MOCK TEST PAPER 2

General Instructions : *Same as Mock Test Paper 1.*

Physics

Section A

Q. 1. The magnitude of vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A}+\vec{B}=\vec{C}$, then the angle between $\vec{A}$ and $\vec{B}$ is :

(1) 0 **(2)** π **(3)** $\frac{\pi}{2}$ **(4)** $\frac{\pi}{4}$

Q. 2. A wave is represented by $y = a\sin(At - Bx + C)$ where A, B, C are constants and t is in seconds and x is in metre. The Dimensions of A, B, C are :

(1) $[T^{-1}]$, $[L]$, $[M^0L^0T^0]$
(2) $[T^{-1}]$, $[L^{-1}]$, $[M^0L^0T^0]$
(3) $[T]$, $[L]$, $[M]$
(4) $[T^{-1}]$, $[L^{-1}]$, $[M^{-1}]$

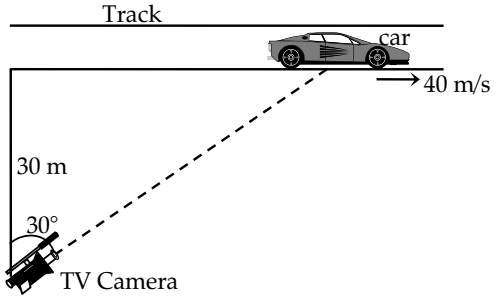
Q. 3. The Ratio of SI unit to CGS unit of Planck's Constant is—

(1) 10^7 **(2)** 10^{-5} **(3)** 10^3 **(4)** 10^5

Q. 4. In a legend the hero-kid kicked a toy pig so that it is projected with a speed greater than that of its cry. If the weight of the toy pig is assumed to be 5 kg and the time of contact 0.01 s, the force with which the hero-kid kicked him was (Speed of cry = 330 m/s) :

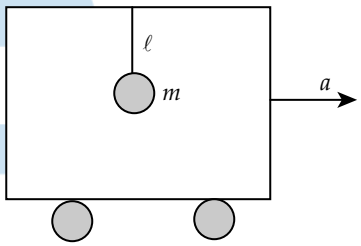
(1) 5×10^{-2} N **(2)** 2×10^5 N
(3) 1.65×10^5 N **(4)** 1.65×10^3 N

Q. 5. A racing car is travelling along a track at a constant speed of 40 m/s. A T.V. camera man is recording the event from a distance of 30 m directly away from the track as shown in figure. In order to keep the car under view in the position shown, the angular speed with which the camera should be rotated, is :



(1) $\frac{4}{5}$ rad/s **(2)** $\frac{3}{4}$ rad/s
(3) $\frac{8}{3}\sqrt{3}$ rad/s **(4)** 1 rad/s

Q. 6. A pendulum of mass m and length ℓ is suspended from the ceiling of a trolley which has a constant acceleration a in the horizontal direction as shown in figure. Work done by the tension is (In the frame of trolley) :



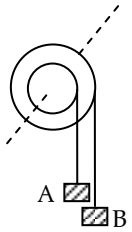
(1) $\frac{mg}{\tan\theta}[\cos(\tan^{-1}(a/g)-1]$

(2) $\frac{mg}{\tan\theta}[\sin(\tan^{-1}(a/g)-1]$

(3) $\frac{mg}{\cos\theta}[\sin(\tan^{-1}(a/g)-1]$

(4) $\frac{mg}{\cos\theta}[\cos(\tan^{-1}(a/g)-1]$

Q. 7. Figure shows a small wheel fixed coaxially on a bigger one of double the radius. The system rotates about the common axis. The strings supporting A and B do not slip on the wheels. If x and y be the distances travelled by A and B in the same time interval, then :



(1) $x = 2y$ **(2)** $x = y$
(3) $y = 2x$ **(4)** None of these

Q. 8. The velocities of a particle in SHM at positions x_1 and x_2 are v_1 and v_2, respectively, its time period will be

(1) $2\pi\sqrt{\frac{(v_1^2-v_2^2)}{(x_2^2-x_1^2)}}$ **(2)** $2\pi\sqrt{\frac{(x_1^2+x_2^2)}{(v_2^2-v_1^2)}}$

(3) $2\pi\sqrt{\frac{(x_1^2-x_2^2)}{(v_2^2-v_1^2)}}$ **(4)** $2\pi\sqrt{\frac{(x_1^2+x_2^2)}{(v_2^2+v_1^2)}}$

Q. 9. One cubic plate, having 15 cm side, floats on water surface. If surface tension of water is 60 dyne/cm. To lift this plate from water, Find the extra force required against weight.

(1) 3600 dyne **(2)** 1800 dyne

(3) 900 dyne **(4)** 7200 dyne

Q. 10. The number density fo electrons in Copper is 8.5×10^{28} m^{-3}. Find the current flowing through copper wire of length 0.2 m, are a of cross section 1 mm^2, when connected to a battery of 4V. Given that electron mobility = 4.5×10^{-6} $m^2v^{-1}s^{-1}$.

(1) 1.3 A **(2)** 1.22 A

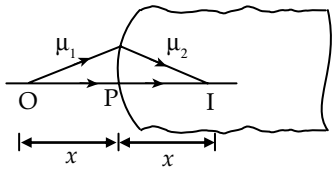
(3) 2.11 A **(4)** 1.12 A

Q. 11. Two coherent sources of different intensities send waves which interfere. The ratio of maximum intensity to the minimum intensity is 25. The intensities of the sources are in the ratio :

(1) 25 : 1 **(2)** 5 : 1

(3) 9 : 4 **(4)** 625 : 1

Q. 12. A spherical surface of radius R separates two medium of refractive indices μ_1 and μ_2, as shown in figure. Where should an object be placed in the medium 1 so that a real image is formed in medium 2 at the same distance ?



(1) $\left(\frac{\mu_2-\mu_1}{\mu_2+\mu_1}\right)R$ **(2)** $\left(\frac{\mu_2+\mu_1}{\mu_2-\mu_1}\right)R$

(3) $\left(\frac{\mu_2+\mu_1}{\mu_2}\right)R$ **(4)** $\left(\frac{\mu_2}{\mu_2+\mu_1}\right)R$

Q. 13. The dispersive powers of flint glass and crown glass are 0.053 and 0.034, respectively and their mean refractive indices are 1.68 and 1.53 for white light. Calculate the angle of the flint glass prism required to form an achromatic combination with a crown glass prism of refracting angle 4° :

(1) 2° **(2)** 4° **(3)** 5° **(4)** 6°

Q. 14. In young's double slit experiment $\frac{d}{D}=10^{-4}$ (d = distance between slits, D = distance of screen from the slits). At a point P on the screen resulting intensity is equal to the intensity due to individual slit I_0. Then the distance of point P from the central maximum is (λ = 6000 Å)

(1) 2 mm **(2)** 1 mm

(3) 0.5 mm **(4)** 4 mm

Q. 15. The mobility of electrons in a semiconductor chip of length 10 cm is observed to be 1000 cm^2/Vs. When a potential difference of 2v is applied across it. What is the drift speed of electrons.

(1) 1 cm/s **(2)** 5 cm/s

(3) 2 m/s **(4)** 1000 m/s

Q. 16. The energy levels of a certain atom for first, second and third levels are E, 4E/3 and 2E, respectively. A photon of wavelength λ is emitted for a transition $3 \rightarrow 1$. What will be the wavelength of emission for transition $2 \rightarrow 1$?

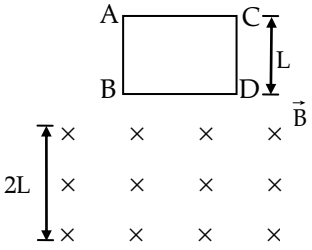
(1) $\frac{\lambda}{3}$ **(2)** $\frac{4\lambda}{3}$ **(3)** $\frac{3\lambda}{4}$ **(4)** 3λ

Q. 17. The graph of $\ell n\left(\frac{R}{R_0}\right)$ versus ℓn A (R = radius of a nucleus and A = its mass number) is :

(1) a straight line **(2)** a parabola

(3) an ellipse **(4)** none of these

Q. 18. A square coil ABCD with its plane vertical is released from rest in a horizontal uniform magnetic field $\vec{B}$ of length 2L. The acceleration of the coil is :



(1) less than g for all the time till the loop crosses the magnetic field completely

(2) less than g when it enters the field and greater than g when it comes out of the field

(3) g all the time

(4) less than g when it enters and comes out of the field but equal to g when it is within the field

Q.19. We have three identical perfectly black plates. The temperatures of first and third plate is T and 3T. What is the temperature of second plate if system is in equilibrium ?

(1) $41^{1/4}$ T **(2)** $51^{1/4}$ T
(3) $2^{1/4}$ T **(4)** $37^{1/4}$ T

Q. 20. If a baseball player can throw a ball at maximum distance = d over a ground, the maximum vertical height to which he can throw it, will be (Ball has same initial speed in each case) :

(1) $\frac{d}{2}$ **(2)** d **(3)** $2d$ **(4)** $\frac{}{4}$

Section B

Q. 21. A ball falls from a height of 1 m on a ground and it loses half its kinetic energy when it hits the ground. What would be the total distance covered by the ball after sufficiently long time ?

Q. 22. Consider a gravity-free hall in which an experimenter of mass 50 kg is resting on a 5 kg pillow, 8 ft above the floor of the hall. He pushes the pillow down so that it starts falling at a speed of 8 ft/s. The pillow makes a perfectly elastic collision with the floor, rebounds and reaches the experimenter's head. The time elapsed in the process is.....s

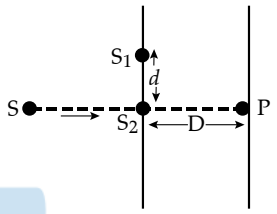
Q. 23. A battery of EMF 10V sets up a current of 1A when connected across a resistor of 8Ω. If the resistor is shunted by another 8Ω resistor, what would be the current in the circuit ? (in A)

Q. 24. A liquid flows out drop by drop from a vessel through a vertical tube with an internal diameter of 2 mm, then the total number of drops that flows out during 10 grams of the liquid flow out..... [Assume that the diameter of the neck of a drop at the moment it breaks away is equal to the internal diameter of tube and surface tension is 0.02 N/m].

Q. 25. A cylinder of area 300 cm^2 and length 10 cm made of material of specific gravity 0.8 is floated in water with its axis vertical. It is then pushed downward, so as to be just immersed. The work done by the agent who pushes the cylinder into the water is.....J.

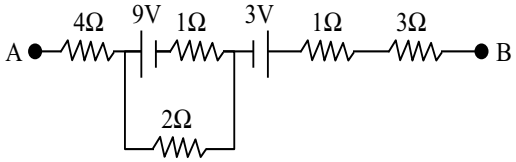
Q. 26. A copper ball of density 8.6 g/cm^3, 1 cm in diameter is immersed in oil of density 0.8 g/cm^3. The charge in μC on the ball, if it remains just suspended in an electric field of intensity 3600 V/m acting in upward direction is..... μC.

Q. 27. In a YDSE experiment two slits S_1 and S_2 have separation of d = 2 mm. The distance of the screen is D = 8/5 m. Source S starts moving from a very large distance towards S_2 perpendicular to S_1S_2 as shown in figure. The wavelength of monochromatic light is 500 nm. The number of maximas observed on the screen at point P as the source moves towards S_2 is 3995 + n. The value of n is.....



Q. 28. A leaky parallel plate capacitor is filled completely with a material having dielectric constant K = 5 and electric conductivity $\sigma = 7.4 \times 10^{-12}\ \Omega^{-1}\ m^{-1}$. If the charge on the plate at the instant t = 0 is q = 8.85 μC, then the leakage current at the instant t = 12 s is.....$\times 10^{-1}$ μA.

Q. 29. Potential difference between the points A and B in the circuit shown is 16 V, then potential difference across 2Ω resistor is .....V. volt. ($V_A > V_B$)



Q. 30. The half-value thickness of an absorber is defined as the thickness that will reduce exponentially the intensity of a beam of particles by a factor of 2. The half-value thickness in (μm) for lead assuming X-ray beam of wavelength 20 pm, μ = 50 cm^{-1} for X-rays in lead at wavelength λ = 20 pm, is..... μm

Chemistry

Section A

Q. 31. Match List–I with List–II:

List–I	List–II
(a) $[PtCl_4]^{2-}$	**(I)** sp^3d
(b) BrF_5	**(II)** d^2sp^3
(c) PCl_5	**(III)** sp^2
(d) $[Co(NH_3)_6]^{3+}$	**(IV)** sp^3d^2

Choose the most appropriate answer from the options given below:

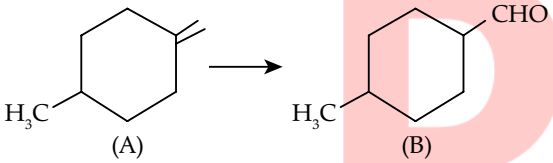
(1) (a)-(II), (b)-(IV), (c)-(I), (d)-(III)

(2) (a)-(III), (b)-(IV), (c)-(I), (d)-(II)

(3) (a)-(III), (b)-(I), (c)-(IV), (d)-(II)

(4) (a)-(II), (b)-(I), (c)-(IV), (d)-(III)

Q. 32. Which of the following reagents/reactions will convert 'A' to 'B'?



(1) PCC oxidation

(2) Ozonolysis

(3) $BH_3, H_2O_2/OH^-$ followed by PCC oxidation

(4) HBr, hydrolysis followed oxidation by $K_2Cr_2O_7$

Q. 33. Which is low spin complex :

(1) $Fe(CN)_6^{4-}$ **(2)** $Co(NO_2)_6^{3-}$

(3) $Mn(CN)_6^{3-}$ **(4)** All of the above

Q. 34. An inorganic salt solution gives a yellow precipitate with silver nitrate. The precipitate dissolves in dilute nitric acid as well as in ammonium hydroxide. The solution contains :

(1) Bromide **(2)** Iodide

(3) Phosphate **(4)** Chromate

Q. 35. Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by 0.2 °C. The percentage association of solute A in water, is:

[Given: Molar mass of A = 93 g mol^{-1}. Molal depression constant of water is 1.86 K kg mol^{-1}]

(1) 50% **(2)** 60% **(3)** 70% **(4)** 80%

Q. 36. The molar conductivity of a conductivity cell filled with 10 moles of 20 mL NaCl solution is Δm_1 and that of 20 moles of another identical cell heaving 80 mL NaCl solution is Δm_2. The conductivities exhibited by these two cells are same.

The relationship between Δm_2 and Δm_1 is

(1) $\Delta m_2 = 2\Delta m_1$ (2) $\Delta m_2 = \Delta m_1/2$

(3) $\Delta m_2 = \Delta m_1$ **(4)** $\Delta m_2 = 4\Delta m_1$

Q. 37. The correct set of the products obtained in the following reactions :Δ

(A) $RCN \xrightarrow{\text{reduction}}$

(B) $RCN \xrightarrow[\text{(ii) } H_2O]{\text{(i) } CH_3MgBr}$

(C) $RNC \xrightarrow{\text{hydrolysis}}$

(D) $RNH_2 \xrightarrow{HNO_2}$

The answer is –

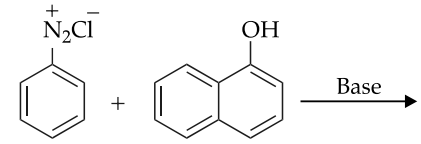
(1) A B
2° Amine Methyl ketone
C D
1°Amine Alcohol

(2) A B
1° Amine Methyl ketone
C D
2° Amine Alcohol

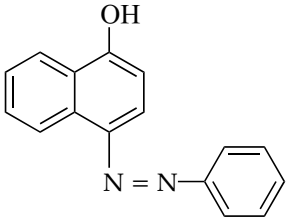
(3) A B
2° Amine Methyl ketone
C D
2° Amine Acid

(4) A B
2° Amine Methyl ketone
C D
2° Amine Aldehyde

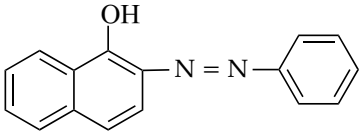
Q. 38. The major product of the following reaction is :

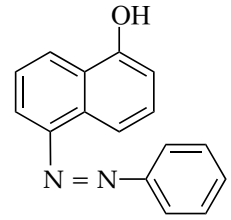


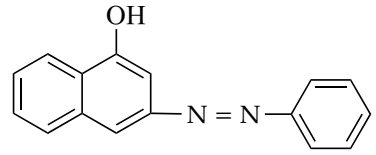
(1)



(2)



(3) 

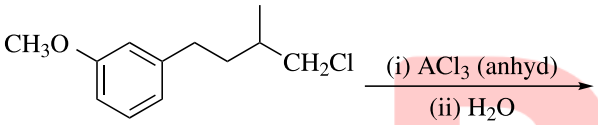
(4) 

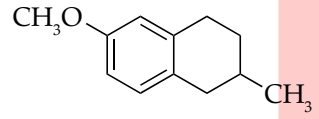
Q. 39. If a compound on analysis was found to contain C = 18.5%, H = 1.55%, Cl = 55.04% and O = 24.81%, then its empirical formula is :

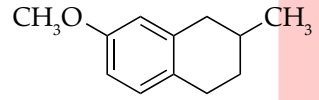
(1) CHClO **(2)** CH_2ClO

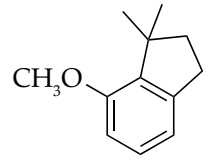
(3) C_2H_2OCl **(4)** $ClCH_2O$

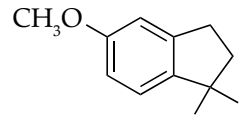
Q. 40. The major product of the following reaction is :

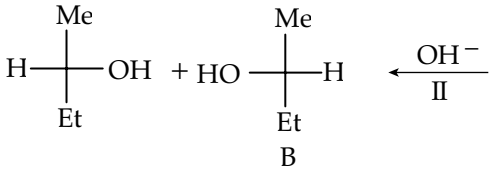


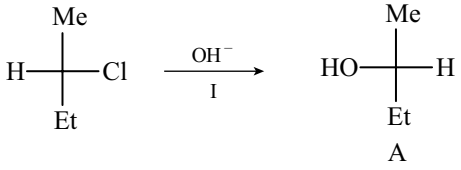
(1) 

(2) 

(3) 

(4) 

Q. 41. 



The reaction involved in steps I and II are :

(1) Both S_N1 **(2)** Both S_N2

(3) I S_N1, II S_N2 **(4)** I S_N2, II S_N1

Q. 42. The correct order of bond strength is

(1) $O_2^- < O_2 < O_2^+ < O_2^{2-}$

(2) $O_2^2 < O_2^- < O_2 < O_2^+$

(3) $O_2^- < O_2^{2-} < O_2 < O_2^+$

(4) $O_2^+ < O_2 < O_2^- < O_2^{2-}$

Q. 43. The enthalpy change states for the following processes are listed below:

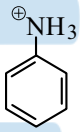
$Cl_2(g) \rightarrow 2Cl\ (g)$	242.3 kJ mol^{-1}
$I_2(g) \rightarrow 2I\ (g)$	151 kJ mol^{-1}
$ICl(g) \rightarrow I\ (g) + Cl\ (g)$	242.3 kJ mol^{-1}
$I_2(s) \rightarrow I_2\ (g)$	62.76 kJ mol^{-1}

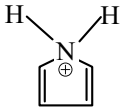
Given that the standard states for iodine chlorine are I_2 (s) and Cl_2 (g), the standard enthalpy of formation for ICl (g) is:

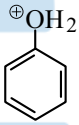
(1) 244.8 kJ mol^{-1} **(2)** –14.3 kJ mol^{-1}

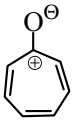
(3) –16.8 kJ mol^{-1} **(4)** 16.8 kJ mol^{-1}

Q. 44. In which delocalization of positive charge is possible :

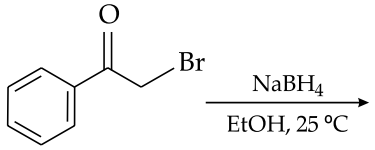
(1) 

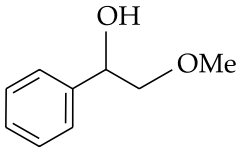
(2) 

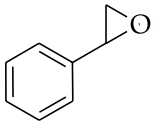
(3) 

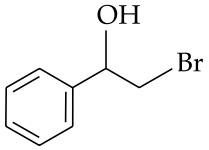
(4) 

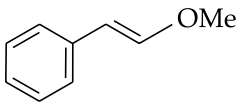
Q. 45. The major product of the following reaction is :



(1) 

(2) 

(3) 

(4) 

Q. 46. Total number of possible stereoisomers of dimethyl cyclopentane is

(1) 10 **(2)** 5 **(3)** 6 **(4)** 4

Q. 47. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R)

Assertion (A) : Aniline on nitration yields ortho, meta & para nitro derivatives of aniline.

Reason (R) : Nitrating mixture is a strong acidic mixture.

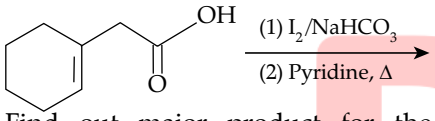
In the light of the above statements, choose the correct answer from the options given below

(1) Both A and R are true and R is the correct explanation of A.

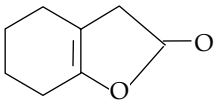
(2) Both A and R are true but R is NOT the correct explanation of A.

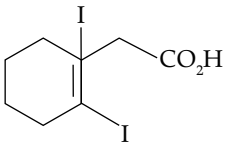
(3) A is true but R is false.

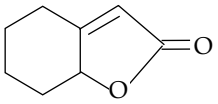
(4) A is false but R is true.

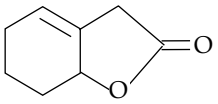
Q. 48. 

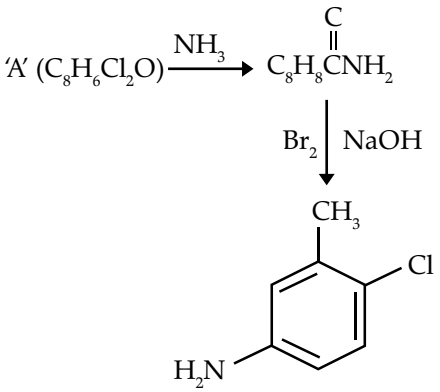
Find out major product for the above reaction

(1) 

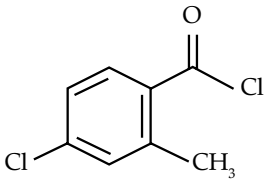
(2) 

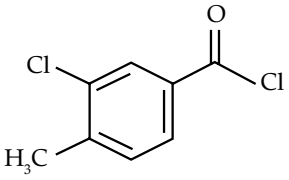
(3) 

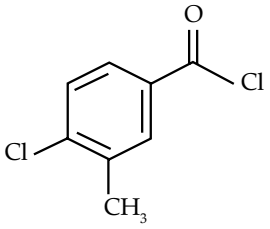
(4) 

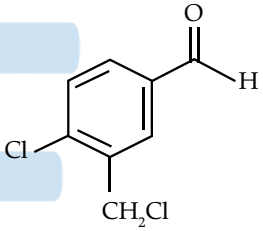
Q. 49. 

Consider the above reaction, the compound 'A' is :

(1) 

(2) 

(3) 

(4) 

Q. 50. Glycosidic linkage between C-1 of α-glucose and C-2 of β-fructose is found in

(1) maltose **(2)** sucrose

(3) lactose **(4)** amylose

Section B

Q. 51. A drop of solution (volume 0.05 mL) contains 3.0×10^{-6} mole of H^+. If the rate constant of disappearance of H^+ is 1.0×10^7 mole $L^{-1}s^{-1}$. It would take for H^+ in drop to disappear in..... $\times 10^{-9}$s

Q. 52. The amount of C-14 isotope in a piece of wood is found to be $1/16^{th}$ of its amount present in a fresh piece of wood. The age of wood, half-life period of C-14 is 5770 years, is.....years

Q. 53. The overall formation constant for the reaction of 6 mol of CN^- with Cobalt(II) is 1×10^{19}. The formation constant for the reaction of 6 mol of CN^- with Cobalt(III) is ..... $\times 10^{63}$. Given that,

$$Co(CN)_6^{-3} + e^{-1} \longrightarrow Co(CN)_6^{-4}$$
$$E^\circ_{Rp} = 0.83\ V$$
$$Co^{+3} + e^{-1} \longrightarrow Co^{+2}$$
$$E^\circ_{Rp} = 1.82\ V$$

Q. 54. The neutralization occurs when 10 mL of 0.1 M acid 'A' is allowed to react with 30 mL of 0.05 M base $M(OH)_2$. The basicity of the acid 'A' is _____. [M is a metal]

Q. 55. Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20×10^{-3} kg of phenol in 1.0 kg of benzene has its freezing point depressed by 0.69 K. The fraction of phenol that has dimerised is..... (K_f for benzene = 5.12 K kg mol^{-1})

Q. 56. 0.2 g of an organic compound was subjected to estimation of nitrogen by Dumas method in which volume of N_2 evolved (at STP) was found to be 22.400 mL. The percentage of nitrogen in the compound is _____ [nearest integer]

(Given : Molar mass of N_2 is 28 g mol^{-1}, molar volume of N_2 at STP : 22.4L)

Q. 57. In alanyl glycyl leucyl alanyl valine, the number of peptide linkages is_____

Q. 58. E.N. of Si is..... (Covalent radius of Si = 1.175 Å)

Q. 59. The number of π–bonds present in C_2 (Vap.) molecule according to molecular orbital theory are.....

Q. 60. The major product 'A' of the following given reaction has_____ sp^2 hybridized carbon atoms.

2, 7-Dimethyl-2, 6-octadiene $\xrightarrow{H^+}$ A (Major Product)

Mathematics

Section A

Q. 61. Let the point P(α, β) be at a unit distance from each of the two lines $L_1 : 3x - 4y + 12 = 0$, and $L_2 : 8x + 6y + 11 = 0$. If P lies below L1 and above L2, then 100(a + b) is equal to

(1) –14 **(2)** 42 **(3)** –22 **(4)** 14

Q. 62. If D, E, F are the mid points of the sides BC, CA and AB respectively of a triangle ABC and 'O' is any point, then, $|\overrightarrow{AD} + \overrightarrow{BE} + \overrightarrow{CF}|$, is

(1) 1 **(2)** 0 **(3)** 2 **(4)** 4

Q. 63. $\int \frac{dx}{e^x + e^{-x}}$ equals

(1) $\log(e^x + e^{-x}) + c$ **(2)** $\log(e^x - e^{-x}) + c$

(3) $\tan^{-1}(e^x) + c$ **(4)** $\tan^{-1}(e^{-x}) + c$

Q. 64. $\int_0^1 |3x-1|\,dx$ equals

(1) 5/6 **(2)** 5/3 **(3)** 10/3 **(4)** 5

Q. 65. The area of the region bounded by the curve $y = \sin x$ and the x-axis in $[-\pi, \pi]$ is

(1) 4 **(2)** 8 **(3)** 12 **(4)** 2

Q. 66. The curve passing through (0, 1) and satisfying $\sin\left(\frac{dy}{dx}\right) = \frac{1}{2}$ is

(1) $\cos\left(\frac{y+1}{x}\right) = \frac{1}{2}$ **(2)** $\sin\left(\frac{y-1}{x}\right) = \frac{1}{2}$

(3) $\cos\left(\frac{x}{y+1}\right) = \frac{1}{2}$ **(4)** $\sin\left(\frac{x}{y-1}\right) = \frac{1}{2}$

Q. 67. If $y = a\log|x| + bx^2 + x$ has its extremum values at $x = -1$ and $x = 2$, then

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

(3) $a = -2, b = \frac{1}{2}$ **(4)** $a = -2, b = \frac{-1}{2}$

Q. 68. If $x = a[\cos\theta + \log\tan\frac{\theta}{2}]$, $y = a\sin\theta$ then $\frac{dy}{dx} =$

(1) cos θ **(2)** sin θ **(3)** tan θ **(4)** cosec θ

Q. 69. The range of the function $y = \frac{1}{2 - \sin 3x}$ is

(1) $\left(\frac{1}{3}, 1\right)$ **(2)** $\left[\frac{1}{3}, 1\right)$

(3) $\left[\frac{1}{3}, 1\right]$ **(4)** $\left(\frac{1}{3}, 1\right]$

Q. 70. $\lim_{x\to -1} \frac{x^3 - 2x - 1}{x^5 - 2x - 1} =$

(1) $\frac{2}{3}$ **(2)** $\frac{1}{3}$ **(3)** $\frac{4}{3}$ **(4)** $\frac{5}{3}$

Q. 71. A circle touching the x-axis at (3, 0) and making an intercept of length 8 on the y-axis passes through the point

(1) (3, 10) **(2)** (3, 5)

(3) (2, 3) **(4)** (1, 5)

Q. 72. If the line $y - \sqrt{3}x + 3 = 0$ cuts the parabola $y^2 = x + 2$ at A and B, then PA. PB is equal to (where co-ordinates of P are $(\sqrt{3}, 0)$)

(1) $\frac{4\left(\sqrt{3}+2\right)}{3}$ **(2)** $\frac{4\left(2-\sqrt{3}\right)}{3}$

(3) $2\sqrt{3}$ **(4)** $\frac{2\left(\sqrt{3}+2\right)}{3}$

Q. 73. The tangent and the normal at a point P on an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ meet its major axis at T and T′ such that $TT' = a$, then $e^2 \cos^2\theta + \cos\theta$ (where e is eccentricity of the ellipse) is equal to

(1) 1 **(2)** $\frac{1}{2}$ **(3)** $\frac{2}{3}$ **(4)** $\frac{1}{4}$

Q. 74. Let the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{7}=1$ and the hyperbola $\frac{x^2}{144}-\frac{y^2}{\alpha}=\frac{1}{25}$ coincide. Then the length of the latus rectum of the hyperbola is

(1) $\frac{32}{9}$ **(2)** $\frac{18}{5}$ **(3)** $\frac{27}{4}$ **(4)** $\frac{27}{10}$

Q. 75. For the roots of the equation $a - bx - x^2 = 0; (a > 0, b > 0)$, which statement is true ?

(1) both roots are positive
(2) both roots are negative
(3) roots have opposite sign, negative root has greater magnitude
(4) roots have opposite sign, positive root has greater magnitude

Q. 76. If $\log_{10} 2 = 0.3010$ and $\log_{10}3 = 0{\cdot}4771$ then number of ciphers after decimal before a significant figure comes in $\left(\frac{5}{3}\right)^{-100}$ is

(1) 21 **(2)** 22 **(3)** 23 **(4)** 24

Q. 77. If the ratio of the sum of n terms of two AP's is $2n : (n+1)$, then ratio of their 8^{th} terms is

(1) 15 : 8 **(2)** 8 : 13 **(3)** 11:6 **(4)** 5 : 17

Q. 78. If the 4^{th} term in the expansion of $\left(ax+\frac{1}{x}\right)^n$ is $\frac{5}{2}$, then the values of a and n respectively are

(1) 2, 6 **(2)** $\frac{1}{2}$, 6

(3) $\frac{1}{2}$, 5 **(4)** 2, 5

Q. 79. The number of positive integers satisfying the inequality ${}^{n+1}C_{n-2} - {}^{n+1}C_{n-1} \le 100$ is

(1) Nine **(2)** Eight **(3)** Five **(4)** Ten

Q. 80. If the orthocentre of the triangle formed by (1, 3) (4, –5) and (a, b) is (2, 4), Then the value of 33b + 22a is

(1) 0 **(2)** $\frac{1}{11}$ **(3)** 1 **(4)** $\frac{3}{11}$

Section B

Q. 81. Given $f_n(x)=\frac{1}{n}\left(\sin^n x+\cos^n x\right)$ for n = 1, 2, 3, ... Then the value of $24(f_4(x) - f_6(x))$ is equal to .....

Q. 82. Let $x = \sin(2\tan^{-1}\alpha)$ and $y = \sin\left(\frac{1}{2}\tan^{-1}\frac{4}{3}\right)$. If S = $\{a \in R : y^2 = 1 - x\}$, the $\sum_{\alpha\in S} 16\alpha^3$ is equal to

Q. 83. The sum of the series

$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{2}{9}\right) + ...$

$+ \tan^{-1}\left[\frac{2^{n-1}}{1+2^{2n-1}}\right] + ...\infty.$

is..... $\frac{k\pi}{4}$. Then the value of k is.....

Q. 84. If the number of five digit numbers with distinct digits and 2 at the 10^{th} place is 336 k, then k is equal to....

Q. 85. In a workshop, there are five machines and the probability of any one of them to be out of service on a day is $\frac{1}{4}$. If the probability that at most two machines will be out of service on the same day is $\left(\frac{3}{4}\right)^3 k$, then k is equal to.....

Q. 86. If function

$$f(x)=\begin{cases}\frac{a\sin x + b\tan x - 3x}{x^3} & , \quad x \neq 0 \\ 0 & , \quad x = 0\end{cases}$$ is

continuous at $x = 0$, then $(a^2 + b^2)$ is equal to.....

Q. 87. Four fair dice are thrown simultaneously. If probability that the highest number obtained is 4 is $\frac{25a}{1296}$, then 'a' is equal to.....

Q. 88. If the sides a, b, c of ΔABC satisfy the equation $4x^3 - 24x^2 + 47x - 30 = 0$ and $\begin{vmatrix} a^2 & (s-a)^2 & (s-a)^2 \\ (s-b)^2 & b^2 & (s-b)^2 \\ (s-c)^2 & (s-c)^2 & c^2 \end{vmatrix} = \frac{p^2}{q}$, where p and q are co-prime and s is semiperimeter of ΔABC, then the value of $(p-q)$ is.....

Q. 89. If $D = \begin{bmatrix} 0 & a\alpha^2 & a\beta^2 \\ b\alpha + c & 0 & a\gamma^2 \\ b\beta + c & (b\gamma + c) & 0 \end{bmatrix}$ is a skew symmetric matrix (where α, β, γ are distinct) and the value of $\begin{vmatrix} (a+1)^2 & (1-a) & (2-c) \\ (3+c) & (b+2)^2 & (b+1)^2 \\ (3-b)^2 & b^2 & (c+3) \end{vmatrix}$ is λ, then the value of $|10\lambda|$ is.....

Q. 90. Let $|z| = |z - 3| = |z - 4i|$, then the value $|2z|$ is.....