonds
(b) 3 two centre - two electron bonds and 3 three centre - two electron bonds
(c) 2 two centre - two electron bonds and 4 three centre - two electron bonds
(d) 4 two centre - two electron bonds and 4 two centre - two electron bonds

59. The monomers of buna-S rubber are

(a) Isoprene and butadiene
(b) Butadiene and phenol
(c) Styrene and butadiene
(d) Vinyl chloride and sulphur

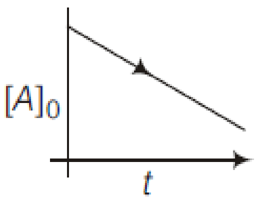
60. Heating a mixture of Cu_2O and Cu_2S will give

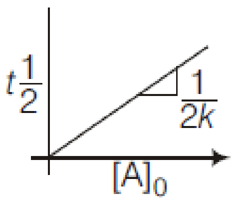
(a) $CuO + CuS$ (b) $Cu + SO_3$
(c) $Cu + SO_2$ (d) $Cu(OH)_2 + CuSO_4$

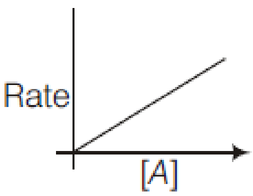
61. Which of the following corresponds to the energy of the possible excited state of hydrogen?

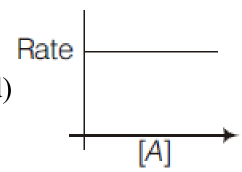
(a) -13.6 eV(b) 13.6 eV
(c) -3.4 eV (d) 3.4 eV

62. Which of the following are the correct representations of a zero -order reaction, where A represents the reactant?

(a) 

(b) 

(c) 

(d) 

(a) i, ii, iii (b) i, ii, iv
(c) ii, iii, iv (d) i, iii, ii

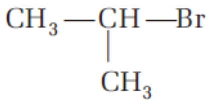
63. The set representing the right order of ionic radius is

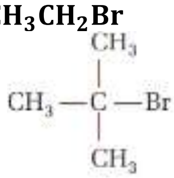
(a) $Li^{+} > Na^{+} > Mg^{2+} > Be^{2+}$
(b) $Mg^{2+} > Be^{2+} > Li^{+} > Na^{+}$
(c) $Na^{+} > Mg^{2+} > Li^{+} > Be^{2+}$
(d) $Na^{+} > Li^{+} > Mg^{2+} > Be^{2+}$

64. Which one of the following statement is correct for d^4 ions [P = pairing energy]

(a) When $\Delta_0 > P$, low-spin complex form
(b) When $\Delta_0 < P$, low-spin complex form
(c) When $\Delta_0 > P$, high-spin complex form
(d) When $\Delta_0 < P$, both high-spin and low-spin complexes form

65. The reactivity of alkyl bromides.

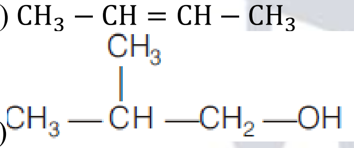
(I) CH_3CH_2Br **(II)** 

(III)  **(IV) CH_3Br**

Towards iodide ion in dry acetone decrease in the order

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

66. Optically active $CH_3 - CH_2 - CH - CH_3$ was found to have lost its optical activity after standing in water containing a few drops of acids, mainly due to the formation of

(a) $CH_3 - CH_2 - CH = CH_2$
(b) $CH_3 - CH = CH - CH_3$
(c) 
(d) $CH_3 - CH_2 - CH_2 - CH_2 - OH$

67. Commercially available H_2SO_4 is 98 g by weight of H_2SO_4 and 2 g by weight of water. It's density is 1.38 g cm^{-3}. Calculate the molality (m) of H_2SO_4 (molar mass of H_2SO_4 is 98 g mol^{-1})

(a) 500 m (b) 20 molal
(c) 50 m (d) 200 m

68. Cyclohexylamine and aniline can be distinguished by

(a) Hinsberg test (b) Carbylamine test
(c) Lassaigne test (d) Azo dye test

69. .... is a potent vasodilator?

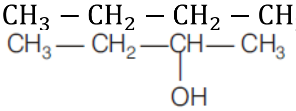
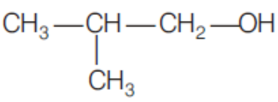
(a) Histamine (b) Serotonin
(c) Codeine (d) Cimetidine

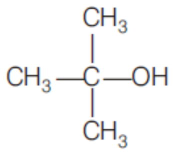
70. Standard enthalpy (heat) of formation of liquid water at 25°C is around

$$H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l)$$

(a) −237 kJ/mol (b) 237 kJ/mol
(c) −286 kJ/mol (d) 286 kJ/mol

71. The alcohol that reacts faster with Lucas reagent is

(a) $CH_3 - CH_2 - CH_2 - CH_2 - OH$
(b) 
(c) 

(d) 

72. Balance the following equation by choosing the correct option.

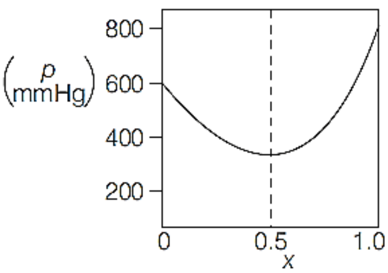
$xKNO_3 + yC_{12}H_{22}O_{11} \longrightarrow$
$p\ N_2 + qCO_2 + rH_2O + s\ K_2CO_3$

	x	y	p	q	r	s
(a)	36	55	24	24	5	48
(b)	48	5	24	36	55	24
(c)	24	24	36	55	48	5
(d)	24	48	36	24	5	55

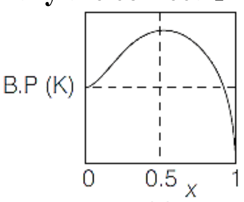
73. Which of the following element is purified by vapour phase refining?
(a) Fe (b) Zr (c) Cu (d) Au

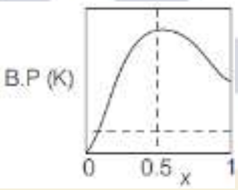
74. When helium gas is allowed to expand into vaccum, heating effect is observed. The reason for this is (assume He as a non- ideal gas)
(a) He is an inert gas
(b) The inversion temperature of helium is very high
(c) The inversion temperature of helium is very low
(d) He has the lowest boiling point.

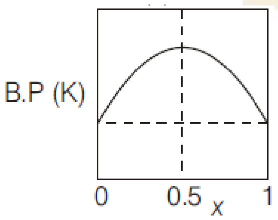
75. The vapour pressure of a non-ideal two component solution is given below

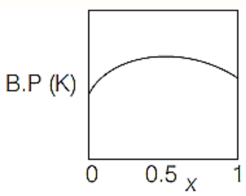


Identify the correct $T - X$ curve for the same mixture,

(a) 

(b) 

(c) 

(d) 

76. Cyclopentadienyl anion is
(a) benzenoid and aromatic
(b) non-benzenoid and aromatic
(c) non-benzenoid and non-aromatic
(d) non-benzenoid and anti- aromatic

77. Oxidation of cyclohexene in presence of acidic potassium permaganate leads to
(a) glutaric acid (b) adipic acid
(c) pimelic acid (d) succinic acid

78. How many emission spectral lines are possible when hydrogen atom is excited to nth energy level?

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

(c) $\frac{(n-1)n}{2}$ (d) $\frac{n^2}{4}$

79. The bond length (pm) of F_2, H_2, Cl_2 and I_2, respectively is

(a) 144,74,199,267

(b) 74,144,199,267

(c) 74,267,199,144

(d) 144,74,267,199

80. The number of tetrahedral and octahedral voids in CCP unit cell are respectively

(a) 4,8 (b) 8,4

(c) 12,6 (d) 6,12

Mathematics

81. If $\tan 20^\circ = \lambda$, then

$$\frac{\tan 160^\circ - \tan 110^\circ}{1 + (\tan 160^\circ)(\tan 110^\circ)} =$$

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

(c) $\frac{1-\lambda^2}{\lambda}$ (d) $\frac{1-\lambda^2}{2\lambda}$

82. Consider the circle $x^2 + y^2 - 6x + 4y = 12$. The equations of a tangent of this circle that is parallel to the line $4x + 3y + 5 = 0$ is

(a) $4x + 3y + 10 = 0$

(b) $4x + 3y - 9 = 0$

(c) $4x + 3y + 9 = 0$

(d) $4x + 3y - 31 = 0$

83. The mean deviation from the mean 10 of the data $6, 7, 11, 12, 13, \alpha, 12, 16$ is

(a) 3.5 (b) 3.25

(c) 3 (d) 3.75

84. Match the following

	List I		List II
(I)	$\int_{-1}^{1} x\lvert x\rvert dx$	(a)	$\frac{\pi}{2}$
(II)	$\int_0^{\frac{\pi}{2}} \left(1 + \log\left(\frac{4+3\sin x}{4+3\cos x}\right)\right) dx$	(b)	$\int_0^{\frac{a}{2}} f(x)dx$
(III)	$\int_0^a f(x)dx$	(c)	$\int_0^a [f(x) + f(-x)]dx$
(IV)	$\int_{-a}^{a} f(x)dx$	(d)	0
		(e)	$\int_0^a f(a-x)dx$

I II III IV I II III IV

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

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

85. If f is differentiable, $f(x + y) = f(x)f(y)$ for all $x, y \in IR, f(3) = 3, f'(0) = 11$, then $f'(3) =$

(a) $\frac{3}{11}$ (b) $\frac{11}{3}$ (c) 8 (d) 33

86. $\int_0^{\pi} \frac{x dx}{4\cos^2 x + 9\sin^2 x} =$

(a) $\frac{\pi^2}{12}$ (b) $\frac{\pi^2}{4}$ (c) $\frac{\pi^2}{6}$ (d) $\frac{\pi^2}{3}$

87. The probability distribution of a random variable X is given below

$X = k$	0	1	2	3	4
$P(X = k)$	0.1	0.4	0.3	0.2	0

The variance of X is

(a) 1.6 (b) 0.24

(c) 0.84 (d) 0.75

88. If $A = \begin{bmatrix} 1 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & -1 & 4 \end{bmatrix}$, $A = B + C, B = B^T$ and $C = -C^T$, then $C =$

(a) $\begin{bmatrix} 0 & 0.5 & 0 \\ -0.5 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ (b) $\begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0.5 \\ 0 & -0.5 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 0 & -0.5 & 0.5 \\ 0.5 & 0 & 0 \\ -0.5 & 0 & 0 \end{bmatrix}$ (d) $\begin{bmatrix} 0 & 0.5 & 0 \\ -0.5 & 0 & 0.5 \\ 0 & -0.5 & 0 \end{bmatrix}$

89. If a is a unit vector, then $|a \times \hat{i}|^2 + |a \times \hat{j}|^2 + |a \times \hat{k}|^2 =$

(a) 2 (b) 4 (c) 1 (d) 0

90. A bag contains 5 red balls, 3 black balls and 4 white balls. Three balls are drawn at random. The probability that they are not of same colour is

(a) $\frac{37}{44}$ (b) $\frac{31}{44}$ (c) $\frac{21}{44}$ (d) $\frac{41}{44}$

91. The radical centre of the circles $x^2 + y^2 - 4x - 6y + 5 = 0$, $x^2 + y^2 - 2x - 4y - 1 = 0$ and $x^2 + y^2 - 6x - 2y = 0 = 0$ lies on the line

(a) $x + y - 5 = 0$

(b) $2x - 4y + 7 = 0$

(c) $4x - 6y + 5 = 0$

(d) $18x - 12y + 1 = 0$

92. If $\operatorname{cosec}\theta - \cot\theta = 2017$, then quadrant in which θ lies is

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

93. If $\int e^{2x} f'(x) dx = g(x)$, then $\int \left(e^{2x} f(x) + e^{2x} f'(x)\right) dx =$

(a) $\frac{1}{2}[e^{2x} f(x) - g(x)] + C$

(b) $\frac{1}{2}[e^{2x} f(x) + g(x)] + C$

(c) $\frac{1}{2}[e^{2x} f(2x) + g(x)] + C$

(d) $\frac{1}{2}[e^{2x} f'(x) + g(x)] + C$

94. If $A = (5, 3)$, $B = (3, -2)$ and a point P is such that the area of the triangle PAB is 9 , then the locus of P represents

(a) a circle

(b) a pair of coincident lines

(c) a pair of parallel lines

(d) a pair of perpendicular lines

95. A straight line makes an intercept on the Y-axis twice as long as that on X-axis and is at unit distance from the origin. Then the line is represented by the equations

(a) $2x + 3y = \pm\sqrt{5}$ (b) $x + y = \pm 2$

(c) $x + y = \pm 2$ (d) $2x + y = \pm\sqrt{5}$

96. Let S and S′ be the foci of an ellipse and B be one end of its minor axis. If SBS′ is a isosceles right angled triangle then the eccentricity of the ellipse is

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

97. For the parabola $y^2 + 6y - 2x = -5$

(I) the vertex is $(-2, -3)$

(II) the directrix is $y + 3 = 0$

Which of the following is correct?

(a) Both I and II are correct

(b) I is true, II is false

(c) Both I and II are false

(d) I is false, II is true

98. If $\frac{x^2+5}{(x^2+1)(x-2)} = \frac{A}{x-2} + \frac{Bx+C}{x^2+1}$, then $A + B + C =$

(a) -1 (b) $\frac{2}{5}$ (c) $\frac{-3}{5}$ (d) 0

99. If the conjugate of $(x + iy)(1 - 2i)$ is $(1 + i)$, then

(a) $x + iy = 1 - i$ (b) $x + iy = \frac{1-i}{1-2i}$

(c) $x - iy = \frac{1-i}{1+2i}$ (d) $x - iy = \frac{1-i}{1+i}$

100. $\int x^4 e^{2x} dx =$

(a) $\frac{e^{2x}}{4}(2x^4 - 4x^3 + 6x^2 - 6x + 3) + C$

(b) $\frac{e^{2x}}{2}(2x^4 - 4x^3 + 6x^2 - 6x + 3) + C$

(c) $\frac{e^{2x}}{8}(2x^4 + 4x^3 + 6x^2 + 6x + 3) + C$

(d) $-\frac{e^{2x}}{4}(2x^4 + 4x^3 + 6x^2 + 6x + 3) + C$

101. The sides of a triangle are in the ratio $1: \sqrt{3}: 2$. Then the angles are in the ratio

(a) $1: 2: 3$ (b) $1: 2: 4$

(c) $1: 4: 5$ (d) $1: 3: 5$

102. The sum of the complex roots of the equations $(x - 1)^3 + 64 = 0$ is

(a) 6 (b) 3 (c) 6i (d) 3i

103. The area of the region bounded by the curves $x = y^2 - 2$ and $x = y$ is

(a) $\frac{9}{4}$ (b) 9 (c) $\frac{9}{2}$ (d) $\frac{9}{7}$

104. If $\mathbf{a} = x\hat{i} + y\hat{j} + z\hat{k}$, then

$(\mathbf{a} \times \hat{i}) \cdot (\hat{i} + \hat{j}) + (\mathbf{a} \times \hat{j}) \cdot (\hat{j} + \hat{k})$

$+(\mathbf{a} \times \hat{k}) \cdot (\hat{k} + \hat{i}) =$

(a) $x - y + z$ (b) $x + y + z$

(c) $x + y - z$ (d) $-x + y + z$

105. If the imaginary part of $\frac{2z+1}{iz+1}$ is -2 , then the locus of the point representing z in the complex plane is

(a) a circle (b) a parabola

(c) a straight line (d) an ellipse

106. Let $f: (-1, 1) \to IR$ be a differentiable function with $f(0) = -1$ and $f'(0) = 1$. If $g(x) = (f(2f(x) + 2))^2$, then $g'(0) =$

(a) 0 (b) -2 (c) 4 (d) -4

107. If the perpendicular distance between the point $(1, 1)$ to the line $3x + 4y + c = 0$ is 7 , then the possible values of c are

(a) $-35,42$ (b) $35,28$

(c) $42, -28$ (d) $28, -42$

108. The solution of $\frac{dy}{dx} = \frac{x+y}{x-y}$ is

(a) $\tan^{-1}\left(\frac{y}{x}\right) = \log\sqrt{x^2 + y^2} + C$

(b) $\tan^{-1}\left(\frac{y}{x}\right) = \log\sqrt{x^2 - y^2} + C$

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

(d) $\cos^{-1}\left(\frac{y}{x}\right) = \log\sqrt{x^2 - y^2} + C$

109. If $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then $\frac{d^2y}{dx^2} =$

(a) $-\frac{b^4}{a^2y^3}$ (b) $\frac{b^2}{ay^2}$

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

110. $\lim_{y\to 1}\left(\frac{1}{y^2-1} - \frac{2}{y^4-1}\right) =$

(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{1}{4}$ (d) 0

111. The solution of $(y - 3x^2)dx + xdy = 0$ is

(a) $y(x) = \sin x + \frac{1}{x^2} + C$

(b) $y(x) = \cos x - \frac{1}{x^2} + C$

(c) $y(x) = x^2 + \frac{C}{x}$

(d) $y(x) = \sqrt{x} + \frac{C}{x}$

112. If the coefficients of $(2r+1)^{th}$ term and $(r+1)^{th}$ term in the expansion of $(1+x)^{42}$ are equal then r can be

(a) 12 (b) 14 (c) 16 (d) 20

113. A point on the plane that passes through the points $(1,-1,6)$, $(0,0,7)$ and perpendicular to the plane $x - 2y + z = 6$ is

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

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

114. If the slope of the tangent of the curve $y = ax^3 + bx + 4$ at $(2, 14)$ is 21 , then the values of a and b respectively

(a) $2, -3$ (b) $3, -2$

(c) $-3, -2$ (d) $2, 3$

115. The probability distribution of a random variable X is given below

x	1	2	3	4	5	6
$P(X = x)$	a	ea	a	b	b	0.3

If mean of X is 4.2 , then a and b are respectively equal to

(a) 0.3,0.2 (b) 0.1,0.4

(c) 0.1,0.2 (d) 0.2,0.1

116. Let $f(x)$ be a quadratic expression such that $f(0) + f(1) = 0$. If $f(-2) = 0$, then

(a) $f\left(\frac{-2}{5}\right) = 0$ (b) $f\left(\frac{2}{5}\right) = 0$

(c) $f\left(\frac{-3}{5}\right) = 0$ (d) $f\left(\frac{3}{5}\right) = 0$

117. The equation of tangent to the curve $\left(\frac{x}{a}\right)^n + \left(\frac{y}{b}\right)^n = 2$ at the point (a, b) is

(a) $\frac{x}{a} = -\frac{y}{b}$ (b) $\frac{x}{a} + \frac{y}{b} = 2$

(c) $\frac{x}{a} = \frac{y}{b}$ (d) $\frac{x}{a} + \frac{y}{b} = n$

118. If the line $x + y + k = 0$ is a normal to the hyperbola $\frac{x^2}{9} - \frac{y^2}{4} = 1$ then $k =$

(a) $\pm\frac{\sqrt{5}}{13}$ (b) $\pm\frac{13}{\sqrt{5}}$

(c) $\pm\frac{13}{5}$ (d) $\pm\frac{5}{13}$

119. The product of all the real roots of $x^2 - 8x + 9 - \frac{8}{x} + \frac{1}{x^2} = 0$ is

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

120. If $\Delta = \begin{vmatrix} 1 & 5 & 6 \\ 0 & 1 & 7 \\ 0 & 0 & 1 \end{vmatrix}$ and $\Delta' = \begin{vmatrix} 1 & 0 & 1 \\ 3 & 0 & 3 \\ 4 & 6 & 100 \end{vmatrix}$, then

(a) $\Delta^2 - 3\Delta' = 0$

(b) $(\Delta + \Delta')^2 - 3(\Delta + \Delta') + 2 = 0$

(c) $(\Delta + \Delta')^2 + 3(\Delta + \Delta') + 5 = 0$

(d) $\Delta + 3\Delta' + 1 = 0$

121. A village has 10 players. A team of 6 players is to be formed. 5 members are chosen out of these 10 players and then the captain is chosen from the remaining players. Then total number of ways of choosing such teams is

(a) 1260 (b) 210

(c) $({}^{10}C_6)5\,!$ (d) $({}^{10}C_5)6$

122. The equation of the straight line passing through the point of intersection of $5x - 6y - 1$, $3x + 2y + 5 = 0$ and perpendicular to the line $3x - 5y + 11 = 0$ is

(a) $5x + 3y + 18 = 0$

(b) $-5x - 3y + 18 = 0$

(c) $5x + 3y + 8 = 0$

(d) $5x + 3y - 8 = 0$

123. An integer is chosen from $\{2k / -9 \le k \le 10\}$. The probability that it is divisible by both 4 and 6 is

(a) $\frac{1}{10}$ (b) $\frac{1}{20}$ (c) $\frac{1}{4}$ (d) $\frac{3}{20}$

124. $\int \frac{dx}{x(x^4+1)} =$

(a) $\frac{1}{4}\log\left(\frac{x^4+1}{x^4}\right) + C$ (b) $\frac{1}{4}\log\left(\frac{x^4}{x^4+1}\right) + C$

(c) $\frac{1}{4}\log(x^4 + 1) + C$ (d) $\frac{1}{4}\log\left(\frac{x^4}{x^4+2}\right) + C$

125. $\sin^{-1}\frac{\sqrt{3}}{2} + \sin^{-1}\sqrt{\frac{2}{3}} =$

(a) $\sin^{-1}\frac{\sqrt{3}+\sqrt{2}}{2\sqrt{3}}$ (b) $\pi - \sin^{-1}\left(\frac{\sqrt{3}+\sqrt{2}}{2\sqrt{3}}\right)$

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

126. α and β are the roots of $x^2 + 2x + c = 0$. If $\alpha^3 + \beta^3 = 4$, then the value of c is

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

127. If the slope of the tangent of the circle $S \equiv x^2 + y^2 - 13 = 0$ at $(2, 3)$ is m, then the point $\left(m, \frac{-1}{m}\right)$ is

(a) an external point with respect to the circle $S = 0$

(b) an internal point with respect to the circle $S = 0$

(c) the centre of the circle $S = 0$

(d) a point on the circle $S = 0$

128. Using the letters of the word TRICK, a five -letter word with distinct letters is formed such that C is in the middle. In how many ways this is possible?

(a) 6 (b) 120

(c) 24 (d) 72

129. The angle between the curves $x^2 = 8y$ and $xy = 8$ is

(a) $\tan^{-1}\left(\frac{-1}{3}\right)$ (b) $\tan^{-1}(-3)$

(c) $\tan^{-1}(-\sqrt{3})$ (d) $\tan^{-1}\left(\frac{-1}{\sqrt{3}}\right)$

130. $f: (-\infty, 0] \to [0, \infty)$ is defined as $f(x) = x^2$. The domain and range of its inverse is

(a) Domain $(f^{-1}) = [0, \infty)$, Range of $(f^{-1}) = (-\infty, 0]$

(b) Domain of $(f^{-1}) = [0, \infty)$, Range of $(f^{-1}) = (-\infty, \infty]$

(c) Domain of $(f^{-1}) = [0, \infty)$, Range of $(f^{-1}) = (0, \infty)$

(d) f^{-1} does not exist

131. If a, b and c are unit vectors such that $a + b + c = 0$ and $(a, b) = \frac{\pi}{3}$, then $|a \times b| + |b \times c| + |c \times a| =$

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

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

132. The differential equation of the simple harmonic motion given by $x = A\cos(nt + \alpha)$ is

(a) $\frac{d^2x}{dt^2} - n^2x = 0$ (b) $\frac{d^2x}{dt^2} + n^2x = 0$

(c) $\frac{dx}{dt} - \frac{d^2x}{dt^2} = 0$ (d) $\frac{d^2x}{dt^2} - \frac{dx}{dt} + nx = 0$

133. If a and b are unit vectors and α is the angle between them, then $a + b$ is a unit vector when $\cos\alpha =$

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

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

134. A parallelogram has vertices $A(4, 4, -1), B(5, 6, -1), C(6, 5, 1)$ and $D(x, y, z)$. Then the vertex D is

(a) (5,1,0) (b) (−5,0,1)

(c) (5,3,1) (d) (5,1,3)

135. If $2x^2 - 10xy + 2\lambda y^2 + 5x - 16y - 3 = 0$ represents a pair of straight lines, then point of intersection of those lines is

(a) $(2, -3)$ (b) $(5, -16)$

(c) $\left(-10, \frac{-7}{2}\right)$ (d) $\left(-10, \frac{-3}{2}\right)$

136. If rank of $\begin{pmatrix} x & x & x \\ x & x^2 & x \\ x & x & x+1 \end{pmatrix}$ is 1, then

(a) $x = 0$ or $x = 1$ (b) $x = 1$

(c) $x = 0$ (d) $x \neq 0$

137. If the vectors $a = \hat{i} + \hat{j} + \hat{k}$, $b = \hat{i} - \hat{j} + 2\hat{k}$ and $c = x\hat{i} + (x - 2)\hat{j} - \hat{k}$ are coplanar, then $x =$

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

138. In order to eliminate the first degree terms from the equation $4x^2 + 8xy + 10y^2 - 8x - 44y + 14 = 0$ the point to which the origin has to be shifted is

(a) $(-2,3)$ (b) $(2,-3)$

(c) $(1,-3)$ (d) $(-1,3)$

139. Two circles of equal radius a cut orthogonally. If their centres are (2, 3) and (5, 6) then radical axis of these circles passes through the point

(a) $(3a, 5a)$ (b) $(2a, a)$

(c) $\left(a, \frac{5a}{3}\right)$ (d) (a, a)

140. If $\tan\theta_1 = k\cot\theta_2$, then $\frac{\cos(\theta_1+\theta_2)}{\cos(\theta_1-\theta_2)} =$

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

(c) $\frac{k+1}{k-1}$ (d) $\frac{k-1}{k+1}$

141. Let $a = 2\hat{i} + \hat{j} - 3\hat{k}$ and $b = \hat{i} + 3\hat{j} + 2\hat{k}$. Then the volume of the parallelopiped having coterminous edges as a, b and c, where c is the vector perpendicular to the plane of a, b and $|c| = 2$ is

(a) $2\sqrt{195}$ (b) 24

(c) $\sqrt{200}$ (d) $\sqrt{195}$

142. **The local maximum of $y = x^3 - 3x^2 + 5$ is attained at**
(a) $x = 0$ (b) $x = 2$
(c) $x = 1$ (d) $x = -1$

143. **In the expansion of $(1+x)^n$, the coefficients of p th and $(p+1)$ th terms are respectively p and q then $p + q =$**
(a) $n + 3$ (b) $n + 2$
(c) n (d) $n + 1$

144. **If** $f(x) = \begin{cases} \sin x & \text{if } x \le 0 \\ x^2 + a^2 & \text{if } 0 < x < 1 \\ bx + 2 & \text{if } 1 \le x \le 2 \\ 0 & \text{if } x > 2 \end{cases}$ **is continuous on IR, then $a + b + ab =$**
(a) -2 (b) 0 (c) 2 (d) -1

145. **If $\cosh^{-1} x = 2\log_e(\sqrt{2} + 1)$, then $x =$**
(a) 1 (b) 2 (c) 4 (d) 3

146. **For any integer $n \ge 1$, $\sum_{K=1}^{n} K(K+2) =$**
(a) $\frac{n(n+1)(n+2)}{6}$ (b) $\frac{n(n+1)(2n+7)}{6}$
(c) $\frac{n(n+1)(2n+1)}{6}$ (d) $\frac{n(n-1)(2n+8)}{6}$

147. **The foci of the ellipse**
$25x^2 + 4y^2 + 100x - 4y + 100 = 0$ are
(a) $\left(\frac{5 \pm \sqrt{21}}{10}, -2\right)$ (b) $\left(-2, \frac{5 \pm \sqrt{21}}{10}\right)$
(c) $\left(\frac{2 \pm \sqrt{21}}{10}, -2\right)$ (d) $\left(-2, \frac{2 \pm \sqrt{21}}{10}\right)$

148. $\left[\frac{1 + \cos\left(\frac{\pi}{12}\right) + i\sin\left(\frac{\pi}{12}\right)}{1 + \cos\left(\frac{\pi}{12}\right) - i\sin\left(\frac{\pi}{12}\right)}\right]^{72} =$
(a) 0 (b) -1 (c) 1 (d) $\frac{1}{2}$

149. **If the range of the function $f(x) = -3x - 3$ is $\{3, -6, -9, -18\}$, then which of the following elements is not in the domain of f ?**
(a) -1 (b) -2 (c) 1 (d) 2

150. **In $\triangle ABC$, if $a = 1, b = 2, \angle C = 60^\circ$ then $4\Delta^2 + c^2 =$**
(a) 6 (b) 3 (c) $\frac{\sqrt{3}}{2}$ (d) 9

151. **If the magnitudes of a, b and a + b are respectively 3,4 and 5 , then the magnitude of (a-b) is**
(a) 3 (b) 4 (c) 6 (d) 5

152. **If $\int f(x)\cos x\,dx = \frac{1}{2}(f(x))^2 + C$ and $f(0) = 0$, then $f'(0) =$**
(a) 1 (b) -1 (c) 0 (d) 2

153. **If α and β are the roots of the equation $ax^2 + bx + c = 0$ and the equation having roots $\frac{1-\alpha}{\alpha}$ and $\frac{1-\beta}{\beta}$ is $px^2 + qx + r = 0$, then $r =$**
(a) $a + 2b$ (b) $ab + bc + ca$
(c) $a + b + c$ (d) abc

154. **If $A\left(\frac{\pi}{3}\right), B\left(\frac{\pi}{6}\right)$ are the points on the circle represented in parametric from with centre $(0,0)$ and radius 12 then the length of the chord AB is**
(a) $6(\sqrt{6} - \sqrt{2})$ (b) $6(\sqrt{6} - \sqrt{3})$
(c) $\sqrt{2}(\sqrt{3} - 1)$ (d) $6(\sqrt{3} - 1)$

155. **If the pair of straight lines $xy - x - y + 1 = 0$ and the line $x + ay - 3 = 0$ are concurrent, then the acute angle between the pair of lines $ax^2 - 13xy - 7y^2 + x + 23y - 6 = 0$ is**
(a) $\cos^{-1}\left(\frac{5}{\sqrt{218}}\right)$ (b) $\cos^{-1}\left(\frac{1}{\sqrt{10}}\right)$
(c) $\cos^{-1}\left(\frac{5}{\sqrt{173}}\right)$ (d) $\cos^{-1}\left(\frac{1}{\sqrt{5}}\right)$

156. The number of solutions of $\cos 2\theta = \sin\theta$ in $(0, 2\pi)$ is

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

157. The lengths of the sides of a triangle are 13, 14 and 15. If R and r respectively denote circumradius and inradius of that triangle, then $8R + r =$

(a) 84 (b) $\frac{65}{8}$ (c) 4 (d) 69

158. If A and B are variances of the 1st ' n ' even numbers and 1st ' n ' odd numbers respectively then

(a) $A = B$ (b) $A > B$

(c) $A < B$ (d) $A = B - 1$

159. If the line $x - y = -4K$ is a tangent to the parabola $y^2 = 8x$ at P, then the perpendicular distance of normal at P from $(K, 2K)$ is

(a) $\frac{5}{2\sqrt{2}}$ (b) $\frac{7}{2\sqrt{2}}$

(c) $\frac{9}{2\sqrt{2}}$ (d) $\frac{1}{2\sqrt{2}}$

160. If A and B are events having probabilities, $P(A) = 0.6, P(B) = 0.4$ and $P(A \cap B) = 0$, then probability that neither A nor B occurs is

(a) $\frac{1}{4}$ (b) 1 (c) $\frac{1}{2}$ (d) 0