Physics

1. The intensity of light emerging from one of the slits in a Young's double slit experiment is found to be 1.5 times the intensity of light emerging from the other slit. What will be the approximate ratio of intensity of an interference maximum to that of an interference minimum?

(a) 2.25 (b) 98
(c) 5 (d) 9.9

2. In a Fraunhofer diffraction experiment, a single slit of width 0.5 mm is illuminated by a monochromatic light of wavelength 600 nm . The diffraction pattern is observed on a screen at a distance of 50 cm from the slit. What will be the linear separation of the first order minima?

(a) 1.0 mm (b) 1.1 mm
(c) 0.6 mm (d) 1.2 mm

3. If R is the Rydberg constant in cm^{-1}, then hydrogen atom does not emit any radiation of wavelength in the range of.

(a) $\frac{1}{R}$ to $\frac{4}{3R}$ cm (b) $\frac{7}{5R}$ to $\frac{19}{5R}$ cm
(c) $\frac{4}{R}$ to $\frac{36}{5R}$ cm (d) $\frac{9}{R}$ to $\frac{144}{7R}$ cm

4. A nucleus X emits a β-particle to produce a nucleus Y. If their atomic masses are M_x and M_y respectively, then the maximum energy of the β-particle emitted is (where, m_e is the mass of an electron and c is the velocity of light)

(a) $(M_x - M_y - m_e)c^2$
(b) $(M_x - M_y + m_e)c^2$
(c) $(M_x - M_y)c^2$
(d) $(M_x - M_y - 2m_e)c^2$

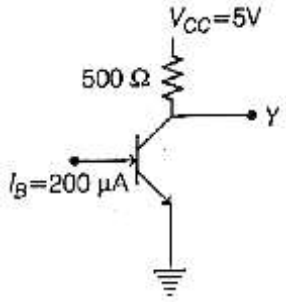
5. For nuclei with mass number close to 119 and 238, the binding energies per nucleon are approximately 7.6 MeV and 8.6 MeV , respecively. If a nucleus of mass number 238 breaks into two nuclei of nearly equal masses, what will be the approximate amount of energy released in the process of fission?

(a) 214 MeV (b) 119 MeV
(c) 2047 MeV (d) 1142 MeV

6. A common emitter transistor amplifier is connected with a load resistance of 6kΩ. When a small AC signal of 15 mV is added to the base-emitter voltage, the alternating base current is 20μ A and the alternating collector current is 1.8 mA . What is the voltage gain of the amplifier?

(a) 90 (b) 640
(c) 900 (d) 720

7.



In the circuit shown, the value of β of the transistor is 48 . If the supplied base current Y ?

(a) 0.2 V (b) 0.5 V
(c) 4 V (d) 4.8 V

8. The frequency v of the radiation emitted by an atom when an electron jumps from one orbit to another is given by $v = k\delta E$, where k is a constant and δE is the change in energy level due to the transition. Then, dimension of k is

(a) $[ML^2\ T^{-2}]$
(b) the same dimension of angular momentum
(c) $[ML^2\ T^{-1}]$
(d) $[M^{-1}\ L^{-2}\ T]$

9. Consider the vectors $\mathbf{A} = \hat{\imath} + \hat{\jmath} - \hat{k}$, $\mathbf{B} = 2\hat{\imath} - \hat{\jmath} + \hat{k}$ and $\mathbf{C} = \frac{1}{\sqrt{5}}(\hat{\imath} - 2\hat{\jmath} + 2\hat{k})$. What is the

value of $\mathbf{C} \cdot (\mathbf{A} \times \mathbf{B})$?

(a) 1 (b) 0

(c) $3\sqrt{2}$ (d) $18\sqrt{5}$

10. A fighter plane, flying horizontally with a speed 360 km/h at an altitude of 500 m drops a bomb for a target straight ahead of it on the ground. The bomb should be dropped at what approximate distance ahead of the target? Assume that acceleration due to gravity (g) is $10\ \text{ms}^{-2}$. Also, neglect air drag.

(a) 1000 m (b) $50\sqrt{5}$ m

(c) $500\sqrt{5}$ m (d) 866 m

11. A block of mass m rests on a horizontal table with a coefficient of static friction μ. What minimum force must be applied on the block to drag it on the table?

(a) $\frac{\mu}{\sqrt{1+\mu^2}}mg$ (b) $\frac{\mu-1}{\mu+1}mg$

(c) $\frac{\mu}{\sqrt{1-\mu^2}}mg$ (d) μmg

12. A tennis ball hits the floor with a speed v at an angle θ with the normal to the floor. If the collision is inelastic and the coefficient of restitution is ε, what will be the angle of reflection?

(a) $\tan^{-1}\left(\frac{\tan\theta}{\varepsilon}\right)$ (b) $\sin^{-1}\left(\frac{\sin\theta}{\varepsilon}\right)$

(c) $\theta\varepsilon$ (d) $\theta\frac{2\varepsilon}{\varepsilon+1}$

13. The bob of a swinging second pendulum (one whose time period is 2 s) has a small speed v_0 at its lowest point. Its height from this lowest point 2.25 s after passing through it, is given by

(a) $\frac{v_0^2}{2g}$ (b) $\frac{v_0^2}{g}$

(c) $\frac{v_0^2}{4g}$ (d) $\frac{9v_0^2}{4g}$

14. A steel and a brass wire, each of length 50 cm and cross-sectional area $0.005\ \text{cm}^2$ hang from a ceiling and are 15 cm apart. Lower ends of the wires are attached to a light horizontal bar. A suitable downward load is applied to the bar, so that each of the wires extends in length by 0.1 cm . At what distance from the steel wire, the load must be applied?

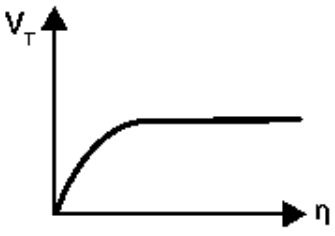
[Young's modulus of steel $= 2 \times 10^{12}$ dyne $/\text{cm}^2$ and that of brass $= 1 \times 10^{12}$ dyne $/\text{cm}^2$]

(a) 7.5 cm (b) 5 cm

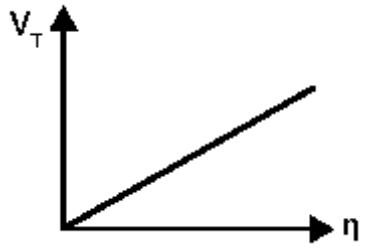
(c) 10 cm (d) 3 cm

15. Which of the following diagrams correctly shows the relation between the terminal velocity v_T of a spherical body falling in a liquid and viscosity η of the liquid?

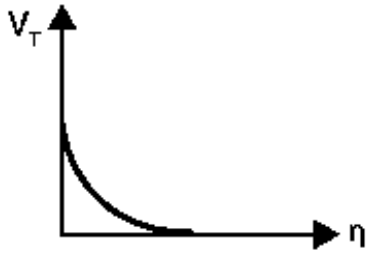
(a)



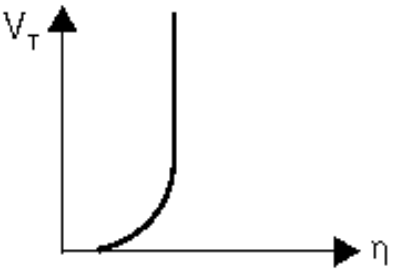
(b)



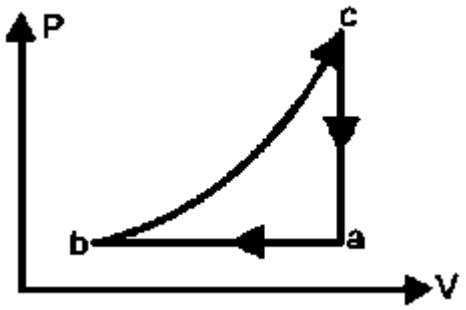
(c)



(d)



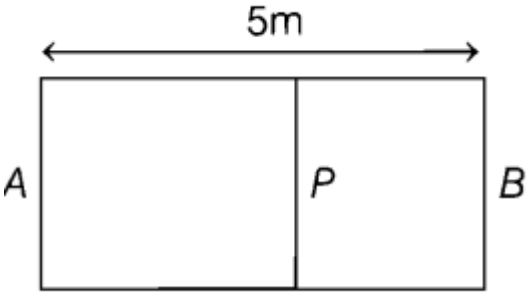
16. An ideal gas undergoes the cyclic process abca as shown in the given $p - V$ diagram.



It rejects 50 J of heat during ab and absorbs 80 J of heat during ca. During bc, there is no transfer of heat and 40 J of work is done by the gas. What should be the area of the closed curve abca?

(a) 30 J (b) 40 J
(c) 10 J (d) 90 J

17. A container AB in the shape of a rectangular parallelopiped of length 5 m is divided internally by a movable partition P as shown in the figure.



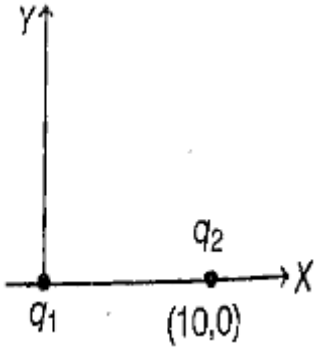
The left compartment is filled with a given mass of an ideal gas of molar mass 32 while the right compartment is filled with an equal mass of another ideal gas of molar mass 18 at same temperature. What will be the distance of P from the left wall A when equilibrium is established?

(a) 2.5 m (b) 1.8 m
(c) 3.2 m (d) 2.1 m

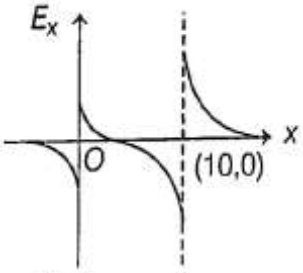
18. When 100 g of boiling water at 100°C is added into a calorimeter containing 300 g of cold water at 10°C, temperature of the mixture becomes 20°C. Then, a metallic block of mass 1 kg at 10°C is dipped into the mixture in the calorimeter. After reaching thermal equilibrium, the final temperature becomes 19°C. What is the specific heat of the metal in CGS unit?

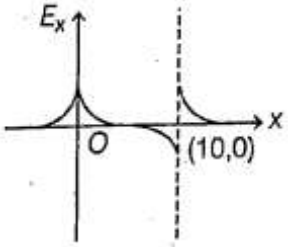
(a) 0.01 (b) 0.3
(c) 0.09 (d) 0.1

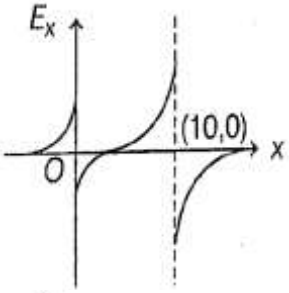
19. As shown in the figure, a point charge $q_1 = +1 \times 10^{-6}$C is placed at the origin in xy-plane and another point charge $q_2 = +3 \times 10^{-6}$C is placed at the coordinate $(10, 0)$.

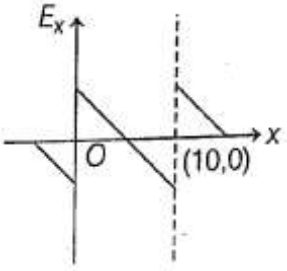


In that case, which of the following graph(s) shows most correctly the electric field vector in E_x in x-direction?

(a)


(b)


(c)


(d)


20. Four identical point masses, each of mass m and carrying charge $+q$ are placed at the corners of a square of sides a on a frictionless plane surface. If the particles are released simultaneously, the kinetic energy of the system when they are infinitely far apart is.

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

(c) $\frac{q^2}{a}(\sqrt{2}+4)$ (d) $\frac{q^2}{a}(\sqrt{2}+1)$

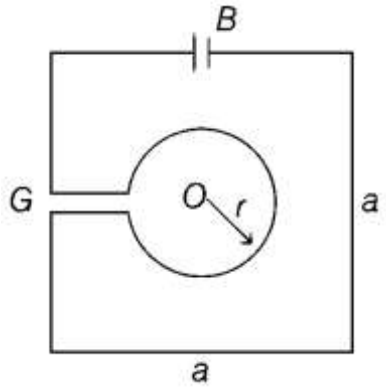
21. A very long charged solid cylinder of radius a contains a uniform charge density ρ. Dielectric constant of the material of the cylinder is K. What will be the magnitude of electric field at a radial distance $x(x < a)$ from the axis of the cylinder?

(a) $\rho\frac{x}{\varepsilon_0}$ (b) $\rho\frac{x}{2k\varepsilon_0}$
(c) $\rho\frac{x^2}{2a\varepsilon_0}$ (d) $\rho\frac{x}{2k}$

22. **A galvanometer can be converted to a voltmeter of full scale deflection V_0 by connecting a series resistance R_1 and can be converted to an ammeter of full scale deflection I_0 by connecting a shunt resistance R_2. What is the current flowing through the galvanometer at its full scale deflection?**

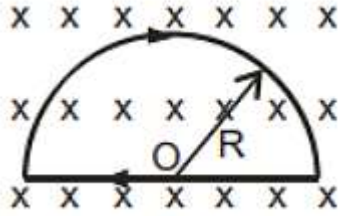
(a) $\frac{V_0-I_0R_2}{R_1-R_2}$ (b) $\frac{V_0+I_0R_2}{R_1+R_2}$
(c) $\frac{V_0-I_0R_1}{R_2-R_1}$ (d) $\frac{V_0+I_0R_1}{R_1+R_2}$

23. **As shown in the figure, a single conducting wire is bent to form a loop in the form of a circle of radius r concentrically inside a square of side a, where $a: r = 8: \pi$. A battery B drives a current through the wire. If the battery B and the gap G are of negligible sizes, determine the strength of magnetic field at the common centre O.**



(a) $\frac{\mu_0 l}{2\pi a}\sqrt{2}(\sqrt{2}-1)$ (b) $\frac{\mu_0 l}{2\pi a}(\sqrt{2}+1)$
(c) $\frac{\mu_0 l}{\pi a}2\sqrt{2}(\sqrt{2}+1)$ (d) $\frac{\mu_0}{\pi a}2\sqrt{2}(\sqrt{2}-1)$

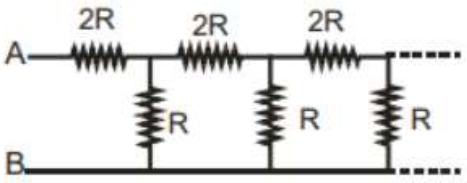
24.



As shown in the figure, a wire is bent to form a D-shaped closed loop, carrying current I, where the curved part is a semi-circle of radius R. The loop is placed in a uniform magnetic field B, which is directed into the plane of the paper. The magnetic force felt by the closed loop is.

(a) zero (b) IRB
(c) $2/RB$ (d) $\frac{1}{2}IRB$

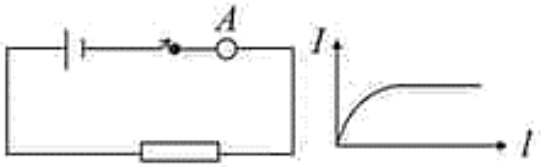
25.



What will be the equivalent resistance between the terminals A and B of the infinite resistive network shown in the figure?

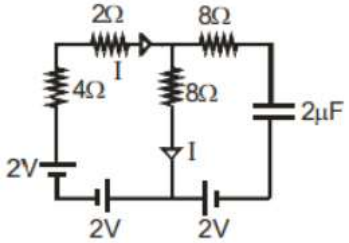
(a) $\frac{(\sqrt{3}+1)R}{2}$ (b) $\frac{(\sqrt{3}-1)R}{2}$
(c) $3\frac{R}{2}$ (d) $(\sqrt{3}+1)R$

26. **When a DC voltage is applied at the two ends of a circuit kept in a closed box, it is observed that the current gradually increases from zero to a certain value and then remains constant. What do you think that the circuit contains?**



(a) A resistor alone
(b) A capacitor alone
(c) A resistor and an inductor in series
(d) A resistor and a capacitor in series

27. Consider the circuit shown.



If all the cells have negligible internal resistance, what will be the current through the 2Ω resistor when steady state is reached?

(a) 0.66 A (b) 0.29 A
(c) 0 A (d) 0.14 A

28. Consider a conducting wire of length L bent in the form of a circle of radius R and another conductor of length $a(a \ll R)$ is bent in the form of a square. The two loops are then placed in same plane such that the square loop is exactly at the center of the circular loop. What will be the mutual inductance between the two loops?

(a) $\mu_0 \frac{\pi a^2}{L}$ (b) $\mu_0 \frac{\pi a^2}{16L}$
(c) $\mu_0 \frac{\pi a^2}{4L}$ (d) $\mu_0 \frac{a^2}{4\pi L}$

29. An object, is placed 60 cm in front of a convex mirror of focal length 30 cm . A plane mirror is now placed facing the object in between the object and the convex mirror such that it covers lower half of the convex mirror. What should be the distance of the plane mirror from the object, so that there will be no parallax between the images formed by the two mirrors?

(a) 40 cm (b) 30 cm
(c) 20 cm (d) 15 cm

30. A thin convex lens is placed just above an empty vessel of depth 80 cm . The image of a coin kept at the bottom of the vessel is thus formed 20 cm above the lens. If now water is poured in the vessel upto a height of 64 cm , what will be the approximate new position of the image? Assume that refractive index of water is $4/3$.

(a) 21.33 cm , above the lens
(b) 6.67 cm , below the lens
(c) 33.67 cm , above the lens
(d) 24 cm , above the lens

31. A conducting circular loop of resistance 20Ω and cross-sectional area 20×10^{-2} m^2 is placed perpendicular to a spatially uniform magnetic field B, which varies with time t as $B = 2\sin(50\pi t)$T. Find the net charge flowing through the loop in 20 ms starting from $t = 0$.

(a) 0.5 C (b) 0.2 C
(c) OC (d) 0.14 C

32. A pair of parallel metal plates are kept with a separation d. One plate is at a potential $+V$ and the other is at ground potential. A narrow beam of electrons enters the space between the plates with a velocity v_0 and in a direction parallel to the plates. What will be the angle of the beam with the plates after it travels an axial distance L ?

(a) $\tan^{-1}\left(\frac{eVL}{mdv_0}\right)$ (b) $\tan^{-1}\left(\frac{eVL}{mdv_0^2}\right)$
(c) $\sin^{-1}\left(\frac{eVL}{mdv_0}\right)$ (d) $\cos^{-1}\left(\frac{eVL}{mdv_0^2}\right)$

33. A metallic block of mass 20 kg is dragged with a uniform velocity of $0.5\ ms^{-1}$ on a horizontal table for 2.1 s . The coefficient of static friction between the block and the table is 0.10 . What will be the maximum possible rise in temperature of the metal block, if the specific heat of the block is 0.1 CGS unit? Assume $g = 10\ ms^{-2}$ and uniform rise in temperature throughout the whole block. [Ignore absorption of heat by the table]

(a) $0.0025°C$ (b) $0.025°C$
(c) $0.001°C$ (d) $0.05°C$

34. Consider an engine that absorbs 130 cal of heat from a hot reservoir and delivers 30 cal heat to a cold reservoir in each cycle. The engine also consumes 2 J energy in each cycle to overcome friction. If the engine works at 90 cycles per minute, what will be the maximum power delivered to the load? [Assume the thermal equivalent of heat is $4.2\ J/cal$]

(a) 816 W (b) 819 W
(c) 627 W (d) 630 W

35. Two pith balls, each carrying charge $+q$ are hung from a hook by two strings. It is found that when each charge is tripled, angle between the strings double. What was the initial angle between the strings?

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

36. A point source of light is used in an experiment of photoelectric effects. If the distance between the source and the photoelectric surface is doubled, which of the following may result?

(a) Stopping potential will be halved.
(b) Photoelectric current will decrease.
(c) Maximum kinetic energy of photoelectrons will decrease.
(d) Stopping potential will increase slightly.

37. Two metallic spheres of equal outer radii are found to have same moment of inertia about their respective diameters. Then, which of the following statement(s) is/are true?

(a) The two spheres have equal masses.
(b) The ratio of their masses is nearly $1.67:1$.
(c) The spheres are made of different materials.
(d) Their rotational kinetic energies will be equal when rotated with equal uniform angular speed about their respective diameters.

38. A simple pendulum of length l is displaced, so that its taught string is horizontal and then released. A uniform bar pivoted at one end is simultaneously released from its horizontal position. If their motions are synchronous, what is the length of the bar?

(a) $\frac{31}{2}$ (b) l
(c) $2l$ (d) $\frac{21}{3}$

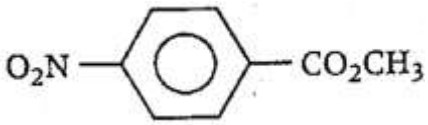
39. A 400Ω resistor, a 250 mH inductor and a 2.5μ F capacitor are connected in series with an AC source of peak voltage 5 V and angular frequency 2 kHz . What is the peak value of the electrostatic energy of the capacitor?

(a) 2μ J (b) 2.5μ J
(c) 3.33μ J (d) 5μ J

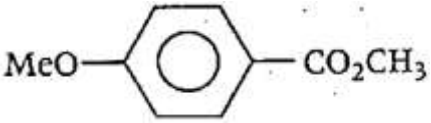
40. A charged particle moves with constant velocity in a region, where no effect of gravity is felt but an electrostatic field E together with a magnetic field B may be present. Then, which of the following cases are possible?

(a) $E \neq 0, B \neq 0$ (b) $E \neq 0, B = 0$
(c) $E = 0, B = 0$ (d) $\mathbf{E} = 0, \mathbf{B} \neq 0$

Chemistry



41.(I)



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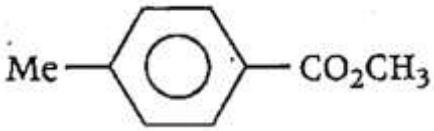


(III)

For the above three esters, the order of rates of alkaline hydrolysis is

(a) I > II > III

(b) II > III > I

(c) I > III > II

(d) III > I > II

42. $\mathbf{Ph - CDO \xrightarrow[Warm]{50\%\ aq.\ NaOH} Ph - \overset{\ominus}{COOH} + an\ alcohol.}$

This alcohol is .

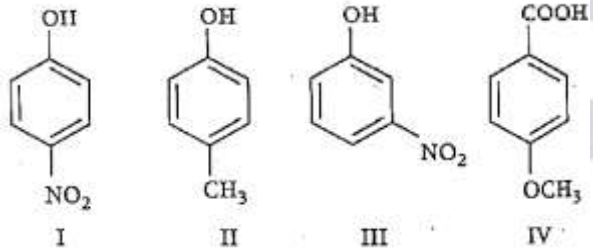
(a) $Ph - CHD - OH$

(b) $Ph - CHD - OD$

(c) $Ph - CD_2 - OH.$

(d) $Ph - CD_2 - OD$

43. The correct order of acidity for the following compound



(a) II < IV < III < I

(b) II < III < I < IV

(c) II < III < IV < I

(d) III < II < I < IV

44.For the following carbocations, the correct order of stability is.

I. $^{\oplus}CH_2 - COCH_3$

II. $^{\oplus}CH_2 - OCH_3$

III. $^{\oplus}CH_2 - CH_3$

(a) III < II < I

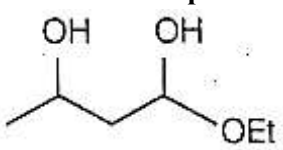
(b) II < I < III

(c) I < II < III

(d) I < III < II

45. The reduction product of ethyl 3-oxobutanoate by $NaBH_4$ in methanol is.

(a)



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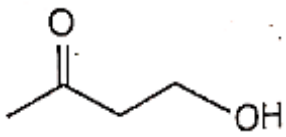
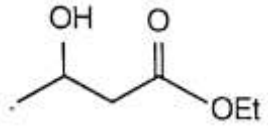
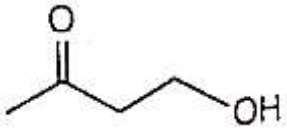
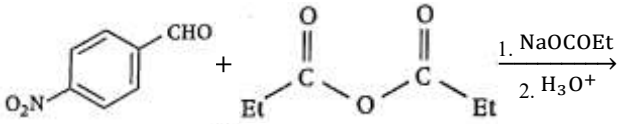
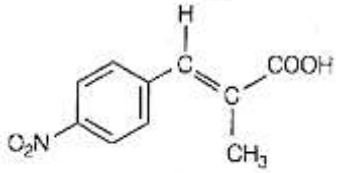


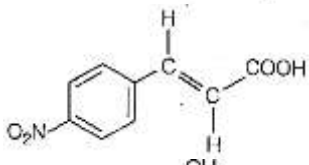
(c) 

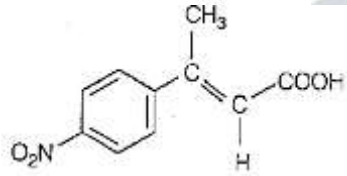
(d) 

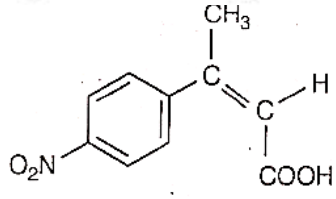
46. What is the major product of the following reaction?



(a) 

(b) 

(c) 

(d) 

47. The maximum number of electrons in an atom in which the last electron filled has the quantum numbers $n = 3, l = 2$ and $m = -1$ is.

(a) 17 (b) 27
(c) 28 (d) 30

48. In the face centred cubic lattice structure of gold the closest distance between gold atoms is (' a ' being the edge length of the cubic unit cell)

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

49. The equilibrium constant for the following reactions are given at 25°C

$2A \rightleftharpoons B + C, K_1 = 1.0$

$2B \rightleftharpoons C + D, K_2 = 16$

$2C + D \rightleftharpoons 2P, K_3 = 25$

The equilibrium constant for the reaction

$P \rightleftharpoons A + \frac{1}{2}B$ **at 25°C is**

(a) $\frac{1}{20}$ (b) 20
(c) $\frac{1}{42}$ (d) 21

50. Among the following, the ion which will be more effective for flocculation of $Fe(OH)_3$ solution Is.

(a) PO_4^{3-} (b) SO_4^{2-}
(c) SO_3^{2-} (d) NO_3^-

51. The mole fraction of ethanol in water is 0.08 . Its molality is.
(a) 6.32 mol kg^{-1}
(b) 4.83 mol kg^{-1}
(c) 3.82 mol kg^{-1}
(d) 2.84 mol kg^{-1}

52. 5 mL of 01M$Pb(NO_3)_2$ is mixed with 10 mL of 0.02 M KI . The amount of PbI_2 precipitated will be about.
(a) 10^{-2} mol
(b) 10^{-4} mol
(c) 2×10^{-4} mol
(d) 10^{-3} mol

53. At 273 K temperature and 76 cm Hg pressure, the density of a gas is $1.964\ g\ L^{-1}$. The gas Is.
(a) CH_4 (b) CO
(c) He (d) CO_2

54. Equal masses of ethane and hydrogen are mixed in an empty container at 298 K . The fraction of total pressure exerted by hydrogen is.
(a) 15: 16 (b) 1: 1
(c) 1: 4 (d) 1: 6

55. An ideal gas expands adiabatically against vacuum. Which of the following is correct for the given process?
(a) $\Delta S = 0$ (b) $\Delta T = -ve$
(c) $\Delta U = 0$ (d) $\Delta P = 0$

56. K_f (water) $= 1.86\ K\ kg\ mol^{-1}$. The temperature at which ice begins to separate from a mixture of 10 mass % ethylene glycol is.
(a) $-1.86\ ^\circ C$ (b) $-3.72^\circ C$
(c) $-3.3^\circ C$ (d) $-3^\circ C$

57. The radius of the first Bohr orbit of a hydrogen atom is 0.53×10^{-8} cm. The velocity of the electron in the first Bohr orbit is.
(a) 2.188×10^8 cm s^{-1}
(b) 4.376×10^8 cm s^{-1}
(c) 1.094×10^8 cm s^{-1}
(d) 2.188×10^9 cm s^{-1}

58. Which of the following statements is not true for the reaction, $2\ F_2 + 2H_2O \rightarrow 4HF + O_2$?
(a) F_2 is more strongly oxidising than O_2
(b) $F - F$ bond is weaker than $O = O$ bond
(c) $H - F$ bond is stronger than $H - O$ bond
(d) F is less electronegative than O

59. The number of unpaired electrons in the uranium ($_{92}U$) atom is.
(a) 4 (b) 6
(c) 3 (d) 1

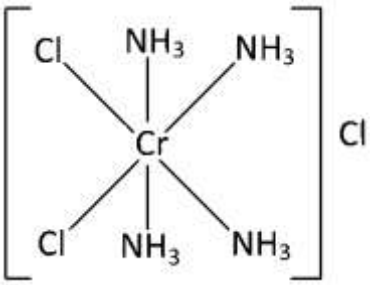
60. How and why does the density of liquid water change on prolonged electrolysis?
(a) Decreases, as the proportion of H_2O increases
(b) Remains unchanged
(c) Increases, as the proportion of D_2O increases
(d) Increases, as the volume decreases

61. The difference between orbital angular momentum of an electron in a $4f$-orbital and another electron in a $4s$-orbital is.
(a) $2\sqrt{3}$ (b) $3\sqrt{2}$
(c) $\sqrt{3}$ (d) 2

62. Which of the following has the largest number of atoms?
(a) 1 g of Ag
(b) 1 g of Fe

(c) 1 g of Cl_2
(d) 1 g of Mg

63. Indicate the correct IUPAC name of the coordination compound shown in the figrue.



(a) Cis-dichlorotetraminochromium (III) chloride
(b) Trans-dichlorotetraminochromium (III) chloride
(c) Trans-tetraminedichlorochromium (III) chloride
(d) Cis-tetraamminedichlorochromium (III) chloride

64. What will be the mass of one atom of ^{12}C ?

(a) 1 amu
(b) 1.9923×10^{-23} g
(c) 1.6603×10^{-22} g
(d) 6 amu

65. Bond order of He_2, He_2^+ and He_2^{2+} are respectively.

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

66. To a solution of a colourless efflorescent sodium salt, when dilute acid is added, a colourless gas is evolved along with formation of a white precipitate. Acidified dichromate solution turns green, when the colourless gas is passed through it. The sodium salt is.

(a) Na_2SO_3 (b) Na_2S
(c) $Na_2S_2O_3$ (d) $Na_2S_4O_6$

67. The reaction for obtaining the metal (M) from its oxide (M_2O_3) ore is given by $M_2O_3(s) + 2Al(l) \xrightarrow{Heat} Al_2O_3(l) + 2M(s)$, (s = solid, l = liquid) in that case, M is.

(a) copper (b) calcium
(c) iron (d) zinc

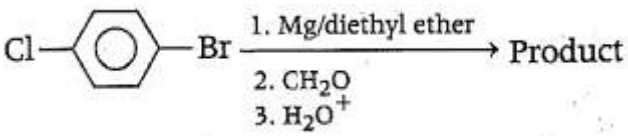
68. In the extraction of Ca by electro reduction of molten $CaCl_2$ some CaF_2 is added to the electrolyte for the following reason :

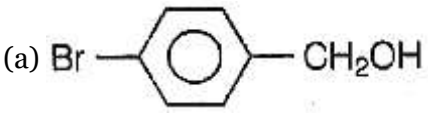
(a) To keep the electrolyte in liquid state at temperature lower than the m.p. of $CaCl_2$
(b) To effect precipitation of Ca
(c) To effect the electrolysis at lower voltage
(d) To increase the current efficiency

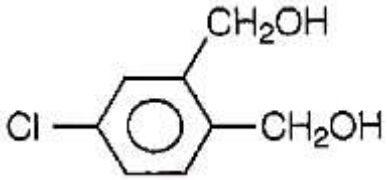
69. The total number of alkyl bromides (including stereoisomers) formed in the reaction $Me_3C - CH = CH_2 + HBr \rightarrow$ will be.

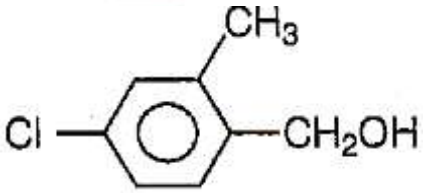
(a) 1 (b) 2
(c) 3 (d) No bromide forms

70. The product in the above reaction is.



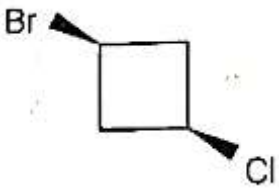
(a) 

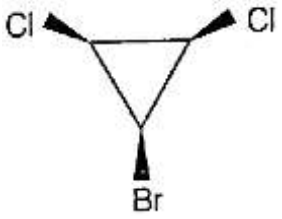
(b) 

(c) 

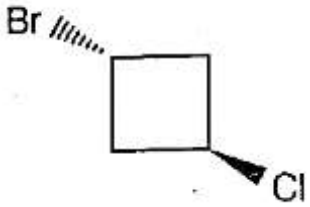
(d) 

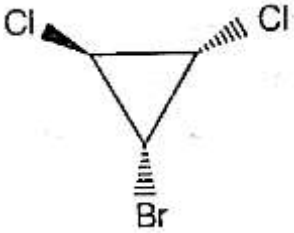
71. Which of the following compounds is asymmetric?

(a) 

(b) 

a

(c) 

(d) 

72. For a reaction $2A + B \rightarrow P$, when concentration of B alone is doubled, $t_{1/2}$ does not change and when concentrations of both A and B is doubled, rate increases by a factor of 4 . The unit of rate constant is,

(a) s^{-1}
(b) $Lmol^{-1}\ S^{-1}$
(c) $molL^{-1}\ s^{-1}$
(d) $L^2\ mol^{-2}\ S^{-1}$

73. A solution is saturated with $SrCO_3$ and SrF_2. The $[CO_3^{2-}]$ is found to be 1.2×10^{-3}M. The concentration of F^- in the solution would be.

(a) 3.7×10^{-6}M
(b) 3.2×10^{-3}M

(c) 5.1×10^{-7}M
(d) 3.7×10^{-2}M
Given: $K_{sp}(SrCO_3) = 7.0 \times 10^{-10}$,
$K_{sp}\ (SrF_2) = 7.9 \times 10^{-10}$

74. A homonuclear diatomic gas molecule shows 2-electron magnetic moment. The one-electron and two-electron reduced species obtained from above gas molecule can act as both oxidising and reducing agents. When the gas molecule is one-electron oxidised the bond length decreases compared to the neutral molecule. The gas molecule is

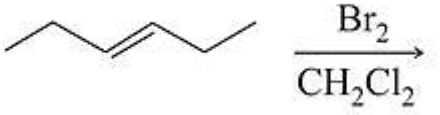
(a) N_2 (b) Cl_2
(c) O_2 (d) B_2

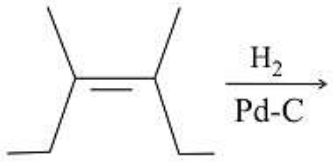
75. Which information below regarding this reaction is applicable?

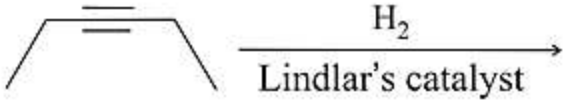
$$CH_3 - O - CH_2 - Cl \xrightarrow[\Delta]{\Delta q \cdot {}^{\circ}OH} CH_3 - O - CH_2 - OH$$

(a) It follows S_N2 pathway, because it is a primary alkyl chloride
(b) It follows S_N1 pathway, because the intermediate carbocation is resonance stabilised
(c) S_N1 pathway is not followed, because the intermediate carbocation is destabilised by -1-effect of oxygen
(d) A mixed S_N1 and S_N2 pathway is followed

76. Which of the following reactions give(s) a meso-compound as the main product?

(a) 

(b) 

(c) 

(d) 

77. For spontaneous polymerization, which of the following is (are) correct?

(a) ΔG is negative
(b) ΔH is negative
(c) ΔS is positive
(d) ΔS is negative

78. Which of the following statement(s) is/are incorrect?

(a) A sink of SO_2 pollutant is O_3 in the atmosphere
(b) FGD is a process of removing NO_2 from atmosphere
(c) NO_x in fuel gases can be removed by alkaline scrubbing
(d) The catalyst used to convert CCl_4 to CF_4 by HF is SbF_5

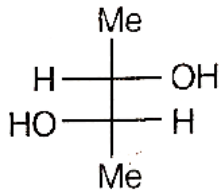
79. SiO_2 is attacked by which one/ones of the following?

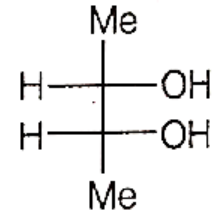
(a) HF
(b) Conc. HCl
(c) Hot NaOH
(d) Fluorine

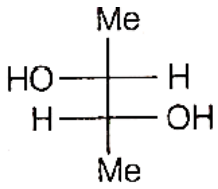
80. $$Me - C \equiv C - Me \xrightarrow[EtOH,-33^{\circ}C]{Na/NH_3\ (liq.)} \underline{\underline{X}}$$

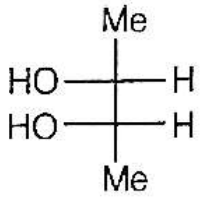
$\xrightarrow{\text{dil.alkaline } KMnO_4}$ **Product(s)**

The product(s) from the above reaction will be.

(a) 

(b) 

(c) 

(d) 

Mathematics

81. Let $\cos^{-1}\left(\frac{y}{b}\right) = \log\left(\frac{x}{n}\right)^n$. Then.

(a) $x^2y_2 + xy_1 + n^2y = 0$
(b) $xy_2 - xy_1 + 2n^2y = 0$
(c) $x^2y_2 + 3xy_1 - n^2y = 0$
(d) $xy_2 + 5xy_1 - 3y = 0$
(Here, $y_2 = \frac{d^2y}{dx^2}, y_1 = \frac{dy}{dx}$).

82. Let $\phi(x) = f(x) + f(1-x)$ and $f''(x) < 0$ in $[0,1]$, then

(a) ϕ is monotonic increasing in $\left[0,\frac{1}{2}\right]$ and monotonic decreasing in $\left[\frac{1}{2},1\right]$
(b) ϕ is monotonic increasing in $\left[\frac{1}{2},1\right]$ and monotonic decreasing in $\left[0,\frac{1}{2}\right]$
(c) ϕ is neither increasing nor decreasing in any sub-interval of $[0,1]$
(d) ϕ is increasing in $[0,1]$

83. $\int \frac{f(x)\phi(x)+\phi(x)f'(x)}{(f(x)\phi(x)+1)\sqrt{f(x)\phi(x)-1}}dx =$

(a) $\sin^{-1}\sqrt{\frac{f(x)}{\phi(x)}} + c$
(b) $\cos^{-1}\sqrt{(f(x))^2 - (\phi(x))^2} + c$
(c) $\sqrt{2}\tan^{-1}\sqrt{\frac{f(x)\phi(x)-1}{2}} + c$
(d) $\sqrt{2}\tan^{-1}\sqrt{\frac{f(x)\phi(x)+1}{2}} + c$

84. The value of $\sum_{n=1}^{10}\int_{-2n-1}^{-2n}\sin^{27}x\,dx + \sum_{n=1}^{10}\int_{2n}^{2n+1}\sin^{27}x\,dx$ is equal to .

(a) 27 (b) 54
(c) -54 (d) 0

85. $\int_0^2 [x^2]dx$ **is equal to.**

(a) 1 (b) $5-\sqrt{2}-\sqrt{3}$

(c) $3-\sqrt{2}$ (d) $8/3$

86. If the tangent to the curve $y^2 = x^3$ **at** (m^2, m^3) **is also a normal to the curve at** (M^2, M^3)**, the the value of** mM **is.**

(a) $-\frac{1}{9}$ (b) $-\frac{2}{9}$

(c) $-\frac{1}{3}$ (d) $-\frac{4}{9}$

87. If $x^2+y^2=a^2$**, then** $\int_0^a \sqrt{1+\left(\frac{dy}{dx}\right)^2}\,dx =$

(a) $2\pi a$ (b) πa

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

88. Let f**, be a continuous function in** $[0,1]$**, then** $\lim_{n\to\infty}\sum_{j=0}^{n}\frac{1}{n}f\left(\frac{j}{n}\right)$ **is.**

(a) $\frac{1}{2}\int_0^{\frac{1}{2}} f(x)dx$ (b) $\int_{\frac{1}{2}}^{1} f(x)dx$

(c) $\int_0^1 f(x)dx$ (d) $\int_0^{\frac{1}{2}} f(x)dx$

89. Let f **be a differentiable function with** $\lim_{x\to\infty} f(x)=0$**. If** $y'+yf'(x)-f(x)f'(x)=0$**,** $\lim_{x\to\infty} y(x)=0$**, then (where** $y'\equiv\frac{dy}{dx}$**).**

(a) $y+1=e^{f(x)}+f(x)$

(b) $y-1=e^{f(x)}+f(x)$

(c) $y+1=e^{-f(x)}+f(x)$

(d) $y-1=e^{-f(x)}+f(x)$

90. If $x\sin\left(\frac{y}{x}\right)dy=\left[y\sin\left(\frac{y}{x}\right)-x\right]dx, x>0$ **and** $y(1)=\frac{\pi}{2}$**, then the value of** $\cos\left(\frac{y}{x}\right)$ **is.**

(a) 1 (b) $\log x$

(c) e (d) 0

91. Let $f(x)=1-\sqrt{(x^2)}$**, where the square root is to be taken positive, then.**

(a) f has no extrema at $x=0$

(b) f has minima at $x=0$

(c) f has maxima at $x=0$

(d) f' exists at 0

92. If the function $f(x)=2x^3-9ax^2+12a^2x+1$ **[** $a>0$ **] attains its maximum and minimum at** p **and** q **respectively such that** $p^2=q$**, then** a **is equal to.**

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

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

93. If a **and** b **are arbitrary positive real numbers, then the least possible value of** $\frac{6a}{5b}+\frac{10b}{3a}$ **is.**

(a) 4 (b) $\frac{6}{5}$

(c) $\frac{10}{3}$ (d) $\frac{68}{15}$

94. If $2\log(x+1)-\log(x^2-1)=\log 2$**, then** $x=$

(a) only 3 (b) -1 and 3

(c) only – 1 (d) 1 and 3

95. The number of complex numbers p **such that** $|p|=1$ **and imaginary part of** p^4 **is 0 , is.**

(a) 4 (b) 2

(c) 8 (d) infinitely many

96. The equation $z\bar{z}+(2-3i)z+(2+3i)\bar{z}+4=0$ **represents a circle of radius**

(a) 2 unit (b) 3 unit

(c) 4 unit (d) 6 unit

97. The expression $ax^2+bx+c(a,b$ **and** c **are real) has the same sign as that of a for all** x **if**

(a) $b^2-4ac>0$

(b) $b^2-4ac\neq 0$

(c) $b^2 - 4ac \leq 0$
(d) b and c have the same sign as that of a

98. In a 12 storied building, 3 persons enter a lift cabin. It is known that they will leave the lift at different floors. In how many ways can they do so if the lift does not stop at the second floor?
(a) 36 (b) 120
(c) 240 (d) 720

99. If the total number of m-element subsets of the set $A = \{a_1, a_2, \ldots, a_n\}$ is k times the number of m element subsets containing a_4, then n is.
(a) $(m-1)k$ (b) mk
(c) $(m+1)k$ (d) $(m+2)k$

100. Let $I(n) = n^n, J(n) = 13.5 \ldots\ldots (2n-1)$ for all $(n > 1), n \in N$, then.
(a) $l\ (n) >$ J (n)
(b) $l(n) < J(n)$
(c) $l(n) = J(n)$
(d) $l(n) = \frac{1}{2}J(n)$

101. If $c_0, c_1, c_2, \ldots., c_{15}$ are the binomial coefficients in the expansion of $(1+x)^{15}$, then the value of $\frac{c_1}{c_0} + 2\frac{c_2}{c_1} + 3\frac{c_3}{c_2} + \cdots + 15\frac{c_{15}}{c_{14}}$ is.
(a) 1240 (b) 120
(c) 124 (d) 140

102. Let $A = \begin{pmatrix} 3-t & 1 & 0 \\ -1 & 3-t & 1 \\ 0 & -1 & 0 \end{pmatrix}$ and $\det A = 5$, then.
(a) $t = 1$ (b) $t = 2$
(c) $t = -1$ (d) $t = -2$

103. Let $A = \begin{pmatrix} 12 & 24 & 5 \\ x & 6 & 2 \\ -1 & -2 & 3 \end{pmatrix}$. The value of x for which the matrix A is not invertible is.
(a) 6 (b) 12
(c) 3 (d) 2

104. Let $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$ be a 2×2 real matrix with $\det A = 1$. If the equation $\det(A - \lambda I_2) = 0$ has imaginary roots (I_2 be the identity matrix of order 2), then.
(a) $(a+d)^2 < 4$
(b) $(a+d)^2 = 4$
(c) $(a+d)^2 > 4$
(d) $(a+d)^2 = 16$

105. If $\begin{vmatrix} a^2 & bc & c^2+ac \\ a^2+ab & b^2 & ca \\ ab & b^2+bc & c^2 \end{vmatrix} = ka^2b^2c^2$, then $k =$
(a) 2 (b) -2
(c) -4 (d) 4

106. If $f: S \to R$, where S is the set of all non-singular matrices of order 2 over R and $f\left[\begin{pmatrix} a & b \\ c & d \end{pmatrix}\right] = ad - bc$, then
(a) f is bijective mapping
(b) f is one-one but not onto
(c) f is onto but not one-one
(d) f is neither one-one nor onto

107. Let the relation ρ be defined on R by $a\rho b$ holds if and only if $a - b$ is zero or irrational, then
(a) ρ is equivalence relation
(b) ρ is reflexive and symmetric but is not transitive
(c) ρ is reflexive and transitive but is not symmetric
(d) ρ is reflexive only

108. The unit vector in ZOX plane, making angles 45° and 60° respectively with $\alpha = 2\hat{i} + 2\hat{j} - \hat{k}$

and $\beta = \hat{j} - \hat{k}$ is.

(a) $\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$ (b) $\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{k}$

(c) $\frac{1}{\sqrt{2}}\hat{i} - \frac{1}{\sqrt{2}}\hat{j}$ (d) $\frac{1}{\sqrt{2}}\hat{i} + \frac{1}{\sqrt{2}}\hat{k}$

109. Four persons A, B, C and D throw an unbiased die, turn by turn, in succession till one gets an even number and win the game. What is the probability that A wins if A begins?

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

(c) $\frac{7}{12}$ (d) $\frac{8}{15}$

110. A rifleman is firing at a distant target and has only 10% chance of hitting it. The least number of rounds he must fire to have more than 50% chance of hitting it at least once, is.

(a) 5 (b) 7

(c) 9 (d) 11

111. $\cos(2x + 7) = a(2 - \sin x)$ can have a real solution for.

(a) all real values of a

(b) $a \in [2,6]$

(c) $a \in (-\infty, 2) \setminus \{0\}$

(d) $a \in (0, \infty)$

112. The differential equation of the family of curves $y = e^x(A\cos x + B\sin x)$ where A, B are arbitrary constants is.

(a) $\frac{d^2y}{dx^2} - 9x = 13$ (b) $\frac{d^2y}{dx^2} - 2\frac{dy}{dx} + 2y = 0$

(c) $\frac{d^2y}{dx^2} + 3y = 4$ (d) $\left(\frac{dy}{dx}\right)^2 + \frac{dy}{dx} - xy = 0$

113. The equation $r\cos\left(\theta - \frac{\pi}{3}\right) = 2$ represents.

(a) a circle (b) a parabola

(c) an ellipse (d) a straight line

114. The locus of the center of the circles which touch both the circles $x^2 + y^2 = a^2$ and $x^2 + y^2 = 4ax$ externally is.

(a) a circle

(b) a parabola

(c) an ellipse

(d) a hyperbola

115. Let each of the equations $x^2 + 2xy + ay^2 = 0$ and $ax^2 + 2xy + y^2 = 0$ represent two straight lines passing through the origin. If they have a common line, then the other two lines are given by.

(a) $x - y = 0, x - 3y = 0$

(b) $x + 3y = 0, 3x + y = 0$

(c) $3x + y = 0, 3x - y = 0$

(d) $(3x - 2y) = 0, x + y = 0$

116. A straight line through the origin 0 meets the parallel lines $4x + 2y = 9$ and $2x + y + 6 = 0$ at P and Q respectively. The point O divides the segment PQ in the ratio.

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

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

117. Area in the first quadrant between the ellipses $x^2 + 2y^2 = a^2$ and $2x^2 + y^2 = a^2$ is.

(a) $\frac{a^2}{\sqrt{2}}\tan^{-1}\frac{1}{\sqrt{2}}$ (b) $\frac{3a^2}{4}\tan^{-1}\frac{1}{2}$

(c) $\frac{5a^2}{2}\sin^{-1}\frac{1}{2}$ (d) $\frac{9\pi a^2}{2}$

118. The equation of circle of radius $\sqrt{17}$ unit, with centre on the positive side of X-axis and through the point $(0, 1)$ is.

(a) $x^2 + y^2 - 8x - 1 = 0$

(b) $x^2 + y^2 + 8x - 1 = 0$

(c) $x^2 + y^2 - 9y + 1 = 0$

(d) $2x^2 + 2y^2 - 3x + 2y = 4$

119. The length of the chord of the parabola $y^2 = 4ax (a > 0)$ which passes through the vertex

and makes an acute angle α with the axis of the parabola is.

(a) $\pm 4a\cot\alpha\operatorname{cosec}\alpha$
(b) $4a\cot\alpha\operatorname{cosec}\alpha$
(c) $-4a\cot\alpha\operatorname{cosec}\alpha$
(d) $4a\operatorname{cosec}^2\alpha$

120. A double ordinate PQ of the hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ is such that $\triangle OPQ$ is equilateral, O being the center of the hyperbola. Then the eccentricity e satisfies the relation.

(a) $1<e<\frac{2}{\sqrt{3}}$ (b) $e=\frac{2}{\sqrt{3}}$
(c) $e=\frac{\sqrt{3}}{2}$ (d) $e>\frac{2}{\sqrt{3}}$

121. If B and B' are the ends of minor axis and S and S' are the foci of the ellipse $\frac{x^2}{25}+\frac{y^2}{9}=1$, then the area of the rhombus $SBS'B'$ will be.

(a) 12 sq units (b) 48 sq units
(c) 24 sq units (d) 36 sq units

122. The equation of the latusrectum of a parabola is $x+y=8$ and the equation of the tangent at the vertex is $x+y=12$. Then, the length of the latusrectum is.

(a) $4\sqrt{2}$ units (b) $2\sqrt{2}$ units
(c) 8 units (d) $8\sqrt{2}$ units

123. The equation of the plane through the point $(2,-1,-3)$ and parallel to the lines $\frac{x-1}{3}=\frac{y+2}{2}=\frac{z}{-4}$ and $\frac{x}{2}=\frac{y-1}{-3}=\frac{z-2}{2}$ is.

(a) $8x+14y+13z+37=0$
(b) $8x-14y-13z-37=0$
(c) $8x-14y-13z+37=0$
(d) $8x-14y+13z+37=0$

124. The sine of the angle between the straight line $\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ and the plane $2x-2y+z=5$ is.

(a) $\frac{2\sqrt{3}}{5}$ (b) $\frac{\sqrt{2}}{10}$
(c) $\frac{4}{5\sqrt{2}}$ (d) $\frac{\sqrt{5}}{6}$

125. Let $f(x)=\sin x+\cos ax$ be periodic function. Then,

(a) a is any real number
(b) a is any irrational number
(c) a is rational number
(d) $a=0$

126. The domain of $f(x)=\sqrt{\left(\frac{1}{\sqrt{x}}-\sqrt{(x+1)}\right)}$ is.

(a) $x>-1$ (b) $(-1,\infty)\setminus\{0\}$
(c) $\left[0,\frac{\sqrt{5}-1}{2}\right]$ (d) $\left[\frac{1-\sqrt{5}}{2},0\right)$

127. Let $y=f(x)=2x^2-3x+2$. The differential of y when x changes from 2 to 1.99 is.

(a) 0.01 (b) 0.18
(c) -0.05 (d) 0.07

128. If $\lim_{x\to 0}\left(\frac{1+cx}{1-cx}\right)^{1/x}=4$, then $\lim_{x\to 0}\left(\frac{1+2cx}{1-2cx}\right)^{1/x}$ is.

(a) 2 (b) 4
(c) 16 (d) 64

129. Let $f: R\to R$ be twice continuously differentiable (or f'' exists and is continuous) such that $f(0)=f(1)=f'(0)=0$. Then.

(a) $f''(c)=0$ for some $c\in R$
(b) there is no point for which $f''(x)=0$
(c) at all points $f''(x)>0$
(d) at all points $f''(x)<0$

130. Let $f(x) = x^{13} + x^{11} + x^9 + x^7 + x^5 + x^3 + x + 12$
Then.
(a) $f(x)$ has 13 non-zero real roots
(b) $f(x)$ has exactly one real root
(c) $f(x)$ has exactly one pair of imaginary roots
(d) $f(x)$ has no real root

131. The area of the region $\{(x, y): x^2 + y^2 \leq 1 \leq x + y\}$ is.
(a) $\frac{\pi^2}{2}$ (b) $\frac{\pi}{4}$
(c) $\frac{\pi}{4} - \frac{1}{2}$ (d) $\frac{\pi^2}{3}$

132. In open interval $\left(0, \frac{\pi}{2}\right)$,
(a) $\cos x + x\sin x < 1$
(b) $\cos x + x\sin x > 1$
(c) no specific order relation can be ascertained between $\cos x + x\sin x$ and 1
(d) $\cos x + x\sin x < \frac{1}{2}$

133. If the line $y = x$ is a tangent to the parabola $y = ax^2 + bx + c$ at the point $(1, 1)$ and the curve passes through $(-1, 0)$, then.
(a) $a = b = -1, c = 3$
(b) $a = b = \frac{1}{2}, c = 0$
(c) $a = c = \frac{1}{4}, b = \frac{1}{2}$
(d) $a = 0, b = c = \frac{1}{2}$

134. If the vectors $\alpha = \hat{\imath} + a\hat{\jmath} + a^2\hat{k}, \beta = \hat{\imath} + b\hat{\jmath} + b^2\hat{k}$ and $\gamma = \hat{\imath} + c\hat{\jmath} + c^2\hat{k}$ are three non-coplanar vectors and $\begin{vmatrix} a & a^2 & 1 + a^3 \\ b & b^2 & 1 + b^3 \\ c & c^2 & 1 + c^3 \end{vmatrix} = 0$, then the value of abc is.
(a) 1 (b) 0
(c) -1 (d) 2

135. Let z_1 and z_2 be two imaginary roots of $z^2 + pz + q = 0$, where p and q are real. The points z_1, z_2 and origin form an equilateral triangle if.
(a) $p^2 > 3q$ (b) $p^2 < 3q$
(c) $p^2 = 3q$ (d) $p^2 = q$

136. If $P(x) = ax^2 + bx + c$ and $Q(x) = -ax^2 + dx +$ where $ac \neq 0 [a, b, c, d$ are all real], then $P(x) \cdot Q(x) = 0$ has.
(a) atleast two real roots
(b) two real roots
(c) four real roots
(d) no real root

137. Let $A = \{x \in R: -1 \leq x \leq 1\}$ and $f: A \to A$ be a mapping defined by $f(x) = x|x|$. Then f is.
(a) injective but not surjective
(b) surjective but not injective
(c) neither injective nor surjective
(d) bijective

138. Let $f(x) = \sqrt{x^2 - 3x + 2}$ and $g(x) = \sqrt{x}$ be two given functions. If S be the domain of fog and T be the domain of $g \circ f$, then.
(a) $S = T$
(b) $S \cap T = \phi$
(c) $S \cap T$ is a singleton
(d) $S \cap T$ is an interval

139. Let ρ_1 and ρ_2 be two equivalence relations. defined on a non-void set S. Then
(a) both $\rho_1 \cap \rho_2$ and $\rho_1 \cup \rho_2$ are equivalence relations
(b) $\rho_1 \cap \rho_2$ is equivalence relation but $\rho_1 \cup \rho_2$ is not so

(c) $\rho_1 \cup \rho_2$ is equivalence relation but $\rho_1 \cap \rho_2$ is not so
(d) neither $\rho_1 \cap \rho_2$ nor $\rho_1 \cup \rho_2$ is equivalence relation.

140. Consider the curve $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. The portion of the tangent at any point of the curve intercepted between the point of contact and the directrix subtends at the corresponding focus an angle of.

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

141. A line cuts the X-axis at $A(7,0)$ and the Y-axis at $B(0,-5)$. A variable line PQ is drawn perpendicular to AB cutting the X-axis at $P(a,0)$ and the Y-axis at $Q(0,b)$. If AQ and BP intersect at R, the locus of R is.

(a) $x^2+y^2+7x+5y=0$
(b) $x^2+y^2+7x-5y=0$
(c) $x^2+y^2-7x+5y=0$
(d) $x^2+y^2-7x-5y=0$

142. Let $0<\alpha<\beta<1$. Then, $\lim_{n\to\infty}\int_{1/(k+\beta)}^{1/(k+\alpha)}\frac{dx}{1+x}$ is.

(a) $\log_\theta \frac{\beta}{\alpha}$ (b) $\log_e \frac{1+\beta}{1+\alpha}$
(c) $\log_e \frac{1+\alpha}{1+\beta}$ (d) ∞

143. $\lim_{x\to 1}\left(\frac{1}{\ln x}-\frac{1}{(x-1)}\right)$

(a) Does not exist (b) 1
(c) $\frac{1}{2}$ (d) 0

144. Let $y=\frac{1}{1+x+\ln x}$, then.

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

145. Consider the curve $y=be^{-x/a}$, where a and b are non-zero real numbers. Then

(a) $\frac{x}{a}+\frac{y}{b}=1$ is tangent to the curve at $(0,0)$
(b) $\frac{x}{a}+\frac{y}{b}=1$ is tangent to the curve, where the curve crosses the axis of y.
(c) $\frac{x}{a}+\frac{y}{b}=1$ is tangent to the curve at (a, 0)
(d) $\frac{x}{a}+\frac{y}{b}=1$ is tangent to the curve at $(2a,0)$

146. The area of the figure bounded by the parabola $x=-2y^2, x=1-3y^2$ is.

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

147. A particle is projected vertically upwards. If it has to stay above the ground for 12 sec , then.

(a) velocity of projection is 192ft/sec
(b) greatest height attained is 600 ft
(c) velocity of projection is 196ft/sec
(d) greatest height attained is 576 ft

148. The equation $x^{(\log_3 x)^2-\frac{9}{2}\log_3 x+5}=3\sqrt{3}$ has

(a) at least one real root
(b) exactly one real root
(c) exactly one irrational root
(d) complex roots

149. In a certain test, there are n questions. In this test 2^{n-i} students gave wrong answers to at

least i questions, where $i = 1, 2, \ldots, n$. If the total number of wrong answers given is 2047, then n is equal to.

(a) 10 (b) 11

(c) 12 (d) 13

150. A and B are independent events. The probability that both A and B occur is $\frac{1}{20}$ and the probability that neither of them occurs is $\frac{3}{5}$. The probability of occurrence of A is.

(a) $\frac{1}{2}$ (b) $\frac{1}{10}$

(c) $\frac{1}{4}$ (d) $\frac{1}{5}$

151. The equation of the straight line passing through the point $(4, 3)$ and making intercepts on the coordinate axes whose sum is -1 is.

(a) $\frac{x}{2} - \frac{y}{3} = 1$ (b) $\frac{x}{-2} + \frac{y}{1} = 1$

(c) $-\frac{x}{3} + \frac{y}{2} = 1$ (d) $\frac{x}{1} - \frac{y}{2} = 1$

152. Consider a tangent to the ellipse $\frac{x^2}{2} + \frac{y^2}{1} = 1$ at any point. The locus of the mid-point of the portion intercepted between the axes is.

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

(c) $\frac{1}{3x^2} + \frac{1}{4y^2} = 1$ (d) $\frac{1}{2x^2} + \frac{1}{4y^2} = 1$

153. Let $y = \frac{x^2}{(x+1)^2(x+2)}$. Then, $\frac{d^2y}{dx^2}$ is.

(a) $2\left[\frac{3}{(x+1)^4} - \frac{3}{(x+1)^3} + \frac{4}{(x+2)^3}\right]$

(b) $3\left[\frac{2}{(x+1)^3} + \frac{4}{(x+1)^2} - \frac{5}{(x+2)^3}\right]$

(c) $\frac{6}{(x+1)^3} - \frac{4}{(x+1)^2} + \frac{3}{(x+1)^3}$

(d) $\frac{7}{(x+1)^3} - \frac{3}{(x+1)^2} + \frac{2}{(x+1)^3}$

154. Let $f(x) = \frac{1}{3}x\sin x - (1 - \cos x)$. The smallest positive integer k such that $\lim_{x\to 0} \frac{f(x)}{x^k} \neq 0$ is.

(a) 4 (b) 3

(c) 2 (d) 1

155. Tangent is drawn at any point $P(x, y)$ on a curve, which passes through $(1, 1)$. The tangent cuts X-axis and Y-axis at A and B respectively. If $AP : BP = 3 : 1$, then

(a) the differential equation of the curve is $3x\frac{dy}{dx} + y = 0$

(b) the differential equation of the curve is $3x\frac{dy}{dx} - y = 0$

(c) the curve passes through $\left(\frac{1}{8}, 2\right)$

(d) the normal at $(1,1)$ is $x + 3y = 4$