JEE Mains (Dropper)

Sample Paper - II

DURATION : 180 Minutes **M. MARKS : 300**

General Instructions:

1. Immediately fill in the particulars on this page of the test booklet.
2. The test is of **3 hours** duration.
3. The test booklet consists of **90** questions **(75 to attempt)**. The maximum marks are **300**.
4. There are three subjects in the question paper, Subject I, II and III consisting of Section-I (**Physics),** Section-II **(Chemistry)**, Section-III **(Mathematics)**, and having **30 questions** in each part.
5. There will be a total of **20 MCQs** and **10 Numerical** Value Based Questions **(attempt any 5)**.
6. Each correct answer will give 4 marks while 1 Marks will be deducted for a wrong response.
7. No student is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc. inside the examination room/hall.
8. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator on duty in the Room/Hall. However, the candidates are allowed to take away this Test Booklet with them.
9. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

Name of the Student (In CAPITALS): _____

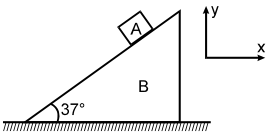
Roll Number: _____

Candidate's Signature: _____

Section-I (PHYSICS)

[Section – A]

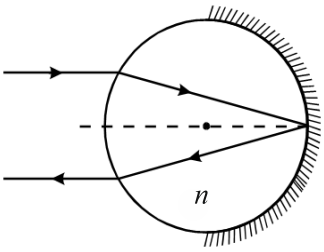
1. In the figure shown the acceleration of A is, $\vec{a}_A = 15\hat{i} + 15\hat{j}$ then the acceleration of B is: (A remains in contact with B)



(1) $6\hat{i}$ (2) $-15\hat{i}$

(3) $-10\hat{i}$ (4) $-5\hat{i}$

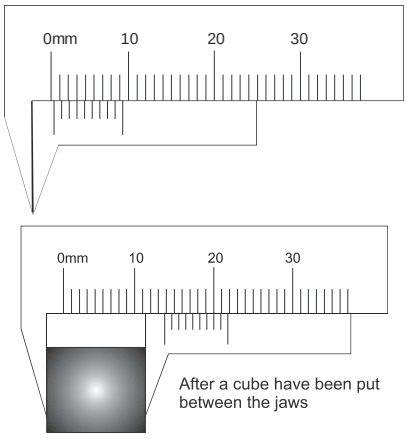
2. A transparent cylinder has its right half polished so as to act as a mirror. A paraxial light ray is incident from left, that is parallel to principal axis, exits parallel to the incident ray as shown. The refractive index *n* of the material of the cylinder is :



(1) 1.2 (2) 1.5

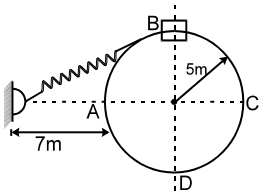
(3) 1.8 (4) 2.0

3. Find the thickness of the cubical object using the defective vernier calliper main scale has mm marks and 10 divisions of vernier scale coincide with 9 divisions of main scale.



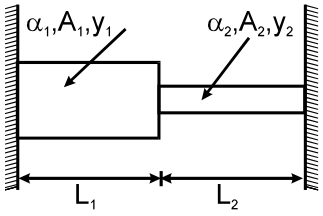
(1) 13.8 mm
(2) 13.5 mm
(3) 14.1 mm
(4) 13.0 mm

4. A collar 'B' of mass 2 kg is constrained to move along a horizontal smooth and fixed circular track of radius 5 m. The spring lying in the plane of the circular track and having spring constant 200 N/m is undeformed when the collar is at 'A'. If the collar B starts from rest, the normal reaction exerted by the track on the collar when it passes through 'A' is:



(1) 360 N
(2) 720 N
(3) 1440 N
(4) 2880 N

5. Two elastic rods are joined between fixed supports as shown in the figure. Condition for no change in the lengths of individual rods with the increase of temperature. (α_1, α_2 = linear expansion co-efficient A_1, A_2 = Area of rods y_1, y_2 = Young modulus)



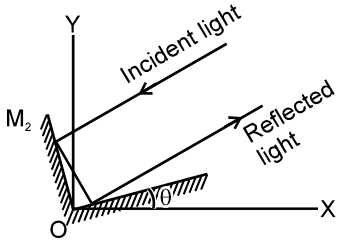
(1) $\frac{A_1}{A_2} = \frac{\alpha_1 y_1}{\alpha_2 y_2}$

(2) $\frac{A_1}{A_2} = \frac{L_1}{L_2}\frac{\alpha_1 y_1}{\alpha_2 y_2}$

(3) $\frac{A_1}{A_2} = \frac{L_2}{L_1}\frac{\alpha_2 y_2}{\alpha_1 y_1}$

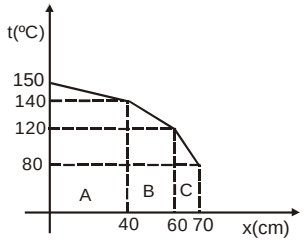
(4) $\frac{A_1}{A_2} = \frac{\alpha_2 y_2}{\alpha_1 y_1}$

6. A light ray gets reflected from a pair of mutually ⊥ mirrors, not necessarily along axes. The intersection point of mirrors is at origin. The incident light is along $y = x + 2$. If the light ray strikes both mirrors in succession, then it may get reflected finally along the line :



(1) $y = 2x - 2$
(2) $y = -x + 2$
(3) $y = -x - 2$
(4) $y = x - 4$

7. The graph shown gives the temperature along an x axis that extends directly through a wall consisting of three layers A, B and C. The air temperature on one side of the wall is 150°C and on the other side is 80°C. Thermal conduction through the wall is steady. Out of the three layers A, B and C, thermal conductivity is greatest of the layer



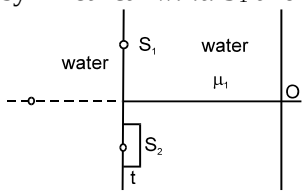
(1) A
(2) B
(3) C
(4) Thermal conductivity of A = Thermal conductivity of B.

8. When a metallic surface is illuminated with monochromatic light of wavelength λ, the stopping potential is $5V_0$. When the same surface is illuminated with light of wavelength 3λ, the stopping potential is V_0. Then the work function of the metallic surface is :

(1) $\frac{hc}{6\lambda}$ (2) $\frac{hc}{5\lambda}$

(3) $\frac{hc}{4\lambda}$ (4) $\frac{2hc}{4\lambda}$

9. A Young's double slit experiment is conducted in water (μ_1) as shown in the figure, and a glass plate of thickness t and refractive index μ_2 is placed in the path of S_2. The magnitude of the phase difference at O is : (Assume that 'λ' is the wavelength of light in air). O is symmetrical w.r.t. S_1 and S_2.



(1) $\left|\left(\frac{\mu_2}{\mu_1}-1\right)t\right|\frac{2\pi}{\lambda}$ (2) $\left|\left(\frac{\mu_1}{\mu_2}-1\right)t\right|\frac{2\pi}{\lambda}$

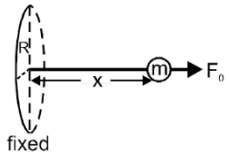
(3) $\left|(\mu_2-\mu_1)t\right|\frac{2\pi}{\lambda}$ (4) $\left|(\mu_2-1)t\right|\frac{2\pi}{\lambda}$

10. The ratio of r.m.s. speed to the r.m.s. angular speed of a diatomic gas at certain temperature is: (assume m = mass of one molecule, M = molecular mass, I = moment of inertia of the molecules)

(1) $\sqrt{\frac{3}{2}}$ (2) $\sqrt{\frac{3I}{2M}}$

(3) $\sqrt{\frac{3I}{2m}}$ (4) 1

11. A fixed planet is in the form of uniform circular ring of radius R. A cosmic particle is at the axis of the ring at an axial distance 'x'. It is held in equilibrium by applying a constant force F_0. The equilibrium of the particle is (for displacements along the axis):



(1) stable if $x > \frac{R}{\sqrt{2}}$

(2) unstable if $x < \frac{R}{\sqrt{2}}$

(3) stable if $x < \frac{R}{\sqrt{2}}$

(4) None of these

12. A 20 gm particle is subjected to two simple harmonic motions $x_1 = 2\sin 10t$, $x_2 = 4\sin\left(10t+\frac{\pi}{3}\right)$. Where x_1 & x_2 are in metre & t is in sec.

(1) the displacement of the particle at $t = 0$ will be $4\sqrt{3}m$.

(2) Maximum speed of the particle will be $10\sqrt{7}$ m/s.

(3) Magnitude of maximum acceleration of the particle will be $200\sqrt{7}$ m/s^2.

(4) Energy of the resultant motion will be 48 J

13. A charged particle is projected in magnetic field $\vec{B}=10\hat{k}$ from origin in x-y plane. The particle moves in a circle and just touches a line $y = 5$ m at $x = 5\sqrt{3}m$. Then (mass of particle = 5×10^{-5} kg, charge = 1μc)

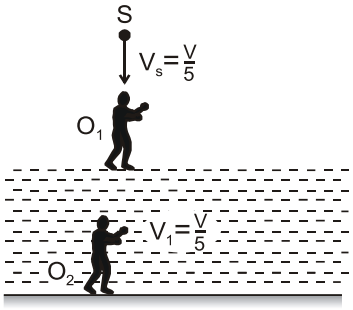
(1) The particle is projected at an angle 30° with x-axis.

(2) The radius of circle is 10 m

(3) Speed of particle is 4 m/s

(4) Work done by magnetic force on the particle is 10 J.

14. In the figure shown an observer O_1 floats (static) on water surface with ears in air while another observer O_2 is moving upwards with constant velocity V_1 = V/5 in water. The source moves down with constant velocity V_s = V/5 and emits sound of frequency 'f'. The velocity of sound in air is V and that in water is 4V. For the situation shown in figure:



(1) The wavelength of the sound received by O_1 is $\frac{2V}{5f}$

(2) The wavelength of the sound received by O_1 is V/f

(3) The frequency of the sound received by O_2 is $\frac{21f}{16}$

(4) The wavelength of the sound received by O_2 is $\frac{18V}{5f}$

15. If one of the slits of a standard Young's double slit experiment is covered by a thin parallel sided glass slab so that it transmits only one half the light intensity of the other, then:

(1) The fringe pattern will get shifted towards the covered slit

(2) The fringe pattern will get shifted away from the covered slit

(3) The bright fringes will become more bright and the dark ones will become less bright

(4) The fringe width will increase.

16. Two point charges of equal magnitude (may be of same or different signs) are located with distance between them equal to *a*. *P* and *Q* are two points on the same side of the perpendicular bisector of the line joining the two charges, *P* being closer to the charges than *Q*. The electric fields at *P* and *Q* are equal in magnitude. Then,

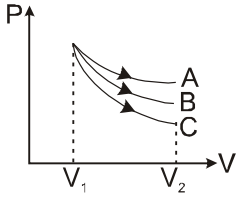
(1) Both charges are of the opposite sign.

(2) The directions of electric fields at *P* and *Q* are opposite.

(3) Moving from *P* towards *Q*, the magnitude of the field first decreases and then increases.

(4) The distance of *P* from the line joining the charges is less than $\frac{a}{2\sqrt{2}}$.

17. An ideal gas undergoes an expansion from a state with temperature T_1 and volume V_1 to V_2 through three different polytropic processes A, B and C as shown in the P-V diagram. If $|\Delta E_A|$, $|\Delta E_B|$ and $|\Delta E_C|$ be the magnitude of changes in internal energy along the three paths respectively, then



(1) $|\Delta E_A| < |\Delta E_B| < |\Delta E_C|$ if temperature in every process decreases

(2) $|\Delta E_A| > |\Delta E_B| > |\Delta E_C|$ if temperature in every process decreases

(3) $|\Delta E_A| > |\Delta E_B| > |\Delta E_C|$ if temperature in every process constant.

(4) $|\Delta E_B| < |\Delta E_A| < |\Delta E_C|$ if temperature in every process increases

18. An electron makes a transition from $n = 2$ to $n = 1$ state in a hydrogen like atom.

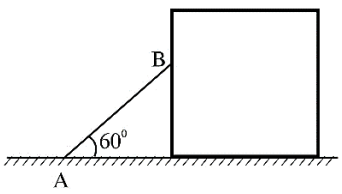
(1) magnetic field at the site of nucleus is decreased by 16 times.

(2) magnetic field at the site of nucleus is increased by 32 times.

(3) angular momentum of electron is constant.

(4) none of these

19. Rod AB is placed against a block which is moving towards right with a speed of 1m/s. If at an instant when the rod makes an angle 60° with the horizontal and end A is sliding towards left with a speed of 1 m/s. Then the speed of the point of contact 'B' of the rod is:



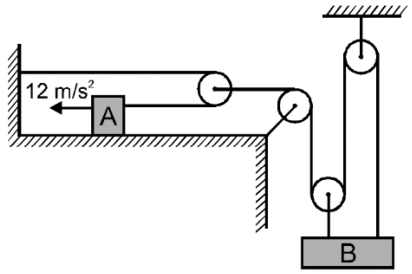
(1) 1 m/s

(2) $\frac{\sqrt{3}}{2}$ m/s

(3) $\frac{1}{2}$ m/s

(4) $\frac{\sqrt{7}}{\sqrt{3}}$ m/s

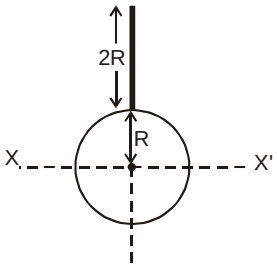
20. Assuming only translational motion of blocks A and B. Find the acceleration of B.



(1) 6 m/s^2
(2) 2 m/s^2
(3) 4 m/s^2
(4) None of these

[Section – B]

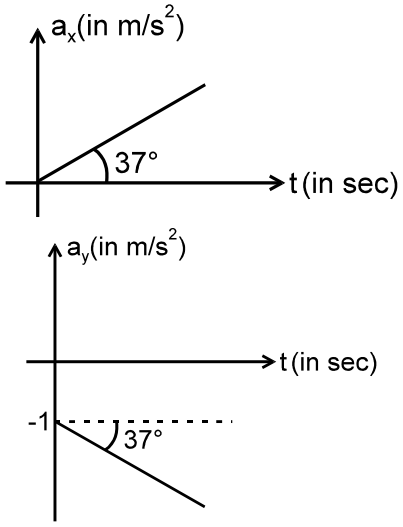
21. A rigid structure consists of a thin ring of radius R = $\frac{75}{290}$ m and a thin radial rod of equal mass and length 2R. The structure is pivoted around a horizontal axis '*xx*' in the plane of the ring, passing through its centre. The structure is released from rest and it rotates around the axis '*xx*' from the initial upright orientation. Find its angular speed in rad/s about the axis when it is inverted. Assume no frictional losses.



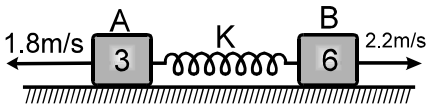
22. Photons having energy equivalent to III line of lyman series can eject electrons from a metal. These electrons can excite H atoms upto $n = 2$ level. If the maximum work function of the metal in eV, is ϕ, find the integer next to ϕ.

23. Two blocks *A* (3kg) and *B* (6kg) are connected by a spring of stiffness 512 N/m and placed on a smooth horizontal surface. Initially the spring is in natural length. Velocity of 1.8 m/s and 2.2 m/s are imparted to *A* and *B* in opposite direction. The maximum extension of the spring will be 5α cm. Find α.

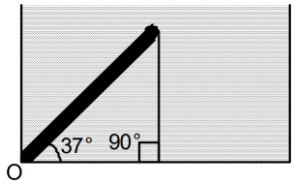
24. In the figure the variation of components of acceleration of a particle of mass 1 kg is shown w.r.t. time. The initial velocity of the particle is $\vec{u} = (-3\hat{i} + 4\hat{j})$ m/s. The total work done by the resultant force on the particle in time interval from t = 0 to t = 4 seconds in joules is:



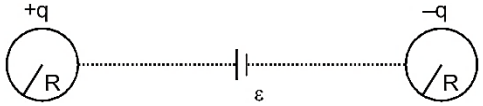
25. A radioactive nucleus can decay by either emitting an α particle or by emitting a β particle. Probability of α decay is 75% while that of β decay is 25%. The decay constant of α decay is λ_1 and that of β decay is λ_2. $\frac{\lambda_1}{\lambda_2}$ is.



26. A cylindrical rod of uniform cross section, is attached at O in a water tank. The linear mass density of rod is $\lambda_0 x$, where x is distance of the element of the rod, from end O as shown in figure. If the tension in string is given by $\frac{10^4}{P}$ N then P is (Length of rod 1m, radius of area of cross section is $\frac{1}{\sqrt{\pi}} m$, ρ_{water} = 1000 kg m^{-3}, g = 10 ms^{-2}, $\lambda_0 = 10^3$ in S.I. unit)



27. Two metallic spheres each of radius R separated by a large distance and connected with a battery of emf ε as shown. In the electric equilibrium the charge on the spheres are $+q$ and $-q$. If $K = \frac{q}{2\pi\varepsilon_0 R\varepsilon}$, find the value of K.



28. A ball is spun with angular acceleration $\alpha = 6t^2 - 2t$, where t is in second α is in rads^{-2}. At $t = 0$, the ball has angular velocity of 10 rads^{-1} and angular position of 4 rad. The most appropriate expression for the angular position of the bass is:

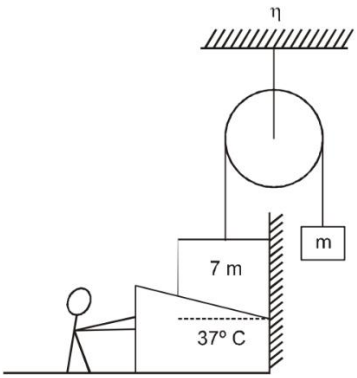
(1) $\frac{3}{4}t^4 - t^2 + 10t$

(2) $\frac{t^4}{2} - \frac{t^3}{3} + 10t + 4$

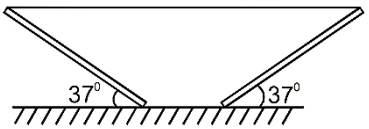
(3) $\frac{2t^4}{3} - \frac{t^3}{6} + 10t + 12$

(4) $2t^4 - \frac{t^3}{2} + 5t + 4$

29. All the surfaces are smooth, pulley is ideal and frictionless. If force applied by person to keep the system in equilibrium is $\frac{\eta mg}{2}$, then calculate η.



30. Two uniform identical rods of same mass are tied together with the help of a string and balanced as shown in the figure. The minimum coefficient of friction for which the system will remain in equilibrium in the position is $\frac{2}{x}$. The value of 'x' is



Section-II (CHEMISTRY)

[Section – A]

31. Select equation having exothermic step

(1) $S^-(g) \rightarrow S^{2-}(g)$

(2) $Na^+_{(g)} + Cl^{\oplus}_{(g)} \rightarrow NaCl_{(s)}$

(3) $Na_{(g)} \rightarrow Na^-_{(g)}$

(4) $Al^{+2}_{(g)} \rightarrow Al^{+3}_{(g)}$

32. Incorrect order of bond angle is

(1) $NH_3 > PH_3 > AsH_3$

(2) $H_2O > H_2S > H_2Se$

(3) $BCl_3 > AlCl_3 > GaCl_3$

(4) $NO_2^+ > NO_2 > NO_2^-$

33. Which of the following compounds give paramagnetic gas on decomposition

(i) $Pb(NO_3)_2$ (ii) $LiNO_3$

(iii) $NaNO_3$ (iv) NH_4NO_2

(1) I, II, III (2) II, III

(3) I, II (4) III, IV

34. Which of the following reaction is not feasible

(1) $F_2 + 2Cl^- \rightarrow 2F^- + Cl_2$

(2) $Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$

(3) $Br_2 + 2F^- \rightarrow 2Br^- + F_2$

(4) $Br_2 + 2I^- \rightarrow 2Br^- + I_2$

35. An acid solution of pH = 5 is diluted 1000 times, the pH of final solution because

(1) 8 (2) 9

(3) 6.95 (4) 3.5

36. In a face center cubic lattice atom A occupies the corner position only and atom B occupies the face centre position. If one atom of B is missing from one of the face centered points the formula of the compound is

(1) AB_3 (2) AB_2

(3) A_2B_5 (4) A_5B_2

37. If 15 mL of H_2 and 10 ml of O_2 reacts to form water, what is left at the end of the reaction

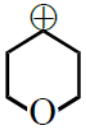
(1) 5 mL H_2

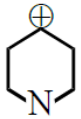
(2) 10 mL H_2

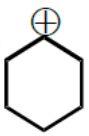
(3) 2.5 mL O_2

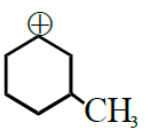
(4) 8 mL H_2

38. Arrange in increasing order of stability of carbocation

(a) 

(b) 

(c) 

(d) 

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

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

39. Which of the following correctly matched
(a) Monds process – Ni
(b) Zone Refining – Ti
(c) Hoop's Method – Al
(d) Hydro metallurgy – Ag
Correct code is :-
(1) a, b, d
(2) b, c, d
(3) a, c, d
(4) a, b, c, d

40. The thermal stability of II A carbonate is
(1) $BeCO_3 > MgCO_3 > CaCO_3 > SrCO_3 > BaCO_3$
(2) $BaCO_3 > SrCO_3 > MgCO_3 > CaCO_3 > BeCO_3$
(3) $BeCO_3 < MgCO_3 < SrCO_3 < CaCO_3 < BaCO_3$
(4) $BeCO_3 < MgCO_3 < CaCO_3 < SrCO_3 < BaCO_3$

41. Incorrect statement is
(1) H_2O_2 has half open book structure
(2) CH_4 is electron precise hydride
(3) $Na_2Al_2Si_2O_8.\ xH_2O$ is formula of calgon
(4) Na_3AlF_6 is cryolite

42. There are four elements, P, Q, R and S their configuration are also given. Which element will have highest value of I.P. (II) ?
(1) P = $[He]2s^1$
(2) Q = $[He]2s^22p^1$
(3) R = $[He]2s^22p^2$
(4) S = $[He]2s^22p^3$

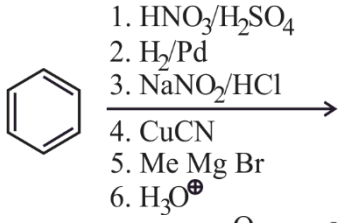
43. In Borax bead test characteristic colour appears due to formation of
(1) Metaborate of transition metals
(2) Sodium Metaborate
(3) Boron oxide
(4) Boric anhydride

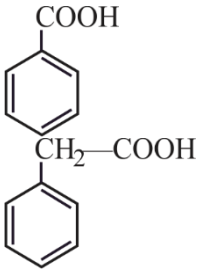
44. If the anions (A) form hexagonal closest packing and cations (C) occupy only 2/3 of the octahedral voids in it, then the general formula of the compound would be
(1) CA
(2) CA_2
(3) C_2A_3
(4) C_3A_2

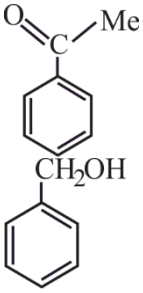
45. For the gaseous reactions
$A \longrightarrow B$ $\quad k_1 = 10^{15}\ e^{-25000/8.314\ T}$
$C \longrightarrow D$ $\quad k_2 = 10^{14}\ e^{-15000/8.314\ T}$
Calculate the approximate value of temperature at which $k_1 = k_2$. [ln 10 = 2.3]
(1) 522 K
(2) 434 K
(3) 320 K
(4) 500 K

46. In 500 ml of 0.2M-NaCl solution, 1500 ml of 0.4 M-$MgCl_2$ solution is mixed. The only incorrect final concentration of ion is (assume volume to be additive)
(1) $[Na^+] = 0.2$ M
(2) $[Mg^{2+}] = 0.3$ M
(3) $[Cl^-] = 0.65$ M
(4) $[Mg^{2+}] = 7.2$ g/L

47. Give the product of the following reaction sequence



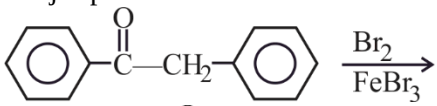
(1) 

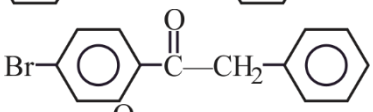
(2) 

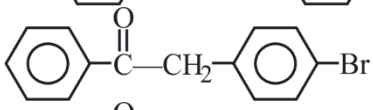
(3)

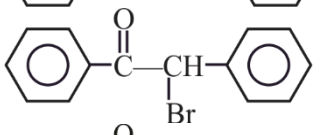
(4)

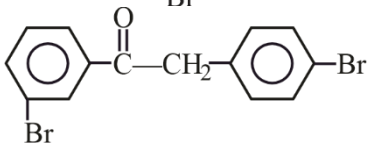
48. The major product obtained in the reaction



(1) 

(2) 

(3) 

(4) 

49. Among the following, narcotic analgesic is
(1) Ibuprofen (2) Morphine
(3) Aspirin (4) Naproxen

50. Which of the following statement is not correct?
(1) Physical adsorption is due to Vander Waal's forces
(2) Physical adsorption is irreversible
(3) Chemical adsorption increases with increase in temperature upto certain limit then decreases
(4) Enthalpy of adsorption ($|\Delta H|$) for a chemical adsorption is greater than that of physical adsorption

[Section – B]

51. How many isomers are possible for the complex ion $[Cr(NH_3)Cl_3(OH)_2]^{2-}$?

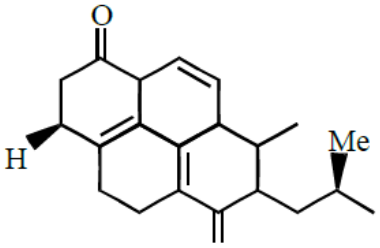
52. 64g of non-volatile solute is added to 624g of benzene. The vapour pressure of benzene has decreased from 200 mm of Hg to 190 mm of Hg. Molecular weight of the solute is

53. CH_3NH_2 (0.08 mole, $pK_b = 3.48$) is added to 0.02 moles of HCl and the solution is diluted to one litre, resulting pH of solution is

54. $Ph-NH_2 \xrightarrow[0-5°C]{NaNO_2+HCl} \xrightarrow[Dil.HCl]{Ph-NH_2} (X)$

Find the sum of number of nitrogen atom present in (X) and total number of stereo isomer of (X) formed?

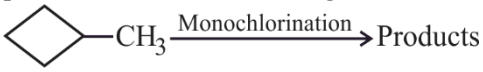
55. How many chiral carbon atoms are present in the following compound?



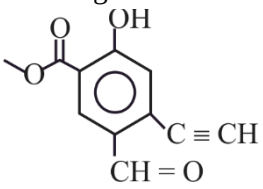
56. Count the polar molecules among the following: XeF_2, XeF_4, XeF_6, ClF_3, IF_7, SO_3, CO_2, SO_2, CCl_4, $CHCl_3$

57. Number of 3c-2e bonds present in B_2H_6 is = x. Number of π-bond in the cyclic trimer of SO_3 = y. Find x + y.

58. Number of optically active monochlorinated product formed in following reaction



59. How many moles of RMgX can be consumed by one mole of following compound when it reacts with excess of RMgX.



60. Total number of enol possible for the compound formed during given reaction will be (including stereoisomer)

$$CH_3MgBr + CH_3CH_2 - \overset{\overset{O}{\|}}{C} - Cl \rightarrow$$

Section-III (MATHEMATICS)

[Section – A]

61. The product $2^{\frac{1}{4}}.4^{\frac{1}{16}}.8^{\frac{1}{48}}.16^{\frac{1}{128}}$ …… to ∞ is equal to

(1) $2^{\frac{1}{2}}$ (2) 2

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

62. Let the observations $x_i (1 \le i \le 10)$ satisfy the equation $\sum_{i=1}^{10}(x_i - 5) = 10$ and $\sum_{i=1}^{10}(x_i - 5)^2 = 40$. If μ and λ are the mean and the variance of the observations, $x_1 - 3, x_2 - 3, \ldots\ldots, x_{10} - 3$, then the ordered pair (μ, λ) is equal to

(1) (6, 6)
(2) (3, 3)
(3) (3, 6)
(4) (6, 3)

63. If e_1 and e_2 are the eccentricities of the ellipse, $\frac{x^2}{18} + \frac{y^2}{4} = 1$ and the hyperbola, $\frac{x^2}{9} - \frac{y^2}{4} = 1$ respectively and (e_1, e_2) is a point on the ellipse, $15x^2 + 3y^2 = k$, then k is equal to

(1) 16
(2) 14
(3) 17
(4) 15

64. If the matrices $A = \begin{bmatrix} 1 & 1 & 2 \\ 1 & 3 & 4 \\ 1 & -1 & 3 \end{bmatrix}$, B = adj A and C = $3A$, then $\frac{|\text{adj } B|}{|C|}$ is equal to

(1) 72
(1) 8
(3) 16
(4) 2

65. If $f(x) = \begin{cases} \dfrac{\sin(a+2)x + \sin x}{x}; & x < 0 \\ b & ; x = 0 \\ \dfrac{\left(x+3x^2\right)^{1/3} - x^{1/3}}{x^{4/3}}; & x > 0 \end{cases}$ is continuous at $x = 0$, then $a + 2b$ is equal to ?

(1) –2 (2) –1
(3) 0 (4) 1

66. 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

(1) 6 (2) 7
(3) 4 (4) 8

67. In a box, there are 20 cards, out of which 10 are labeled as A and the remaining 10 are labelled as B. Cards are drawn at random, one after the other and with replacement, till a second A – card is obtained. The probability that the second A – card appears before the third B – card is

(1) $\frac{9}{16}$ (2) $\frac{15}{16}$
(3) $\frac{13}{16}$ (4) $\frac{11}{16}$

68. The number of real roots of the equation, $e^{4x} + e^{3x} - 4e^{2x} + e^{x} + 1 = 0$ is

(1) 2 (2) 4
(3) 3 (4) 1

69. A spherical iron ball of 10 cm radius is coated with a layer of ice of uniform thickness that melts at a rate of 50 cm^3/ min. When the thickness of ice is 5 cm, then the rate (in cm/min) at which of the thickness of ice decreases, is

(1) $\frac{5}{6\pi}$ (2) $\frac{1}{36\pi}$
(3) $\frac{1}{18\pi}$ (4) $\frac{1}{54\pi}$

70. The value of $\int_0^{2\pi} \frac{x\sin^8 x}{\sin^8 x + \cos^8 x} dx$ is equal to

(1) 2π (2) 4π
(3) π^2 (4) $2\pi^2$

71. Let z be a complex number such that $\left|\frac{z-i}{z+2i}\right| = 1$ and $|z| = \frac{5}{2}$. Then the value of $|z+3i|$ is

(1) $\frac{15}{4}$ (2) $2\sqrt{3}$
(3) $\sqrt{10}$ (4) $\frac{7}{2}$

72. Negation of the statement $\sqrt{5}$ is an integer or 5 is irrational' is

(1) $\sqrt{5}$ is an integer and 5 is irrational
(2) $\sqrt{5}$ is not an integer or 5 is not irrational
(3) $\sqrt{5}$ is not an integer and 5 is not irrational
(4) $\sqrt{5}$ is irrational or 5 is an integer

73. Let C be the centroid of the triangle with vertices (3, –1), (1, 3) and (2, 4). Let P be the point of intersection of the lines $x + 3y - 1 = 0$ and $3x - y + 1 = 0$. Then the line passing through the points C and P also passes through the point

(1) (–9, –7) (2) (–9, –6)
(3) (7, 6) (4) (9, 7)

74. If for some α and β in R, the intersection of the following three planes

$x + 4y - 2z = 1$
$x + 7y - 5z = \beta$
$x + 5y + \alpha z = 5$

is a line in R^3, then $\alpha + \beta$ is equal to

(1) 0 (2) 2
(3) 10 (4) –10

75. Let f be any function continuous on $[a, b]$ and twice differentiable on (a, b).

If for all $x \in (a,b)$, $f'(x) > 0$ and $f''(x) < 0$, then for any $c \in (a,b)$, $\frac{f(c) - f(a)}{f(b) - f(c)}$ is greater than

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

76. The value of

$\cos^3\left(\frac{\pi}{8}\right).\cos\left(\frac{3\pi}{8}\right) + \sin^3\left(\frac{\pi}{8}\right).\sin\left(\frac{3\pi}{8}\right)$ is

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

77. A circle touches the y-axis at the point (0, 4) and passes through the point (2, 0). Which of the following lines is not a tangent to this circle?

(1) $3x - 4y - 24 = 0$
(2) $3x + 4y - 6 = 0$
(3) $4x - 3y + 17 = 0$
(4) $4x + 3y - 8 = 0$

78. If for all real triplets (a, b, c), $f(x) = a + bx + cx^2$; then $\int_0^1 f(x)dx$ is equal to

(1) $\frac{1}{2}\left\{f(1)+3f\left(\frac{1}{2}\right)\right\}$

(2) $\frac{1}{6}\left\{f(0)+f(1)+4f\left(\frac{1}{2}\right)\right\}$

(3) $\frac{1}{3}\left\{f(0)+f\left(\frac{1}{2}\right)\right\}$

(4) $2\left\{3f(1)+2f\left(\frac{1}{2}\right)\right\}$

79. If $f'(x)=\tan^{-1}(\sec x+\tan x)$, $-\frac{\pi}{2}<x<\frac{\pi}{2}$, and $f(0) = 0$, then $f(1)$ is equal to

(1) $\frac{\pi-1}{4}$ (2) $\frac{\pi+1}{4}$

(3) $\frac{\pi+2}{4}$ (4) $\frac{1}{4}$

80. The integral $\int\frac{dx}{(x+4)^{8/7}(x-3)^{6/7}}$ is equal to (where C is a constant of integration)

(1) $-\frac{1}{13}\left(\frac{x-3}{x+4}\right)^{-13/7}+C$

(2) $-\left(\frac{x-3}{x+4}\right)^{-1/7}+C$

(3) $\left(\frac{x-3}{x+4}\right)^{1/7}+C$

(4) $\frac{1}{2}\left(\frac{x-3}{x+4}\right)^{3/7}+C$

[Section – B]

81. The projection of the line segment joining the points (1, –1, 3) and (2, – 4, 11) on the line joining the points (–1, 2, 3) and (3, –2, 10) is _____

82. If the vectors, $\vec{p}=(a+1)\hat{i}+a\hat{j}+a\hat{k}$, $\vec{q}=a\hat{i}+(a+1)\hat{j}+a\hat{k}$ and $\vec{r}=a\hat{i}+a\hat{j}+(a+1)\hat{k}(a\in R)$ are coplanar and $3(\vec{p}.\vec{q})^2-\lambda|\vec{r}\times\vec{q}|^2=0$, then the value of λ is_____.

83. If for $x\geq 0, y=y(x)$ is the solution of the differential equation, $(x+1)dy=\left((x+1)^2+y-3\right)dx, y(2)=0$, then $y(3)$ is equal to _____.

84. The coefficient of x^4 in the expansion of $\left(1+x+x^2\right)^{10}$ is _____.

85. The number of distinct solutions of the equation, $\log_{\frac{1}{2}}|\sin x|=2-\log_{\frac{1}{2}}|\cos x|$ in the interval [0, 2π], is _____.

86. If $\sin\theta+\cos\theta=\frac{1}{2}$, then $16(\sin(2\theta)+\cos(4\theta)+\sin(6\theta))$ is $\pm k$ then the value k is equal to

87. Let $A=\{a_{ij}\}$ be a 3×3 matrix, where $a_{ji}=\begin{cases}(-1)^{j-i} & If \quad i<j\\ 2 & if \quad i=j\\ (-1)^{i+j} & if \quad i>j\end{cases}$ then det $(3Adj\,(2A^{-1}))$

88. Let $\binom{n}{k}$ denote ${}^nC_k$ and $\begin{bmatrix}n\\k\end{bmatrix}=\begin{cases}\binom{n}{k}, & \text{if } 0\leq k\leq n\\ 0 & \text{otherwise}\end{cases}$. If $A_k=\sum_{i=0}^{9}\binom{9}{i}\begin{bmatrix}12\\12-k+i\end{bmatrix}+\sum_{i=0}^{8}\binom{8}{i}\begin{bmatrix}13\\13-k+i\end{bmatrix}$ and $A_4-A_3=190p$, then p is equal to.....

89. Let $a_1, a_2, \ldots\ldots, a_{10}$ be an AP with common difference – 3 and $b_1, b_2, \ldots\ldots, b_{10}$ be a GP with common ration 2. Let $c_k=a_k+b_k, k=1,2,\ldots\ldots,10$. If $c_2=12$ and $c_3=13$, then $\sum_{k=1}^{10}c_k$ is equal to

90. Let $z=\frac{1-i\sqrt{3}}{2}, i=\sqrt{-1}$.

Then the value of $21+\left(z+\frac{1}{z}\right)^3+\left(z^2+\frac{1}{z^2}\right)^3+\left(z^3+\frac{1}{z^3}\right)^3+\ldots+\left(z^{21}+\frac{1}{z^{21}}\right)^3$ is_____.