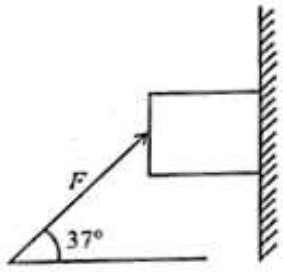
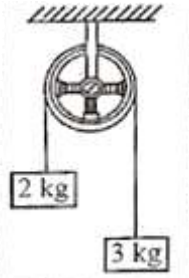
Physics

1. **Two resistance 60.36Ω and 30.09Ω are connected in parallel. The equivalent resistance is**
   (a) $20 \pm 008\Omega$ (b) $20 \pm 006\Omega$
   (c) $20 \pm 003\Omega$ (d) $20 \pm 010\Omega$
2. **Assertion (A) :** The velocity of a proiectile at a point on its trajectory is equal to the slope at that point.
   Reason (R): The velocity vector at a point always along the tangent to the trajectory at that point.
   (a) Both A and R are true and R is the correct explanation of A
   (b) Both A and R are true but R is not the correct explanation of A
   (c) A is true but R is false
   (d) A is false but R is true
3. **A body is projected from the ground at an angle of $\tan^{-1}\left(\frac{8}{7}\right)$ with the horizontal. The ratio of the maximum height attained by it to its range is**
   (a) 8: 7 (b) 4: 7
   (c) 2: 7 (d) 1: 7
4. **A body is projected with a speed u at an angle θ with the horizontal. The radius of curvature of the trajectory, when it makes an angle $\left(\frac{\theta}{2}\right)$ with the horizontal is (g-acceleration due to gravity)**
   (a) $\frac{u^2\cos^2\theta\sec^3\left(\frac{\theta}{2}\right)}{\sqrt{3}g}$
   (b) $\frac{u^2\cos^2\theta\sec^3\left(\frac{\theta}{2}\right)}{2g}$
   (c) d) $\frac{u^2\cos^2\theta\sec^3\left(\frac{\theta}{2}\right)}{g}$
   (d) $\frac{u^2\cos^2\theta\sec^3\left(\frac{\theta}{2}\right)}{g}$
5. **Sand is to be piled up on a horizontal ground in the form of a regular cone of a fixed base of radius R. Coefficient of static friction between the sand layers is μ. Maximum volume of the sand can be piled up in the form of cone without slipping on the ground is**
   (a) $\frac{\mu R^3}{3\pi}$ (b) $\frac{\mu R^3}{3}$
   (c) $\frac{\pi R^3}{3\mu}$ (d) $\frac{\mu\pi R^3}{3}$
6. **A block of mass 2 kg is being pushed against a wall by a force $F = 90$ N as shown in the figure. If the coefficient of friction is 0.25 , then the magnitude of acceleration of the block is (Take, $g = 10\ ms^{-2}$) $\left(\sin 37^\circ = \frac{3}{5}\right)$**



   (a) $16\ ms^{-2}$ (b) $8\ ms^{-2}$
   (c) $38\ ms^{-2}$ (d) $54\ ms^{-2}$
7. **A body of mass 2 kg thrown vertically from the ground : with a velocity of $8\ ms^{-1}$ reaches a maximum height of 3 m . The work done by the air resistance is (acceleration due to gravity $= 10\ ms^{-2}$)**
   (a) 4 J (b) 60 J
   (c) 64 J (d) 8 J
8. **The system of two masses 2 kg and 3 kg as shown in the figure is released from rest. The work done on 3 kg block by the force of gravity during first 2 seconds of its motion is $(g = 10\ ms^{-2})$**

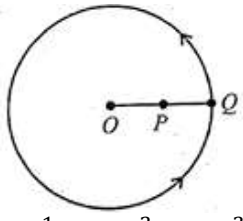


(a) 120 J (b) 80 J
(c) 40 J (d) 30 J

9. A rigid metallic sphere is spinning around its own axis in the absence of external torque. If the temperature is raised, its volume increases by 9%. The change in its angular speed is

(a) increases by 9%
(b) decreases by 9%
(c) increases by 6%
(d) decreases by 6%

10. Two spheres P and Q, each of mass 200 g are attached to a string of length one metre as shown in the figure. The string and the spheres are then whirled in a horizontal circle about O at a constant angular speed. The ratio of the tension in the string between P and Q to that of between P and O is (P is at mid-point of the line joining O and Q)



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

11. The potential energy of a simple harmonic oscillator of mass 2 kg at its mean position is 5 J . If its total energy is 9 J and amplitude is 1 cm , then its time period is

(a) $\frac{\pi}{100}$ s (b) $\frac{\pi}{50}$ s
(c) $\frac{\pi}{20}$ s (d) $\frac{\pi}{10}$ s

12. Three masses $m, 2m$ and $3m$ are arranged in two triangular configurations as shown in figure 1 and figure 2. Work done by an external agent in changing, the configuration from figure 1 to figure 2 is

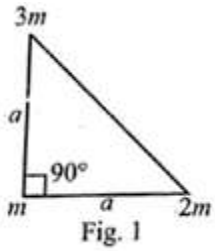


Fig. 1

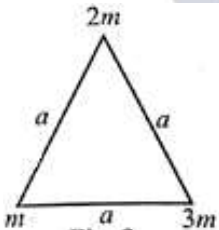
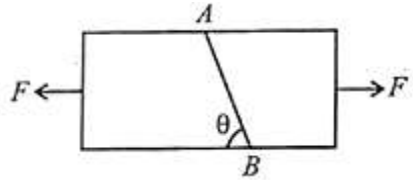


Fig. 2

(a) $\frac{6Gm^2}{a}\left[2-\frac{6}{\sqrt{2}}\right]$ (b) 0
(c) $\frac{Gm^2}{a}\left[6+\frac{6}{\sqrt{2}}\right]$ (d) $-\frac{Gm^2}{a}\left[6-\frac{6}{\sqrt{2}}\right]$

13. Two equal and opposite forces each F act on a rod of uniform cross-sectional area a as shown in the figure. Shearing stress on the section AB will be



(a) $\frac{F\sin\theta\cos\theta}{a}$ (b) $\frac{F\sin\theta}{a}$

(c) $\frac{F\cdot\cos\theta}{a}$ (d) $\frac{F\sin^2\theta}{a}$

14. A body is suspended by a light string. The tensions in the string when the body is in air, when the body is totally immersed in water and when the body is totally immersed in a liquid are respectively $40.2\ N, 28.4\ N$ and $16.6\ N$. The density of the liquid is

(a) $1200\ kg-m^{-3}$ (b) $1600\ kg-m^{-3}$

(c) $2000\ kg-m^{-3}$ (d) $2400\ kg-m^{-3}$

15. Steam at $100°C$ is passed into 1 kg of water contained in a calorimeter at $9°C$ till the temperature of water and calorimeter is increased to $90°C$. The mass of the steam condensed is nearly (water equivalent of calorimeter $= 0.1$ kg, specific heat of water $= 1 cal g^{-1}\ °C^{-1}$ and latent heat of vaporisation $= 540 cal g^{-1}$)

(a) 81 g (b) 162 g

(c) 243 g (d) 486 g

16. Three very large plates of same area are kept parallel and close to each other. They are considered as ideal black surfaces and have very high thermal conductivity. First and third plates are maintained at absolute temperatures. - $2T$ and $3T$ respectively. Temperature of the middle plate in steady state is

(a) $\left(\frac{65}{2}\right)^{\frac{1}{4}}$ T (b) $\left(\frac{97}{4}\right)^{\frac{1}{4}}$ T

(c) $\left(\frac{97}{2}\right)^{\frac{1}{4}}$ T (d) $(97)^{\frac{1}{4}}$ T

17. A thermally insulated vessel with nitrogen gas at $27°C$ is moving with a velocity of $100\ ms^{-1}$. If the vessel is stopped suddenly, then the percentage change in the pressure of the gas is nearly (assume entire loss in KE of the gas is given as heat to gas and $R = 8.3 J mol^{-1}\ K^{-1}$)

(a) 1.1 (b) 0.93

(c) 0.5 (d) 2.25

18. Match the following lists.

LIST- I	LIST -II
(A) Zeroth law of Thermodynamics	(I) Direction of flow of heat
(B) First law of Thermodynamics	(II) Work done is zero
(C) Free expansion Of a gas	(III) Thermal equilibrium
(D) Second law of Thermodynamics	(IV) Law of Conservation of energy

The correct answer is

A	B	C	D		A	B	C	D
(a) II	IV	III	I	(b)	III	IV	II	I
(c) III	I	II	IV	(d)	I	III	IV	II

19. For a molecule of an ideal gas, the number density is $2\sqrt{2} \times 10^8\ cm^{-3}$ and the mean free path is $\frac{10^{-2}}{\pi}$ cm. The diameter of the gas molecule is

(a) 5×10^{-4} cm (b) 0.5×10^{-4} cm

(c) 2.5×10^{-4} cm (d) 4×10^{-4} cm

20. A solid ball is suspended from the ceiling of a motor car through a light string. A transverse pulse travels at the speed $60\ cm^{-1}$ on the string, when the car is at rest. When the car accelerates on a horizontal road, then speed of the pulse is $66\ cm^{-1}$. The acceleration of the car is nearly $(g = 10\ ms^{-2})$

(a) $4.3\ ms^{-2}$ (b) $2.9\ ms^{-2}$

(c) $6.8\ ms^{-2}$ (d) $5.5\ ms^{-2}$

21. A reflector is moving with $20\ ms^{-1}$ towards a stationary source of sound. If the source is producing sound waves of 160 Hz , then the wavelength of the reflected wave is (speed of sound in air is $340\ ms^{-1}$)

(a) $\frac{17}{8}$ m (b) $\frac{17}{11}$ m

(c) $\frac{17}{9}$ m (d) $\frac{17}{16}$ m

22. A light ray- incidents normally on one surface of an equilateral prism. The angle of deviation of the light ray is (refractive index of the material of the prism $= \sqrt{2}$)

(a) 60° (b) 30°

(c) 0° (d) 120°

23. Two polaroids are placed in the path of unpolarised light beam of intensity I_0 such that no light is emitted from the second polaroid. If a third polaroid whose polarisation axis makes an angle θ with that of the first polaroid is placed between the polaroids, then intensity of light emerging from the last polaroid is

(a) $\left(\frac{I_0}{8}\right)\sin^2 2\theta$ (b) $\left(\frac{I_0}{4}\right)\sin^2 2\theta$

(c) $\left(\frac{I_0}{2}\right)\cos^2 \theta$ (d) $I_0\cos^2 \theta$

24. Two points charges are kept in air with a separation between them. The force between them-is F_1, if half of the space between the charges is filled with a dielectric constant 4 and the force between them is F_2, if $\frac{1}{3}$ rd of the space between the charges is filled with dielectric of dielectric constant 9 . Then $\frac{F_1}{F_2}$ is

(a) $\frac{27}{64}$ (b) $\frac{16}{81}$ (c) $\frac{81}{64}$ (d) $\frac{100}{81}$

25. A simple pendulum with a bob of mass 40 g and charge $+2\mu C$ makes 20 oscillation in 44 s . A vertical electric field magnitude $4.2 \times 10^4 NC^{-1}$ pointing downward is applied. The time taken by the pendulum to make 15 oscillation in the electric field is (acceleration due to gravity $= 10\ ms^{-2}$)

(a) 30 s (b) 60 s

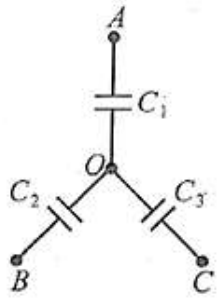
(c) 90 s (d) 15 s

26. A parallel plate capacitor has a capacity 80×10^{-6} F , when air is present between its plates. The space between the plates is filled with a dielectric slab of dielectric constant 20. The capacitor is now connected to a battery of 30 V by wires. The dielectric slab is then removed. Then, the charge passing through the wire is

(a) $12 \times 10^{-3}C$ (b) $25.3 \times 10^{-3}C$

(c) $120 \times 10^{-3}C$ (d) $45.6 \times 10^{-3}C$

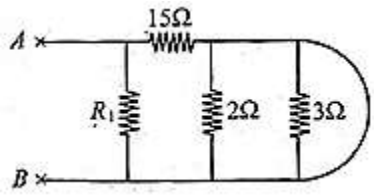
27. Three uncharged capacitors of capacities C_1, C_2 and C_3 are connected as shown in the figure. A, B and C are at potentials V_1, V_2 and V_3, respectively, then the potential at O is



(a) $\frac{C_1V_1+C_2V_2+C_3V_3}{C_1+C_2+C_3}$ (b) $\frac{C_1V_1+C_2V_2-C_3V_3}{C_1+C_2+C_3}$

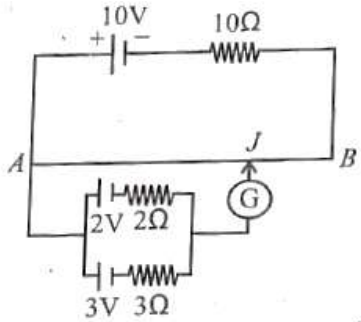
(c) $\frac{C_1V_1-C_2V_2-C_3V_3}{C_1+C_2+C_3}$ (d) zero

28.The equivalent resistance between *A* and *B* is 6Ω. The value of R_1 is



(a) 20Ω (b) 10Ω
(c) 5Ω (d) 25Ω

29. A battery of emf 10 V is connected to a uniform wire AB of 1 m length and having a resistance of 10Ω in series with a 10Ω resistor as shown in the figure. Two cells of emf 2 V and 3 V having internal resistance 2Ω and 3Ω, respectively are connected as shown in the figure. If the galvanometer shows null deflection at point J on the wire, then the distance of point J from the point B is.



(a) 48 cm (b) 50 cm
(c) 52 cm (d) 54 cm

30. Two infinitely long wires carry currents 4 A and 3 A placed along X-axis and Y-axis respectively. Magnetic field at a point P(0, 0, d)m will be…… T.

(a) $\frac{4\mu_0}{2\pi d}$ (b) $\frac{3\mu_0}{2\pi d}$
(c) $\frac{7\mu_0}{2\pi d}$ (d) $\frac{5\mu_0}{2\pi d}$

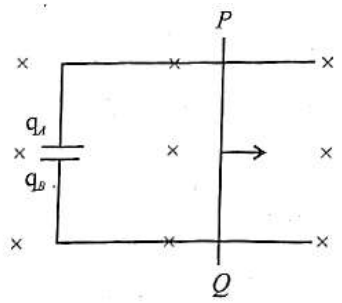
31. Two moving coil galvanometer, X and Y have coils with resistance 10Ω and 14Ω cross-sectional areas 4.8×10^{-3} m^2 and 2.4×10^{-3} m^2, number of turns 30 and 45 respectively. They are placed in magnetic field of 0.25 T and 0.50 T respectively. Then; the ratio of their current sensitivities and the ratio of their voltage sensitivities are respectively

(a) 2: 3,14: 15 (b) 5: 7,2: 1
(c) 2: 13,1: 2 (d) 14: 15,2: 9

32. Two short bar magnets each of magnetic moment of 9Am^2 are placed such that one is at x = −3 cm and the other at y = −3 cm. If their magnetic moments are directed along positive and negative X-directions respectively, then the resultant magnetic field at the origin is

(a) 100 T (b) 10 T
(c) 0.1 T (d) 0.001 T

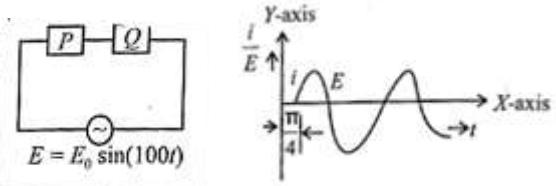
33. A conducting rod PQ of length 1 m is moving with a uniform speed 2 ms^{-1} in a uniform magnetic field of 4 T which is directed into the paper. A capacitor of capacity 10μ F is connected as shown in the figure. Then, the charge on the plates of the capacitor are



(a) $q_A = +80\mu C, q_B = -80\mu C$

(b) $q_A = -80\mu C, q_B = +80\mu C$
(c) $q_A = +125\mu C, q_B = 1.25\mu C$
(d) $q_A = -125\mu C, q_B = +1.25\mu C$

34. For the AC circuit shown below, phase difference between emf and current is $\frac{\pi}{4}$ radian as shown in the graph. If the impedance of the circuit is 1414Ω, then the values of P and Q are



(a) $1k\Omega, 10\mu$ F (b) $1k\Omega, 1.\mu F$
(c) $1k\Omega, 10\mu H$ (d) $1k\Omega, 1\mu H$

35. In a plane electromagnetic wave, the electric field oscillates with a frequency $2 \times 10^{10}\ s^{-1}$ and amplitude $40 Vm^{-1}$, then the energy density due to electric field is $(\varepsilon_0 = 8.85 \times 10^{-12} Fm^{-1})$

(a) $1.52 \times 10^{-9} Jm^{-3}$
(b) $2.54 \times 10^{-19} Jm^{-3}$
(c) $3.54 \times 10^{-9} Jm^{-3}$
(d) $4.56 \times 10^{-9} Jm^{-3}$

36. Photons of frequencies equal to the frequencies of H_β and H_∞ lines of hydrogen incident on a photosensitive plate, whose threshold frequency is equal to the frequency of H_α line of hydrogen. The ratio of the maximum kinetic energies of the emitted electrons is

(a) 7:16 (b) 3:4
(c) 8:27 (d) 5:36

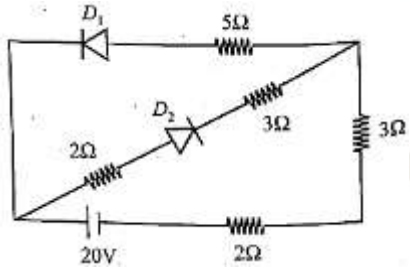
37. Hydrogen atom is in its n^{th} energy state. If de-Broglie wavelength of the electron is λ, then

(a) $\lambda \propto \frac{1}{n^2}$ (b) $\lambda \propto \frac{1}{n}$
(c) $\lambda \propto n^2$ (d) $\lambda \propto n$

38. If 200 MeV of energy is released in the fission of one nucleus of $^{235}_{92}U$, then the number of nuclei that must undergo fission to release an energy of 1000 J is

(a) 3.125×10^{13} (b) 6.25×10^{13}
(c) 12.5×10^{13} (d) 3.125×10^{14}

39. If the diodes are ideal in the circuit given below, then the current through the cell is



(a) 4 A (b) 1.5 A
(c) 2 A (d) 3 A

40. If a message signal of frequency 10 kHz and peak voltage 12 V is used to modulate a carrier wave of frequency 1 MHz , the modulation index is 0.6 . To make the modulation index 0.75 , the carrier peak voltage should be

(a) decreased by 25% (b) increased by 25%
(c) decreased by 20% (d) increased by 20%

Chemistry

41. If the radius of electron orbit in the excited state of hydrogen atom is 476.1 pm , the energy of electron in that excited state in J is (Radius and energy of electron in the first orbit of hydrogen atom are 52.9 pm and -2.18×10^{-18} J respectively)

(a) -2.42×10^{-18} (b) -19.62×10^{-18}
(c) -2.42×10^{-19} (d) -6.05×10^{-19}

42. A light of frequency 1.6×10^{16} Hz when falls on a metal plate emits electrons that have double the kinetic energy compared to the kinetic energy of emitted electrons when frequency of 1.0×10^{16} Hz falls on the same plate. The threshold frequency (v_0) of the metal in Hz is

(a) 1×10^{15} (b) 4×10^{15}
(c) 3×10^{15} (d) 4×10^{13}

43. To which group and period does the element belong if the electronic configuration of an element in its -2 oxidation state is $1s^2 2s^2 2p^6 3s^2 3p^6$?

(a) period 3, group 16 (b) period 3, group 17
(c) period 4, group 16 (d) period 4 , group 17

44. Which set of the following molecules has only one lone pair of electrons on their respective central atoms?

(i) SO_2 (ii) XeF_4 (iii) $PbCl_2$
(iv) SF_4 (v) ClF_3

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

45. XeF_4 is square planar where as CCl_4 is tetrahedral because

(a) in XeF_4, ' Xe' ' is sp^2 hybridised and in CCl_4 ' C ' is sp^3. hybridised
(b) in both XeF_4 and CCl_4 the central atom is sp^3 hybridised
(c) in XeF_4,' Xe' is sp^3d^2 hybridised but due to the presence of 2 lone pairs of electrons shape is square planar whereas in CCl_4 ' C ' is sp^3 hybridised
(d) Xe is noble gas, whereas C is a non-metal

46. 16 g each of H_2, He and O_2 are present in a container exerting 10 atm . pressure at T(K). The pressure in atm exerted by 16 g each of He and O_2 in the second container of same volume and temperature is

(a) 1.8 (b) 6.4
(c) 3.6 (d) 5.4

47. One litre of $0,15M Na_2SO_3$ aqueous solution is mixed with 500 mL of $0.2M K_2Cr_2O_7$ aqueous solution in acid medium. What is the number of moles of $K_2Cr_2O_7$ remaining in the solution after the reaction?

(a) 0.1 (b) 0.0125
(c) 0.025 (d) 0.05

48. From the following data

$$CH_3OH(l) + \frac{3}{2}O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$$
$$\Delta_r H^\circ = -726 \text{ kJ mol}^{-1}$$
$$H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(l);$$
$$\Delta_r H^\circ = -286 \text{ kJ mol}^{-1}$$
$$C(\text{graphite}) + O_2(g) \longrightarrow CO_2(g);$$
$$\Delta_r H^\circ = -393 \text{ kJ mol}^{-1}$$

The standard enthalpy of formation of $CH_3OH(l)$ in $kJmol^{-1}$ is

(a) -239 (b) 239
(c) 547 (d) -905

49. At 1000 K , the equilibrium constant. K_C for the reaction $2NOCl(g) \rightleftharpoons 2NO(g) + CL_2(g)$ is 4.0×10^{-6} mol L^{-1}. The K_P (in bar) at the same temperature is ($R = 0.083$ L^{-1} bar K^{-1} mol^{-1})

(a) 3.32×10^{-6} (b) 3.32×10^{4}
(c) 3.32×10^{-4} (d) 3.32×10^{-3}

50. If the pK_a of acetic acid and pK_b of dimethylamine are 4.76 and 3.26 respectively, the pH of dimethyl ammonium acetate solution is

(a) 7.75 (b) 6.75
(c) 7.0 (d) 8.5

51. Which of the following statements are correct?

(i) $NaH(s)$ reacts violently with water to form NaOH and H_2

(ii) An example for electron rich hydride is NH_3

(iii) Nickel forms saline hydride

(a) (i), (iii) (b) (ii), (iii)

(c) (i), (ii), (iii) (d) (i), (ii)

52. Which of the following nitrates on heating does not give its oxide?

(a) $LiNO_3$ (b) $NaNO_3$

(c) $Ba(NO_3)_2$ (d) $Be(NO_3)_2$

53. BF_3 reacts with NaH at 450 K to form NaF and X. When X reacts with LiH in diethyl ether, Y is formed. What is Y ?

(a) $LiBO_2$ (b) $Li_2\ B_4O_7$

(c) $LiBH_4$ (d) $B_2H_6 \cdot LiH$

54. Assertion (A) : $[SiF_6]^{2-}$ is formed but $[SiCl_6]^{2-}$ is not

Reason (R) : Electronegativity (EN) of F is higher than EN of Cl

(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 not correct but (R) is correct

55. The environmental friendly chemical now-a-days used for bleaching the paper in the presence of a suitable catalyst is

(a) chlorine

(b) sulphur dioxide

(c) hydrogen peroxide

(d) bleaching powder

56. The IUPAC name of the following compound is

(a) 5-cyanopentan-2-one

(b) 5-oxohexanenitrile

(c) 4-oxopentanenitrile

(d) 2-oxopentanenitrile

57. Identify the correct statements from the following

(i) Petrol and CNG operated automobiles cause less pollution

(ii) Alkanes having tertiary hydrogen can be oxidised to alcohols by $KMnO_4$

(iii) Methane can be prepared by Kolbe's electrolytic method.

(iv) Alkyl chloride on reduction with zinc and dilute hydrochloric acid gives alkane

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

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

58. What are X and Y in the following reaction?

$$\underset{\mathbf{X}}{\text{Pent} - 2 - \text{ene}} \xrightarrow[\text{(ii) } Zn/H_2O]{\text{(i) } O_3} \underset{\mathbf{y}}{X + Y}$$

(a) CH_3CHO	CH_3CH_2CHO
(b) CH_3CH_2CHO	CH_3CH_2CHO
(c) CH_3CHO	$(CH_3)_2CO$
(d) CH_3CHO	CH_3CHO

59. The total number of body centred lattices possible among the 14 bravais lattices is

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

60. The measured osmotic pressure of a solution prepared by dissolving 17.4 mg of K_2SO_4 in 2 L of water at $27°C$ is 3.735×10^{-3} bar. The van't Hoff factor is ($R = 0.083$ L bar K^{-1} mol^{-1}; atomic weights $K = 39$, $S = 32; O = 16$)

(a) 2.84 (b) 3.0
(c) 2.0 (d) 2.32

61. Dissolving 120 g of a compound (mol. wt $= 60$) in 1000 g of water gave a solution of density 1.12 g mL^{-1}. The molarity of solution is

(a) 1.0 M (b) 2.0 M
(c) 2.5 M (d) 4.0 M

62. When an aqueous solution of $CuCl_2$ is electrolysed using Pt inert electrodes, the reaction at cathode and anode respectively are

(a) $4H_2O(l) \xrightarrow{+4e^-} 2H_2(g) + 4\bar{O}_2(aq)$;
$2H_2O(1) \xrightarrow{+4e^-} O_2(g) + 4H^+(aq)$
(b) $2Cu^{2+}(aq) \xrightarrow{+4e^-} 2Cu(s)$;
$2H_2O(l) \xrightarrow{+4e^-} O_2(g) + 4H^+(aq)$
(c) $Cu^{2+}(aq) \xrightarrow{+2e^-} Cu(s)$;
$2Cl^-(aq) \xrightarrow{-2e^-} Cl_2(g)$
(d) $2H_2O(l) \xrightarrow{+2e^-} H_2(g) + 2\bar{O}H(aq)$
$2Cl^-(aq) \xrightarrow{-2e^-} Cl_2(g)$

63. Thermal decomposition of HCOOH is a first order reaction and the rate constant at T(K) is 4.606×10^{-3} s^{-1}. The time required to decompose 90% of initial quantity of HCOOH at T(K) in second is

(a) 100 (b) 500
(c) 1000 (d) 50

64. Which one of the following statement is not correct?

(a) A mixture of dinitrogen and dioxygen at room temperature is an example for aerosol
(b) Lyophilic sols are more stable compared to lyophobic sols
(c) Formation of micelles is possible only above Kraft temperature
(d) An example for a soap is sodium stearate and an example for detergent is sodium lauryl sulphate

65. In Ellingham diagram, the plot is drawn between

(a) temperature, $\Delta H°$ (b) temperature, $\Delta G°$
(c) pressure, $\Delta S°$ (d) temperature, $\Delta E°$

66. Identify the reaction which does not liberate N_2

(a) $NaN \longrightarrow ?$
(b) $(NH_4)_2Cr_2O_7 \xrightarrow[\Delta]{} ?$
(c) $NH_4Cl + Ca(OH)_2 \longrightarrow ?$
(d) $Ba(N_3)_2 \xrightarrow[\Delta]{} ?$

67. Identify the molecules which contains lone pair of electrons on the sulphur atom

(a) H_2SO_5 (b) $H_2\ S_2O_8$
(c) $H_2\ S_2O_7$ (d) H_2SO_3

68. Which statement about noble gases is not correct?

(a) ' Xe' ' forms XeF_6 under suitable conditions
(b) 'Ar' is used in electric bulbs
(c) The number of lone pair of electrons present on Xe in XeF_2 is 3 .
(d) 'He' has the highest boiling point among all the noble gases

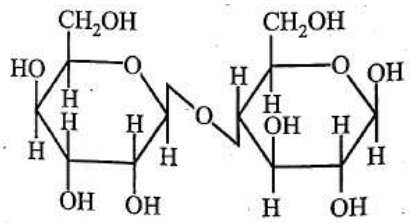
69. Crystal field splitting energies for octahedral (Δ_0) and tetrahedral (Δ_t) geometries caused by the same ligands are related through the expression

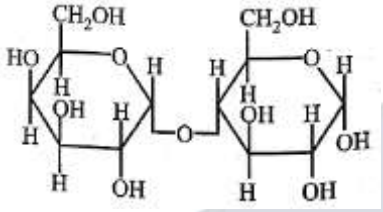
(a) $\Delta_0 = \Delta_t$ (b) $4\Delta_0 = 9\Delta_t$
(c) $9\Delta_0 = \Delta_t$ (d) $\Delta_0 = 2\Delta_t$

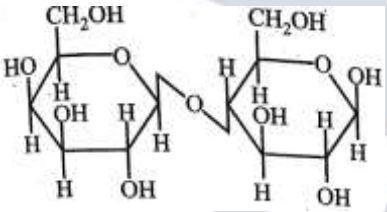
70. In lanthanide series, the element well known to exhibit +4 oxidation state is
(a) Lu (b) Ce (c) Pm (d) Nd

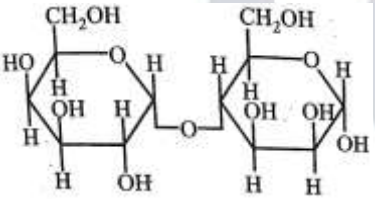
71. In anionic polymerisation, the compound which acts as effective chain initiator is
(a) BF_3 (b) $(CH_3CO)_2O_2$
(c) $SnCl_2$ (d) $R - Li$

72. Which one of the following is the structure of lactose?

(a) 

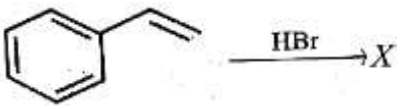
(b) 

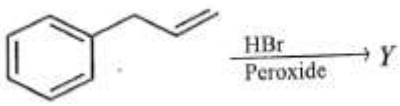
(c) 

(d) 

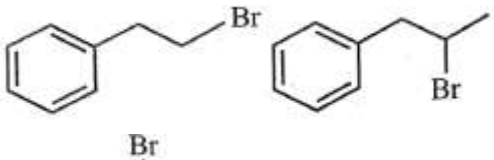
73. Which of the following statements are correct?
(i) Drugs that mimic natural messenger by switching on the receptor are called agonists.
(ii) Shape of the receptor does not change after attachment of chemical messenger.
(iii) A cationic detergent is formed when stearic acid reacts with polyethylene glycol.
(iv) Seldane is an antihistamine
(a) (ii), (iii) (b) (i), (iii), (iv)
(c) (i), (iv) (d) (i), (ii), (iii)

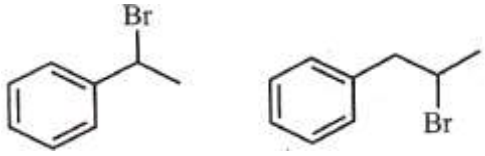
74. Identify the major products X and Y in the following reactions

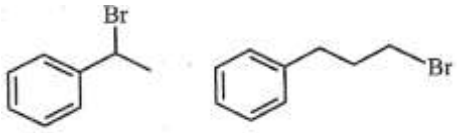
(i) 

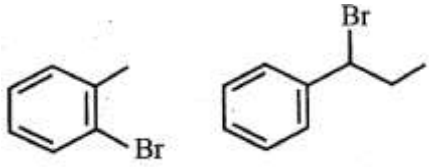
(ii) 

X y

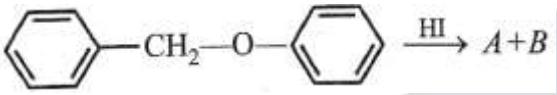
(a) 

(b) 

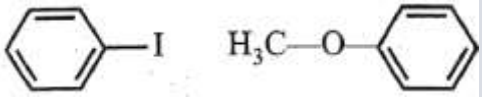
(c) 

(d) 

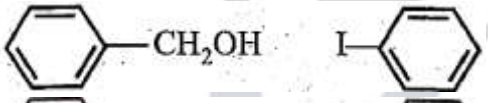
75. Identify A and B is the following reactions

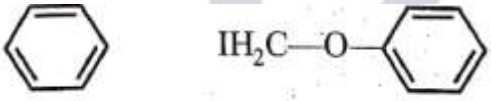


A B

(a) 

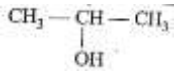
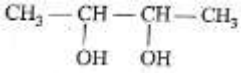
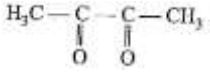
(b) 

(c) 

(d) 

76. Identify A, B and C in the following reactions.

Isopropyl chloride $\xrightarrow{NaOH}$ A $\xrightarrow{Cu/573K}$ B $\xrightarrow{NaOI}$ C + Iodoform

	A	B	C
(a)	$CH_3CH_2CH_2OH$	$CH_3CH_2CH_2CHO$	CH_3CH_2COONa
(b)	CH_3CH_2OH	CH_3CHO	$HCOONa$
(c)		CH_3COCH_3	CH_3COONa
(d)			CH_3COONa

77. Match the following

LIST- I	LIST- II
(A) Lucas reagent	(I) $SnCl2 + HCl. H3O+$
(B) Clemmensen Reagent	(II) $[Ag(NH_3)_2]^+$
(C) Tollens reagent	(III) Anhydrous

	$ZnCl_2$ /conc. HCl
(D) Stephen reaction	**(IV) Zn- Hg conc. HCl**
	(V) $C_6H_5SO_2Cl$

A B C D **A B C D**

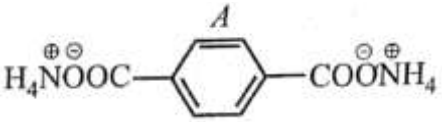
(a) III IV II I (b) III IV I II

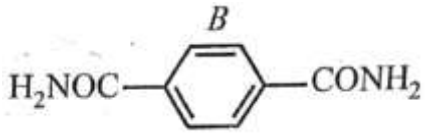
(c) IV II III V (d) IV III I V

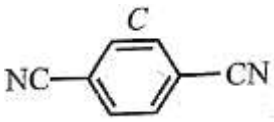
78. What are A, B and C in the following reactions?

Phthalic acid $+NH_3 \longrightarrow A \xrightarrow{\Delta} B \xrightarrow[\text{temperature}]{\text{High}} C$

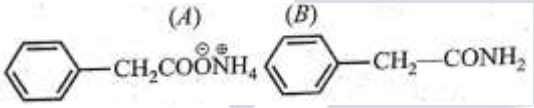
(a)

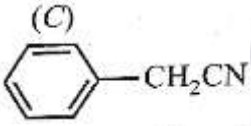




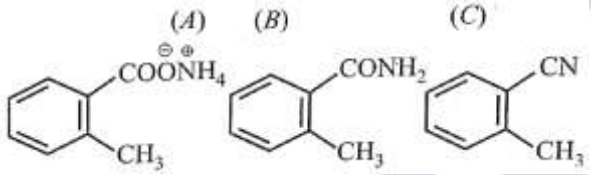


(b)

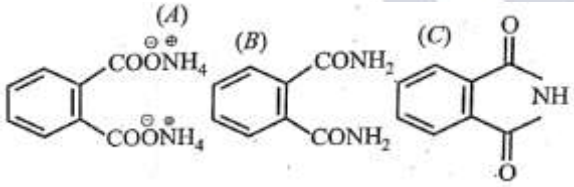




(c)



(d)

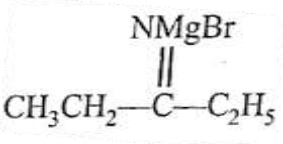


79. What are A and B in the following reaction sequence?

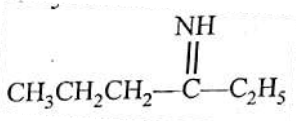
Propionitrile $+A \longrightarrow B \xrightarrow{H_3O^+}$ propiophenone

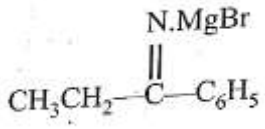
A B

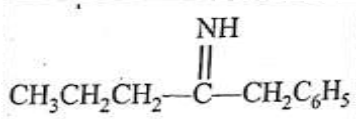
(a) C_2H_5MgBr



(b) C_2H_5MgBr



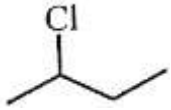
(c) C_6H_5MgBr 

(d) $C_6H_5CH_2MgBr$ 

80. $C_2H_5Cl \xrightarrow{KCN} X \xrightarrow{H_2/Catalyst} Y \xrightarrow[alc.KOH]{CHCl_3} Z$

What is ' Z ' in the above sequence of reactions?

(a)  (b) 

(c)  (d) 

Mathematics

81. If $f: R \to R$ is defined by $f(x) = [2x] - 2[x]$ for $x \in R$, then the range of f is (Here $[x]$ denotes the greatest integer not exceeding x)

(a) Z , the set of all integers

(b) N , the set of all natural numbers

(c) R, the set of all real numbers

(d) {0,1}

82. Given that a, b and c are real numbers such that $b^2 = 4ac$ and $a > 0$. The maximal possible set $D \subseteq R$ on which the function $f: D \to R$ given by $f(x) = \log\{ax^3 + (a+b)x^2 + (b+c)x + c\}$ is defined, is

(a) $R - \left\{-\frac{b}{2a}\right\}$

(b) $R - \left(\left\{-\frac{b}{2a}\right\} \cup (-\infty, -1)\right)$

(c) $R - \left(\left\{-\frac{b}{2a}\right\} \cup (x: x \geq 1)\right)$

(d) $R - \left(\left\{-\frac{b}{2a}\right\} \cup (-\infty, -1)\right)$

83. For any natural number n, $\left(15 \times 5^{2n}\right) + \left(2 \times 2^{3n}\right)$ is divisible by

(a) 7 (b) 11 (c) 13 (d) 17

84. For the matrix $A = \begin{bmatrix} 3 & -3 & 4 \\ 2 & -3 & 4 \\ 0 & -1 & 1 \end{bmatrix} \cdot A^{-1} =$

(a) A (b) A^2 (c) A^3 (d) A^4

85. If $A = \begin{bmatrix} k/2 & 0 & \\ 0 & l/3 & \\ 0 & 0 & \end{bmatrix}$ and $A^{-1} = \begin{bmatrix} 1/2 & 0 & 0 \\ 0 & 1/3 & 0 \\ 0 & 0 & 1/4 \end{bmatrix}$,

then $k + l + m =$

(a) 1 (b) 9 (c) 14 (d) 29

86. If A and B are the two real values of k for which the system of equations $x + 2y + z = 1, x + 3y + 4z = k, x + 5y + 10z = k^2$ is consistent, then $A + B =$

(a) 3 (b) 4 (c) 5 (d) 7

87. Let $z = x + iy$ and a point P represent z in the Argand plane. If the real part of $\frac{z-1}{z+i}$ is 1 , then a point that lies on the locus of P is

(a) (2016,2017) (b) $(-2016,2017)$

(c) $(-2016, -2017)$ (d) $(2016, -2017)$

88. If $13e^{i\tan^{-1}\frac{5}{12}} = a + ib$, then the ordered pair $(a, b) =$

(a) (12,5) (b) (5,12)
(c) (24,10) (d) (10,24)

89. If $z_1 = 1 - 2i; z_2 = 1 + i$ and $z_3 = 3 + 4i$, then $\left(\frac{1}{z_1} + \frac{3}{z_2}\right)\frac{z_3}{z_2} =$

(a) $13 - 6i$ (b) $13 - 3i$
(c) $6 - \frac{13}{2}i$ (d) $\frac{13}{2} - 3i$

90. If $1, \omega, \omega^2$ are the cube roots of unity, then

$$\frac{1}{1+2\omega} + \frac{1}{2+\omega} - \frac{1}{1+\omega} =$$

(a) 1 (b) ω (c) ω^2 (d) 0

91. The number of integral values of x satisfying $5x - 1 < (x + 1)^2 < 7x - 3$ is

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

92. For real number x, if the minimum value of $f(x) = x^2 + 2bx + 2c^2$ is greater than the maximum value of $g(x) = -x^2 - 2cx + b^2$, then

(a) $c^2 > 2b^2$ (b) $c^2 < 2b^2$
(c) $b^2 = 2c^2$ (d) $c^2 = 2b^2$

93. If a, b and c are the roots of $x^3 + qx + r = 0$, then $(a - b)^2 + (b - c)^2 + (c - a)^2 =$

(a) $-6q$ (b) $-4q$
(c) $6q$ (d) $4q$

94. If the sum of two roots of the equation $x^3 - 2px^2 + 3qx - 4r = 0$ is zero, then the value of r is

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

95. The sum of the four digit even numbers that can be formed with the digits 0, 3, 5, 4 with out repetition is

(a) 14684 (b) 43536
(c) 46526 (d) 52336

96. If x is the number of ways in which six women and six men can be arranged to sit in a row such that no two women are together and if y is the number of ways they are seated around a table in the same manner, then $x : y =$

(a) 12: 1 (b) 42: 1
(c) 16: 1 (d) 6: 1

97. The number of 5 -letter words that can be formed by using the letters of the word SARANAM is

(a) 1120 (b) 6720
(c) 480 (d) 720

98. The number of rational terms in the binomial expansion of $(\sqrt[4]{5} + \sqrt[5]{4})^{100}$ is

(a) 50 (b) 5 (c) 6 (d) 51

99. The numerically greatest term in the binomial expansion of $(2a - 3b)^{19}$ when $a = \frac{1}{4}$ and $b = \frac{2}{3}$ is

(a) ${}^{19}C_5 \cdot 2^{11}$ (b) ${}^{19}C_3 \cdot \frac{1}{2^{11}}$
(c) ${}^{19}C_4 \cdot \frac{1}{2^{13}}$ (d) ${}^{19}C_3 \cdot 2^{13}$

100. If $\frac{x^2+5x+7}{(x-3)^3} = \frac{A}{(x-3)} + \frac{B}{(x-3)^2} + \frac{C}{(x-3)^3}$, then the equation of the line having slope A and passing through the point (B, C) is

(a) $x + y - 20 = 0$ (b) $x - y + 20 = 0$
(c) $x + y + 20 = 0$ (d) $x - y - 20 = 0$

101. If $\cos\left(x-\frac{\pi}{3}\right), \cos x, \cos\left(x+\frac{\pi}{3}\right)$ are in a harmonic progression, then $\cos x =$

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

102. $\cos^3 110^\circ + \cos^3 10^\circ + \cos^3 130^\circ =$

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

103. If the general solution of $\sin 5x = \cos 2x$ is of the form $a_n \cdot \frac{\pi}{2}$ for $n = 0, \pm1, \pm2, \ldots$, then $a_n =$

(a) $\frac{2n}{5+2(-1)^n}$ (b) $\frac{2n+(-1)^n}{5+2(-1)^n}$

(c) $\frac{2n+1}{5+2(-1)^n}$ (d) $\frac{2n-1}{5+2(-1)^n}$

104. Let x, y be real numbers such that $x \neq y$ and $xy \neq 1$. If $ax + b\sec(\tan^{-1} x) = c$ and $ay + b\sec(\tan^{-1} y) = c$, then $\frac{x+y}{1-xy} =$

(a) $\frac{2ab}{a^2-b^2}$ (b) $\frac{2ac}{a^2+c^2}$

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

105. $\tanh^{-1}\frac{1}{2} + \coth^{-1} 3 =$

(a) $\log\sqrt{6}$ (b) $\log 6$

(c) $-\log\sqrt{6}$ (d) $-\log 6$

106. If the median of a $\triangle ABC$ through A is perpendicular to AC, then $\frac{\tan A}{\tan C} =$

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

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

107. In $\triangle ABC$, $\tan\frac{A}{2} + \tan\frac{B}{2} =$

(a) $\frac{c\cot\frac{C}{2}}{4s}$ (b) $\frac{2c\cot\frac{C}{2}}{a+b+c}$

(c) $\frac{2c\tan\frac{C}{2}}{s}$ (d) $\frac{c\tan\frac{C}{2}}{a+b+c}$

108. In a $\triangle ABC$, D, E and F respectively are the points of contact of the incircle with the sides AB, BC and CA such that $AD = \alpha$, $BE = \beta$ and $CF = \gamma$, then $\frac{\alpha\beta\gamma}{\alpha+\beta+\gamma} =$

(a) R^2 (b) 2R

(c) 2r (d) r^2

109. Let $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ be three non-coplanar vectors. The vector equation of a line which passes through the point of intersection of two lines, one joining the points $\mathbf{a}+2\mathbf{b}-5\mathbf{c}, -\mathbf{a}-2\mathbf{b}-3\mathbf{c}$ and the other joining the points $-4\mathbf{c}, 6\mathbf{a}-4\mathbf{b}+4\mathbf{c}$ is

(a) $\mathbf{r} = 2\mathbf{a}-4\mathbf{b}+3\mathbf{c}+\mu(\mathbf{a}-6\mathbf{b}+4\mathbf{c})$

(b) $\mathbf{r} = 3\mathbf{a}+6\mathbf{b}-\mathbf{c}+\mu(\mathbf{a}+2\mathbf{b}+\mathbf{c})$

(c) $\mathbf{r} = 2\mathbf{a}+3\mathbf{b}-\mathbf{c}+\mu(\mathbf{a}+\mathbf{b}-\mathbf{c})$

(d) $\mathbf{r} = -2\mathbf{b}+3\mathbf{c}+\mu(\mathbf{a}-4\mathbf{b}+3\mathbf{c})$

110. In $\triangle PQR$, M is the mid-point of QR and C is the midpoint of PM. If QC when extended meets PR at N, then $\frac{|\overline{QN}|}{|\overline{CN}|} =$

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

111. If $\mathbf{a} = \hat{\mathbf{i}}-2\hat{\mathbf{j}}-3\hat{\mathbf{k}}, \mathbf{b} = 2\hat{\mathbf{i}}+\hat{\mathbf{j}}-\hat{\mathbf{k}}, \mathbf{c} = \hat{\mathbf{i}}+3\hat{\mathbf{j}}-2\hat{\mathbf{k}}$, then $[(\mathbf{a}\times\mathbf{b})\times(\mathbf{b}\times\mathbf{c})(\mathbf{b}\times\mathbf{c})\times(\mathbf{c}\times\mathbf{a})(\mathbf{c}\times\mathbf{a})\times(\mathbf{a}\times\mathbf{b})] =$

(a) 160000 (b) -8000

(c) 400 (d) -40

112. If $\mathbf{a} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} + 3\hat{\mathbf{k}}, \mathbf{b} = -\hat{\mathbf{i}} + 2\hat{\mathbf{j}} + \hat{\mathbf{k}}, \mathbf{c} = \hat{\mathbf{i}} + 2\hat{\mathbf{j}} - 2\hat{\mathbf{k}}$, $\mathbf{n}$ is perpendicular to both $\mathbf{a}$ and $\mathbf{b}$ and θ is the angle between $\mathbf{c}$ and $\mathbf{n}$ then $\sin\theta =$

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

113. If $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ are mutually perpendicular vectors of the same magnitude, then the cosine of the angle between $\mathbf{a}$ and $\mathbf{a} + \mathbf{b} + \mathbf{c}$ is

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

114. If $\mathbf{a}, \mathbf{b}$ and $\mathbf{c}$ are non-coplanar vectors and the four points with position vectors $2\mathbf{a} + 3\mathbf{b} - \mathbf{c}, \mathbf{a} - 2\mathbf{b} + 3\mathbf{c}, 3\mathbf{a} + 4\mathbf{b} + 2\mathbf{c}$. and $k\mathbf{a} - 6\mathbf{b} + 6\mathbf{c}$ are coplanar, then $k =$

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

115. The mean and the standard deviation of a data of 8 items are 25 and 5 respectively. If two items 15 and 25 are added to this data, then the variance of the new data is

(a) 29 (b) 24 (c) 26 (d) 29

116. The mean deviation from the median for the following distribution (corrected to two decimals) is

x_i	6	9	3	12	15	13	21	22
f_i	4	5	3	2	5	4	4	3

(a) 13.42 (b) 5.36
(c) 4.97 (d) 11.25

117. If a die is rolled three times, then the probability of getting a larger number on its face than the previous number each time, is

(a) $\frac{15}{216}$ (b) $\frac{5}{54}$ (c) $\frac{13}{216}$ (d) $\frac{1}{18}$

118. A man is known to speak the truth 2 out of 3 times. If he throws a die and reports that it is six, then the probability that it is actually five, is

(a) $\frac{3}{8}$ (b) $\frac{1}{7}$ (c) $\frac{2}{7}$ (d) $\frac{4}{5}$

119. If the probability function of a random variable X is defined by $P(X = k) = a\left(\frac{k+1}{2^k}\right)$ for $k = 0, 1, 2, 3, 4, 5$, then the probability that X takes a prime value is

(a) $\frac{13}{20}$ (b) $\frac{23}{60}$ (c) $\frac{11}{20}$ (d) $\frac{19}{60}$

120. If X is a binomial variate with mean 6 and variance 2 , then the value of $P(5 \leq X \leq 7)$ is

(a) $\frac{4762}{6561}$ (b) $\frac{4672}{6561}$
(c) $\frac{5264}{6561}$ (d) $\frac{5462}{6651}$

121. Let $A(2, 3), B(3, -6), C(5, -7)$ be three points. If P is a point satisfying the condition $PA^2 + PB^2 = 2PC^2$, then a point that lies on the locus of P is

(a) $(2, -5)$ (b) $(-2,5)$
(c) $(13,10)$ (d) $(-13, -10)$

122. If the coordinates of a point P changes to $(2, -6)$ when the coordinate axes are rotated through an angle of $135°$, then the coordinates of P in the original system are

(a) $(-2,6)$ (b) $(-6,2)$
(c) $(2\sqrt{2}, 4\sqrt{2})$ (d) $(\sqrt{2}, -\sqrt{2})$

123. If the portion of a line intercepted between the coordinates axes is divided by the point $(2, -1)$ in the ratio of $3:2$, then the equation of that line is

(a) $5x - 2y - 20 = 0$ (b) $2x - y - 5 = 0$
(c) $3x - y - 7 = 0$ (d) $x - 3y - 5 = 0$

124. The equation of the line passing through the point of intersection of the lines $2x + y - 4 = 0, x - 3y + 5 = 0$ and lying at a distance of $\sqrt{5}$ units from the origin, is

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

125. The equation of the line joining the centroid with the ortho-centre of the triangle formed by the points $(-2,3),(2,-1),(4,0)$ is
(a) $x+y-2=0$
(b) $11x-y-14=0$
(c) $x-11y+6=0$
(d) $2x-y-2=0$

126. The lines represented by the equations $23x^2-48xy+3y^2=0$ and $2x+3y+4=0$ form
(a) an isosceles triangle
(b) a right angled triangle
(c) an equilateral triangle
(d) a scalene triangle

127. If the line $x+2y=k$ intersects the curve $x^2-xy+y^2+3x+3y-2=0$ at two points A and B and if O is the origin, then the condition for $\angle AOB=90^\circ$ is
(a) $k^2+k+1=0$
(b) $k^2-2k+10=0$
(c) $2k^2+9k-10=0$
(d) $3k^2+8k-1=0$

128. If $2x^2+3xy-2y^2=0$ represents two sides of a parallelogram and $3x+y+1=0$ is one of its diagonals, then the other diagonal is
(a) $x-3y+1=0$ (b) $x-3y+2=0$
(c) $x-3y=0$ (d) $3x-y=0$

129. If the lengths of the tangents drawn from P to the circles $x^2+y^2-2x+4y-20=0$ and $x^2+y^2-2x-8y+1=0$ are in the ratio $2:1$, then the locus P is
(a) $x^2+y^2+2x+12y+8=0$
(b) $x^2+y^2-2x+12y+8=0$
(c) $x^2+y^2+2x-12y+8=0$
(d) $x^2+y^2-2x-12y+8=0$

130. The equation of a circle touching the coordinate axes and the line $3x-4y=12$ is
(a) $x^2+y^2+6x+6y+9=0$
(b) $x^2+y^2+6x+6y-9=0$
(c) $x^2+y^2-6x-6y+9=0$
(d) $x^2+y^2-6x-6y-9=0$

131. The pole of the straight line $9x+y-28=0$ with respect to the circle $2x^2+2y^2-3x+5y-7=0$ is
(a) $(3,1)$ (b) $(3,-1)$
(c) $(-3,1)$ (d) $(4,-8)$

132. The point of intersection of the direct common tangents drawn to the circles $(x+11)^2+(y-2)^2=225$ and $(x-11)^2+(y+2)^2=25$ is
(a) $\left(\frac{-11}{2},1\right)$ (b) $(-22,4)$
(c) $\left(\frac{11}{2},-1\right)$ (d) $(22,-4)$

133. In List-I, a pair of circles is given in A, B, C and in List-II, angle between those pair of circles is given. Match the items from List-I to List-II.

List – I	List – II
(A) $(x-2)^2+y^2=2(x-2)^2+(y-1)^2=1$	(I) 90^o
(B) $x^2+y^2-6x-6y+9=0$ $x^2+y^2-4x+4y-9=0$	(II) 135^o

(C) $x^2+y^2+4x-14y+28=0$ **(III)** 60^o

$x^2+y^2+4x+5=0$ **(IV)** 30^o

The correct matching is

	A	B	C		A	B	C
(a)	I	II	III	(b)	II	I	III
(c)	III	I	IV	(d)	IV	III	I

134. **If the radical axis of the circles $x^2+y^2+2gx+2fy+c=0$ and $2x^2+2y^2+3x+8y+2c=0$ touches the circle $x^2+y^2+2x+2y+1=0$, then**

(a) $g=\frac{3}{4}$ or $f=2$ (b) $g\neq\frac{3}{4}, f=2$

(c) $g=\frac{3}{4}$ or $f\neq 2$ (d) $g=\frac{2}{5}$ or $f=1$

135. **The line $y=6x+1$ touches the parabola $y^2=24x$. The coordinates of a point P on this line, from which the tangent to $y^2=24x$ is perpendicular to the line $y=6x+1$, is**

(a) $(-1,-5)$ (b) $(-2,-11)$

(c) $(-6,-35)$ (d) $(-7,-41)$

136. **A point on the parabola whose focus is $S(1,-1)$ and whose vertex is $A(1,1)$ is**

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

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

137. **An ellipse having the coordinate axes as its axes and its major axis along Y-axis, passes through the point $(-3,1)$ and has eccentricity $\sqrt{\frac{2}{5}}$. Then its equation is**

(a) $3x^2+5y^2-15=0$

(b) $5x^2+3y^2-32=0$

(c) $3x^2+5y^2-32=0$

(d) $5x^2+3y^2-48=0$

138. **The product of the perpendicular distances drawn from the points $(3,0)$ and $(-3,0)$ to the tangent of the ellipse $\frac{x^2}{36}+\frac{y^2}{27}=1$ at $\left(3,\frac{9}{2}\right)$ is**

(a) 36 (b) 27 (c) 9 (d) 63

139. **The equation of the hyperbola whose asymptotes are the lines $3x+4y-2=0, 2x+y+1=0$ and which passes through the point $(1,1)$ is**

(a) $6x^2+11xy+4y^2-30x+2y+7=0$

(b) $6x^2+11xy+4y^2-x+2y-22=0$

(c) $6x^2+11xy+4y^2-x+2y+22=0$

(d) $6x^2+11xy+4y^2-3x-7y-11=0$

140. **If the ortho centre and the centroid of a triangle are $(-3,5,2)$ and $(3,3,4)$ respectively, then its circumcentre is**

(a) (6,2,5) (b) $(6,2,-5)$

(c) $(6,-2,5)$ (d) $(6,-2,-5)$

141. **A plane cuts the coordinate axes X, Y, Z at A, B, C respectively such that the centroid of the $\triangle$ ABC is $(6,6,3)$. Then the equation of that plane is**

(a) $x+y+z-6=0$

(b) $x+2y+z-18=0$

(c) $2x+y+z-18=0$

(d) $x+y+2z-18=0$

142. **If the foot of the perpendicular drawn from the origin to a plane is $(1,2,3)$, then a point on that plane is**

(a) (3,2,1) (b) (7,2,1)
(c) (7,3,−1) (d) (6,−3,4)

143. If [x] denotes the greatest integer ≤ x, then $\lim_{n\to\infty}\frac{1}{n^3}\{[1^2x]+[2^2x]+[3^2x]+\cdots+[n^2x]\}=$

(a) $\frac{x}{2}$ (b) $\frac{\dot{x}}{3}$ (c) $\frac{x}{6}$ (d) 0

144. If a function f defined by $f(x)=\begin{cases}\frac{1-\sqrt{2}\sin x}{\pi-4x}, & \text{if } x\neq\frac{\pi}{4}\\ k, & \text{if } x=\frac{\pi}{4}\end{cases}$ is continuous at $x=\frac{\pi}{4}$, then k =

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

145. The derivative of $f(x)=x^{\tan^{-1}x}$ with respect to $g(x)=\sec^{-1}\left(\frac{1}{2x^2-1}\right)$ is

(a) $\frac{1}{2}\sqrt{1-x^2}x^{\tan^{-1}x}\left[\frac{\log x}{1+x^2}+\frac{\tan^{-1}x}{x}\right]$

(b) $-\frac{1}{2}\sqrt{1-x^2}x^{\tan^{-1}}\left[\log(\tan^{-1}x)+x(1+x^2)\tan^{-1}x\right]$

(c) $\frac{-2^{\tan^{-1}}\left[\frac{\log x}{1+x^2}+\frac{\tan^{-1}x}{x}\right]}{\sqrt{1-x^2}}$

(d) $-\frac{1}{2}\sqrt{1-x^2}x^{\tan x^{-1}}\left[\frac{\log x}{1+x^2}+\frac{\tan^{-1}x}{x}\right]$,

146. If $x=3\cos t$ and $y=4\sin t$, then $\frac{d^2y}{dx^2}$ at the point $(x_0,y_0)=\left(\frac{3}{2}\sqrt{2},2\sqrt{2}\right)$, is

(a) $\frac{4\sqrt{2}}{9}$ (b) $-\frac{4\sqrt{2}}{9}$
(c) $\frac{8\sqrt{2}}{9}$ (d) $-\frac{8\sqrt{2}}{9}$

147. If $y=\frac{2}{\sqrt{a^2-b^2}}\tan^{-1}\left[\sqrt{\frac{a-b}{a+b}}\tan\frac{x}{2}\right]$, then $\left.\frac{d^2y}{dx^2}\right|_{x=\frac{\pi}{2}}=$

(a) $\frac{b}{2a^2}$ (b) $\frac{b}{a^2}$ (c) $\frac{2b}{a}$ (d) $\frac{b_1^2}{2a}$

148. If $f(x)=x^3+ax^2+bx+5\sin^2x$ is an increasing function on R, then

(a) $a^2-3b-15<0$
(b) $a^2-3b+15>0$
(c) $a^2-3b-15>0$
(d) $a^2+3b+15>0$

149. The approximate value of $\cos 31^\circ$ is
(Take $1^\circ=0.0174$)

(a) 0.7521 (b) 0.866
(c) 0.7146 (d) 0.8573

150. If x and y are two positive numbers such that $x+y=32$, then the minimum value of x^2+y^2 is,

(a) 500 (b) 256
(c) 1024 (d) 512

151. The constant ' c ' of Lagrange's mean value theorem for the function $f(x)=\frac{2x+3}{4x-1}$ defined on [1, 2] is

(a) $\frac{1+\sqrt{15}}{3}$ (b) $\frac{1+\sqrt{21}}{4}$
(c) $\frac{5}{3}$ (d) $\frac{3}{2}$

152.

$\int\frac{\sin 2xdx}{\sin^4x+\cos^4x}=\tan^{-1}(f(x))+c$, then $f\left(\frac{\pi}{3}\right)=$

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

153.

$\int\left(\frac{\log x-1}{1+(\log x)^2}\right)^2dx=$

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

(c) $\frac{x}{1+(\log x)^2}+c$ (d) $\frac{-x}{1+(\log x)^2}+c$

154.

$$\int \frac{dx}{x^3+3x^2+2x} =$$

(a) $\log|x|+\log\left|\frac{x+2}{x+1}\right|+c$

(b) $\log|x|-\log|x+1|+\log|x+2|+c$

(c) $\frac{1}{2}[\log|x|+\log|x+1|+\log|x+2|]+c$

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

155. For $n \geq 2$, If $I_n = \int \sec^n x dx$, then $I_4 - \frac{2}{3}I_2 =$

(a) $\sec^2 x\tan x + c$

(b) $\frac{1}{3}\sec^2 x\tan x + c$

(c) $\frac{2}{3}\sec^2 x\tan x + c$

(d) $\frac{1}{2}\log|\sec x+\tan x| + c$

156. $\lim\limits_{n\to\infty}\left(\frac{\sqrt{1}+2\sqrt{2}+3\sqrt{3}+\cdots+n\sqrt{n}}{n^{\frac{5}{2}}}\right) =$

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

157. $\int_0^{\frac{\alpha}{3}} \frac{f(x)}{f(x)+f\left(\frac{\alpha-3x}{3}\right)}dx =$

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

158. The area (in sq. units) of the region bounded by the X-axis and the curve $y = 1 - x - 6x^2$ is

(a) $\frac{125}{216}$ (b) $\frac{125}{512}$

(c) $\frac{25}{216}$ (d) $\frac{25}{512}$

159. If m and n are respectively the order and degree of the differential equation of the family of parabolas with focus at the origin and X-axis as its axis, then $mn - m + n =$

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

160. The general solution of $\left(1+e^{\frac{x}{y}}\log\right)dx + e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy = 0$

(a) $ye^{\frac{y}{x}} + x = c$ (b) $ye^{\frac{x}{y}} - x = c$

(c) $ye^{\frac{x}{y}} + y = c$ (d) $ye^{\frac{x}{y}} + x = c$