

JEE-ADVANCE-MODEL TEST-PAPER II

Time: 3:00 Hours

IMPORTANT INSTRUCTIONS

Max Marks: 240

PHYSICS:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 1 – 8)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 9 – 16)	Questions with Multiple Correct Choice	4	-2	8	32
Sec – III(Q.N : 17 – 20)	Questions with Comprehension Type (2 Comprehensions – 2 + 2 = 4Q)	4	-2	4	16
Total				20	80

CHEMISTRY:

Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 21 – 28)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 29 – 36)	Questions with Multiple Correct Choice	4	-2	8	32
Sec – III(Q.N : 37 – 40)	Questions with Comprehension Type (2 Comprehensions – 2 + 2 = 4Q)	2	-1	4	16
Total				20	80

MATHEMATICS:

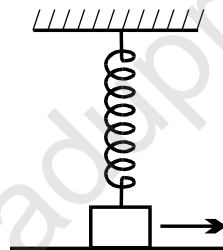
Section	Question Type	+Ve Marks	- Ve Marks	No.of Qs	Total marks
Sec – I(Q.N : 41 – 48)	Questions with Integer Answer Type	4	0	8	32
Sec – II(Q.N : 49 – 56)	Questions with Multiple Correct Choice	4	-2	8	32
Sec – III(Q.N : 57 – 60)	Questions with Comprehension Type (2 Comprehensions – 2 + 2 = 4Q)	2	-1	4	16
Total				20	80

SECTION – I
(INTEGER ANSWER TYPE)

This section contains 8 questions. The answer is a single digit integer ranging from 0 to 9 (both inclusive).

Marking scheme +4 for correct answer , 0 if not attempted and 0 in all other cases.

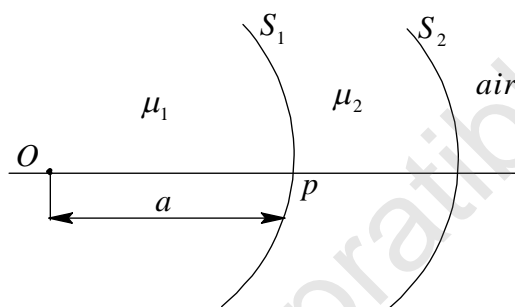
- Dimensional formula for coefficient of viscosity is $[M]^x [L]^y [T]^z$. The value of $x^2 + y^2 + z^2$ is
- A spring is attached with a block of mass m and a fixed horizontal rod. The block is lying on a smooth horizontal table and initially the spring is vertical and unstretched. Natural length of spring is $3l_0$. A constant horizontal force F is applied on the block so that block moves in the direction of force. When length of the spring becomes $5l_0$, block is about to leave the contact with the table. If initial and final velocity of block is zero, $F = \frac{mg}{4} + \frac{mg}{N}$. What is 'N'?



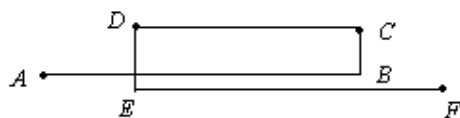
- A spherical black body has a radius R and steady surface temperature T , heat sources ensure the heat evolution at a constant rate and distributed uniformly over its volume. The new steady surface temperature of the object if the radius is decreased by half is $\sqrt[4]{\frac{T^4}{N}}$? Assume surrounding to be at absolute zero and heat evolution rate through unit volume remain same.
- When a certain metallic surface is illuminated with monochromatic light of wavelength λ , the stopping potential for photoelectric current is $3V_0$ and when the same surface is illuminated with light of wavelength 2λ , the stopping potential is V_0 . The threshold wavelength of this surface for photoelectric effect is $K\lambda$. Calculate the value of K .
- A target element A is bombarded with electrons and the wavelengths of the

characteristic spectrum are measured. A second characteristic spectrum is also obtained, because of an impurity in the target. The wavelength of the K lines are 196 pm (element A) and 169 pm (impurity). If the atomic number of impurity is $z = (10x - 1)$. Find the value of x . (atomic number of element A is 27).

6. A point object 'O' is placed in a medium of refractive index $\mu_1 = 1.4$. S_1 and S_2 are two concentric spherical surfaces of radii 1m and 2m. To the right of 'O' contains a medium of refractive index $\mu_2 = 1.5$ between the interfaces S_1 and S_2 . Find the object distance of O from S_1 (in meter) so that an image of 'O' as seen by observer from air, coincides with O.



7. In the shown figure, a planar frame made of thin uniform rods. The length of section AB and EF is l_1 and its thermal linear coefficient of expansion is α_1 . The length of section CD is l_2 and its thermal linear coefficient of expansion is α_2 . CB and DE are of same length having thermal linear coefficient of expansion α_2 . Points A, B, E and F reside on same line, that is, sections AB and EF overlap. Then the ratio $\frac{l_1}{l_2}$ for which the distance between end A and end F remains the same at all temperatures is $\frac{\alpha_2}{n\alpha_1}$; then find n.



8. The values of two resistors are $(5.0 \pm 0.2)k\Omega$ and $(10.0 \pm 0.1)k\Omega$. What is percentage error in the equivalent resistance when they are connected in parallel?

SECTION – II
(MULTIPLE CORRECT ANSWER TYPE)

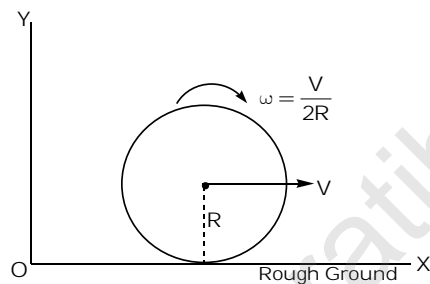
This section contains 8 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONE OR MORE than ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

9. A passenger car is driving on a level highway behind a truck. A stone got stuck between double tyres of the rear wheels of the truck. Both the vehicles have a speed 54 km/h in same direction. At what may be the distance(s) of separation should the car maintain with the truck, so that the stone will not strike it if flies out from the double tyres? (Take $g = 10\text{m/s}^2$)

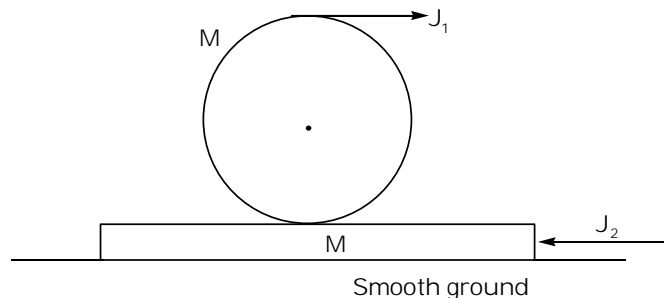
- A) 19.6 m B) 22.5 m C) 24 m D) 27.5 m

10. A disc is released on x – axis at some point with initial linear and angular velocities as shown. XZ plane is taken as rough horizontal surface and \vec{L} is z – component of angular momentum of disc. P is a point about which \vec{L} can be conserved. Then P can be



- A) $(4R, 0, 0)$ B) Any point on X – axis
 C) $(2R, 0, 3R)$ D) $(0, R, 0)$

11. A solid sphere of mass M is kept on a long smooth plank of mass M which is resting on a smooth horizontal surface as shown. J_1 and J_2 are the simultaneous impulses given to the sphere and plank respectively. What is the relation between the magnitudes of J_1 and J_2 such that there is no relative motion between the sphere and plank at their point of contact?



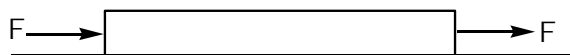
- A) $J_2 = \frac{3}{2}J_1$ B) $J_2 = \frac{5}{7}J_1$ C) $J_2 = \frac{7}{5}J_1$ D) $J_2 > J_1$

12. A person drank stomach full of water. In this situation, a small punch on his

stomach can make him more painful. Which of the following laws/principles can explain this?

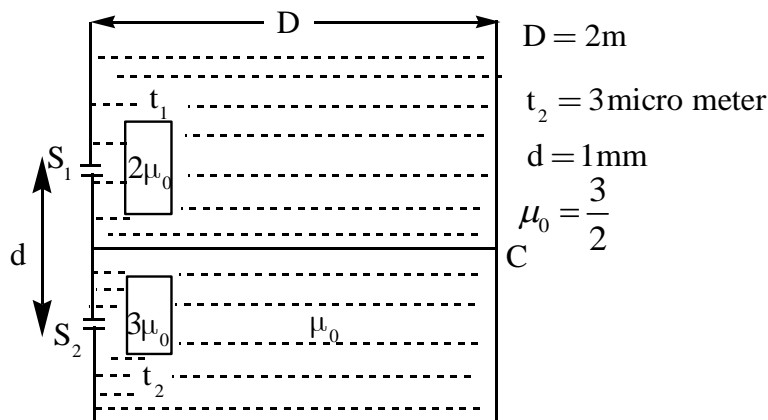
- A) Pascal's law
B) Archimedes principle
C) Bernoulli's principle
D) Equation of continuity

13. A uniform bar (elastic) is kept on smooth horizontal plane and two forces are applied as shown in figure.



Select the correct statement(s).

- A) Change in length of the bar is zero
B) Strain in the bar is non uniform.
C) Strain energy density in the bar is non uniform.
D) No strain energy is stored in the bar
14. λ_0 is the wavelength of photon emitted by stationary (fixed) H – atom in first excited state. Now H – atom (not fixed) in its first excited state is moving in gravity free space. If it emits a photon of wavelength λ along its direction of motion, then
- A) λ may be equal to λ_0
B) λ may be less than λ_0
C) λ may be greater than λ_0
D) Total momentum of system is same before and after emission of photon
15. A parallel beam of mono chromatic light is incident on the two slits of YDSE and the interference is observed on a screen. The space between slits and screen is filled with a liquid of refractive index μ_0 . Two transparent slabs of thicknesses t_1 and t_2 and refractive indices $2\mu_0$ and $3\mu_0$ are introduced in front of slits as shown and central maximum is formed at screen centre C. Now the liquid is removed and then the central maximum will be shifted. Based on this, choose the correct statement(s)



- A) $t_1 = 2t_2$
 B) $t_1 = 3t_2$
 C) Central maximum is shifted towards down
 D) Central maximum is shifted by a distance 3 mm

16. Least count [LC] is the minimum length measured by a Vernier calipers and [Let us define Vernier count (VC) = 1 MSD – 1 VSD]. Main scale division (MSD) of the calipers is 1 mm and N divisions of main scale are divided into 10 Vernier scale divisions (VSD). Which of the following statement(s) is/are correct?

- A) If $N = 5$, then $LC = VC = 0.5$ mm
 B) If $N = 6$, then $LC = 0.2$ mm $VC = 0.4$ mm
 C) If $N = 7$, then $LC = 0.1$ mm and $VC = 0.3$ mm
 D) If $N = 8$, then $LC = VC = 0.2$ mm

SECTION – III (PARAGRAPH TYPE)

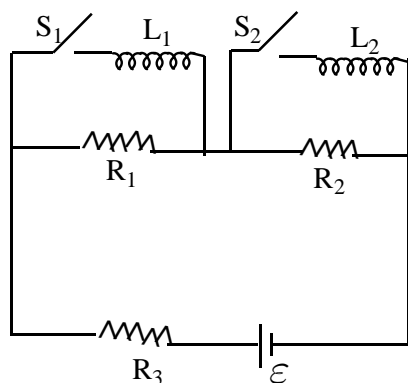
This section contains **2 groups of questions**. Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONE OR MORE** is/are correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

Paragraph for Question Nos. 17 to 18

Switches S_1 and S_2 are initially open in the circuit given below.

$R_1 = R_2 = R_3 = 1\Omega$, $\varepsilon = 6V$, $L_1 = L_2 = 2H$. Now S_1 is closed at $t = 0$



17. Which of the following statements is **correct**, just after closing of S_1 ?
- A) The rate of change of current in L_1 is zero
 - B) Potential difference across L_1 is $2V$
 - C) Current through L_1 is zero
 - D) The rate of change of energy stored in L_1 is zero
18. S_1 is closed for long time and then S_2 is closed. Select the **correct** statement, after closing of S_2
- A) Current through L_1 changes
 - B) Current through R_1 increases and then decreases
 - C) Current through R_2 changes
 - D) None of the above

Paragraph for Question Nos. 19 to 20

A point sound source of frequency 224 Hz is moving along a circle of radius 3 m with constant speed 30 m/s . A stationary detector is placed in the plane of circle at a distance 2 m from centre of circle. The speed of sound is 300 m/s .

Answer the following questions

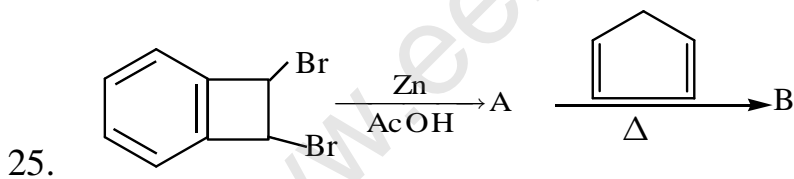
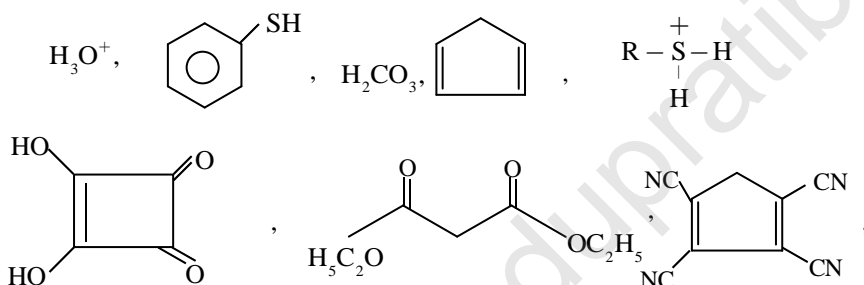
19. The maximum frequency recorded by the detector is
- A) 224 Hz
 - B) 240 Hz
 - C) Less than 243 Hz
 - D) $\frac{2240}{9}\text{ Hz}$
20. The minimum frequency recorded by the detector is
- A) 224 Hz
 - B) 210 Hz
 - C) Greater than 208 Hz
 - D) $\frac{2240}{11}\text{ Hz}$

SECTION – I
(INTEGER ANSWER TYPE)

This section contains 8 questions. The answer is a single digit integer ranging from 0 to 9 (both inclusive).

Marking scheme +4 for correct answer, 0 if not attempted and 0 in all other cases.

21. A certain buffer solution has equal concentrations of HX and X^- . The K_b for X^- is 10^{-10} . The pH of the buffer is
22. MX is a crystalline ionic compound. X^- ions make the ccp structure and M^+ ions occupy the octahedral voids. The total number of voids left unoccupied in 0.5 mol of the compound is $a \times 10^{23}$. What is a ?
23. For a second order reaction, $t_{75\%} = x t_{50\%}$, find the value of x.
24. How many of the following compounds are more acidic than phenol



No. of sp^2 hybridized carbon atoms in product 'B' is

26. Find the number of $Fe-N$ (iron-nitrogen) linkage(s) in $[Fe(EDTA)]^-$ octahedral complex.
27. Out of given aq. ion(s), find the number of ions which produce ppt. with dil. $HCl + H_2S$:
 $Cr^{3+}, Zn^{2+}, Cd^{2+}, Hg^{2+}, Fe^{2+}, Bi^{3+}, Pb^{2+}$
28. The molarity of perhydrol solution is nearly equal to

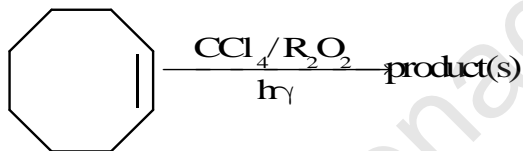
SECTION – II
(MULTIPLE CORRECT ANSWER TYPE)

This section contains 8 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONE OR MORE than ONE option can be correct.

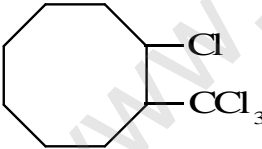
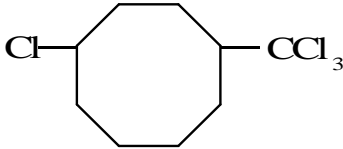
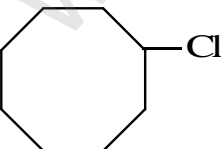
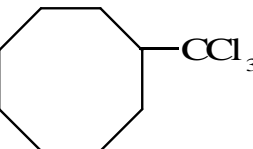
Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

29. Which of the following statement(s) is/are true?
- A) Lyophobic sol shows greater light scattering effect than lyophilic sol.
 - B) The stability of lyophobic sol is due to presence of charge on sol particles
 - C) An inhibitor increases the value of rate constant
 - D) The absolute entropy of an element is zero at 25⁰C and 1 atm pressure
30. Identify the true statement(s) among the following
- A) On bombarding ${}_7\text{N}^{14}$ nuclei with α -particle, the nuclei of the product formed after release of proton would be ${}_8\text{O}^{17}$
 - B) All radioactive disintegrations follow first order kinetics
 - C) A Nuclide and its decay product after α -emission are called isodiapheres
 - D) Half life of radium is 1580 years. Its average life will be 1097.22 years

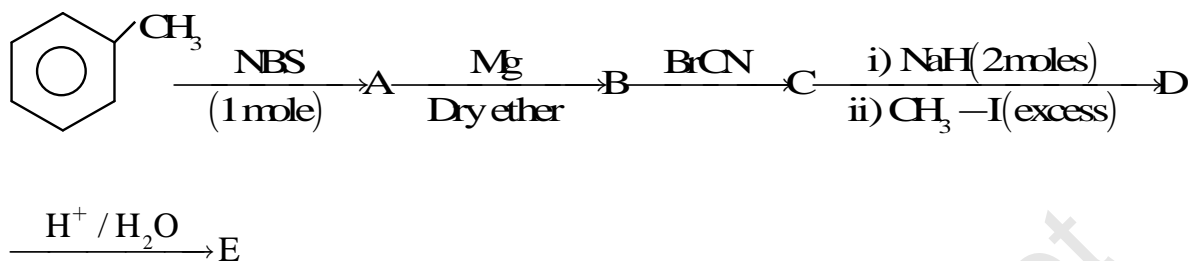
31.



Which of the following product(s) is/are formed in the above reaction

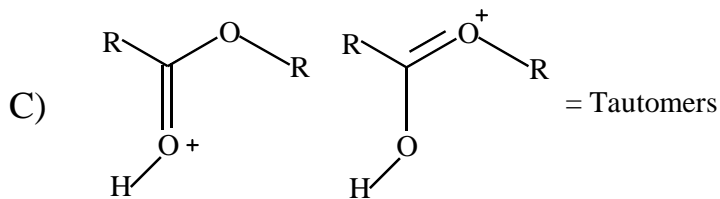
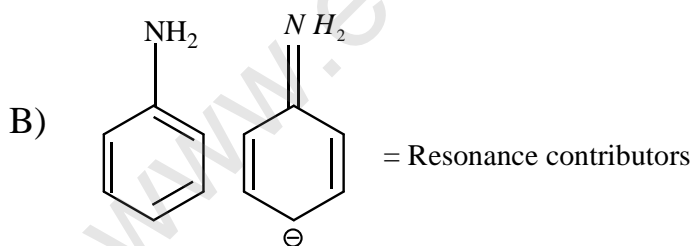
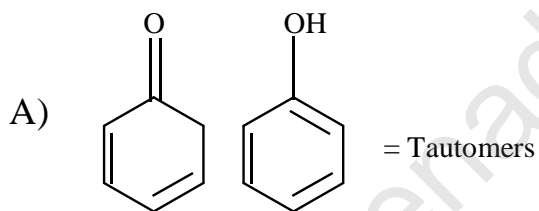
- A) 
- B) 
- C) 
- D) 

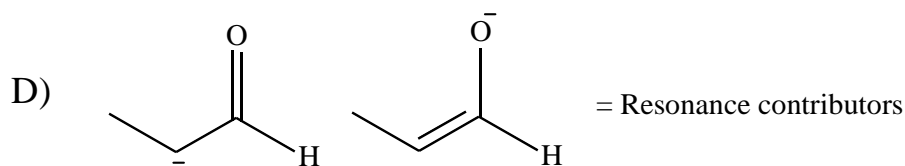
32.



Select the correct statement(s)

- A) Product E can undergo HVZ reaction
- B) B to C conversion is nucleophilic substitution
- C) Compound E cannot undergo electrophilic substitution
- D) Decarboxylated product of E can have one benzylic hydrogen
33. Which of the following is / are correctly given pair(s)?





34. Choose the incorrect statement(s)
- A) All S – F bond length are identical in SF₄
 - B) All Cl – F bond length are identical in ClF₃
 - C) All < FCIF > angles are identical in ClF₃
 - D) In PCl₅ molecule equatorial P – Cl bond lengths are different from the axial P – Cl bond lengths
35. Synergic bonding in metal carbonyl complexes [M=Metal]:
- A) Decreases C-O bond strength
 - B) Increases M-C bond length
 - C) Increases bond order for M-C bond
 - D) Increases paramagnetism of complex
36. Choose the correct statement(s):
- A) Oxide of Ag and Hg can be simply reduced by heating
 - B) CsI₃(s) is the thermodynamically more stable than NaI₃(s)
 - C) Roasting is a cause of acid rain
 - D) Graphite is thermodynamically more stable than diamond

SECTION – III (PARAGRAPH TYPE)

This section contains **2 groups of questions**. Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONE OR MORE** is/are correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

Paragraph for Question Nos. 37 to 38

The standard cell potential (E_{cell}^0) of a reaction is related as $\Delta G^0 = nFE_{\text{cell}}^0$, where $-\Delta G^0$ equals maximum electrical work.

n = number of moles of electrons exchanged as per the balanced chemical equation.

$$\Delta G_r^0 = \Delta H_r^0 - T\Delta S_r^0 \dots\dots\dots (1)$$

and also

$$\frac{\partial(\Delta G_r^0)}{\partial T} = -\Delta S_r^0 \dots\dots\dots (2)$$

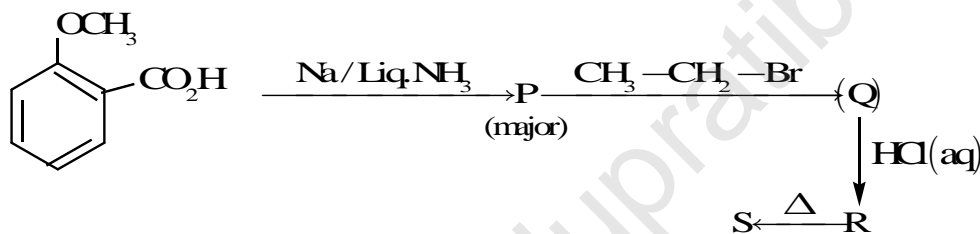
37. The temperature coefficient of the cell $\left(\frac{dE^0}{dT}\right)_p$ is given by.

- A) $\frac{nF}{\Delta S_r^0}$ B) $\frac{\Delta S_r^0}{nF}$ C) $\frac{\Delta S_r^0}{nFT}$ D) $-nEF^0$

38. At 300K, ΔH^0 for the reaction. $Zn(s) + 2AgCl(aq) \longrightarrow ZnCl_2(aq) + 2Ag(s)$ is -218 kJ/mole while the E^0 of the was 1.015V. $\left[\frac{dE^0}{dT}\right]_p$ of the cell is.

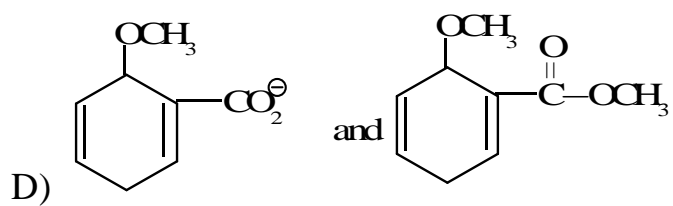
- A) $-4.2 \times 10^{-4} VK^{-1}$ B) $-3.81 \times 10^{-4} VK^{-1}$ C) $0.11 VK^{-1}$ D) $+7.62 \times 10^{-4} VK^{-1}$

Paragraph for Question Nos. 39 to 40

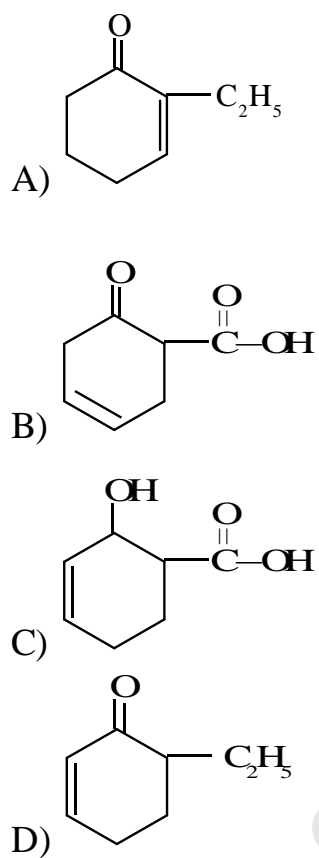


39. Products P and Q in the above sequence of reactions are

- A) and
- B) and
- C) and



40. The product 'S' formed in sequence of reactions can be



SECTION – I
(INTEGER ANSWER TYPE)

This section contains 8 questions. The answer is a single digit integer ranging from 0 to 9 (both inclusive).

Marking scheme +4 for correct answer , 0 if not attempted and 0 in all other cases.

41. A hexagon is inscribed in a circle of radius R and it has sides continuously given by 1,1,2,2,3,3 units. Then $[R(2R^2 - 7)] = \underline{\hspace{2cm}}$ where [.] is G.I.F
42. Two distinct numbers are chosen at random from the set $\{1,2,3,\dots,3n\}$. The probability that $x^2 - y^2$ divisible by 3 is $\frac{pn+q}{r(3n-1)}$ then $p+q+r = \underline{\hspace{2cm}}$ where G.C.D (p, q)= G.C.D(q, r)= G.C.D (r, p) = 1
43. If the complex numbers z_1 and z_2 both satisfy the equation $z + \bar{z} = 2|z-1|$ and $\text{Arg}(z_1 - z_2) = \frac{\pi}{4}$ then imaginary part of $(z_1 + z_2)$ is $\underline{\hspace{2cm}}$
44. The maximum distance from centre of the curve $3x^2 + 4y^2 - 6x - 16y + 7 = 0$ to any of its normals is $\underline{\hspace{2cm}}$ (in units)
45. Shortest distance between circle $(8x - 33)^2 + 64y^2 = 1$ and parabola $4y^2 = x$ is $\frac{\sqrt{65} - k}{8}$ where $k = \underline{\hspace{2cm}}$
46. OABC is a tetrahedron with $O = (0,0,0)$, $A = (1,2,1)$, $B = (2,1,3)$ and $C = (-1,1,2)$ then the angle between faces OAB and ABC is θ such that $|35\cos\theta - 27| = \underline{\hspace{2cm}}$.
47. $\lim_{n \rightarrow \infty} \sum_{k=0}^n \frac{n_{C_k}}{n^k (3+k)} = L$ where $n_{C_k} = \frac{n!}{k!(n-k)!}$. Then $[L+2] = \underline{\hspace{2cm}}$ where [.] is G.I.F
48. The graphs $y = 2x^3 - 4x + 2$ and $y = x^3 + 2x - 1$ intersect exactly at 3 distinct points. The slope line passing through two of these points is equal to $\underline{\hspace{2cm}}$

SECTION – II
(MULTIPLE CORRECT ANSWER TYPE)

This section contains 8 multiple choice questions. Each question has 4 options (A), (B), (C) and (D) for its answer, out of which ONE OR MORE than ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

49. If p_1, p_2 denote the lengths of the perpendiculars from the point $(2, 3)$ on the two normals to the circle $x^2 + y^2 = 2016$ having slopes $\frac{5}{7}$ and $\frac{3}{2}$, then which is / are correct
- A) $p_1 + p_2 = \frac{31}{14}$ B) $|p_1 - p_2| = \frac{31}{\sqrt{74}} - \frac{12}{\sqrt{13}}$
- C) $p_1 p_2 = \frac{372}{\sqrt{962}}$ D) $p_1 p_2 = \frac{15}{14}$
50. Consider the circle $C_1 : x^2 + y^2 = 4$ and the circle $C_2 : x^2 + y^2 - 6x - 8y - 24 = 0$. Then which is / are correct
- A) C_1 and C_2 touch each other
- B) C_1 completely lies within C_2 without a common point
- C) C_1 and C_2 touch each other externally
- D) the number of common tangents of C_1 and C_2 is one
51. Using the elements of the set $\{-3, -2, -1, 0, 1, 2, 3\}$
- A) The number of 3×3 matrices having trace 0 is $37(7^6)$
- B) The number of 3×3 matrices is 7^9
- C) The number of 3×3 skew symmetric matrices is 7^3
- D) The number of 3×3 symmetric matrices is 7^6
52. Let N be the number of right angled triangles with integer sides and in-radius $r = 2016$. Then N is divisible by
- A) 2 B) 3 C) 5 D) 7

-
53. Let $f : \mathbb{R} \rightarrow \mathbb{Z}, f(x) = [x]^2 + [x+1] - 3$, where $[\cdot]$ is G.I.F. Then which is /are true
- A) $f(x)$ is a many-one and not onto function
 - B) $f(x) = 0$ for infinite number of values of x
 - C) $f(x) = 0$ for only two real values of x
 - D) $f(x)$ is a many-one and onto function
54. In a ΔABC , $\angle C = 2\angle A$ and $AC = 2BC$, then which of the following is/are true ?
- A) Angles A, B, C are in Arithmetic Progression
 - B) Angles A, C, B are in Arithmetic Progression
 - C) ΔABC is a right angled isosceles triangle
 - D) $BC^2 + CA^2 + AB^2 = 8R^2$, where R is the circumradius of ΔABC
55. If the solution of the equation $\frac{d^2x}{dt^2} + 4\frac{dx}{dt} + 3x = 0$, given that for $t = 0; x = 0$ and $\frac{dx}{dt} = 12$ is in the form $x = Ae^{-3t} + Be^{-t}$, then
- A) $A + B = 0$
 - B) $A + B = 12$
 - C) $|AB| = 36$
 - D) $|AB| = 49$
56. Let $f(x) = \sin\left(\frac{\pi}{6}\sin\left(\frac{\pi}{2}\sin x\right)\right)$ for all $x \in \mathbb{R}$ and $g(x) = \frac{\pi}{2}\sin x$ for all $x \in \mathbb{R}$. Then which of the following is (are) true ?
- A) Range of f is $\left[-\frac{1}{2}, \frac{1}{2}\right]$
 - B) Range of $f \circ g$ is $\left[-\frac{1}{2}, \frac{1}{2}\right]$
 - C) $\lim_{x \rightarrow 0} \frac{f(x)}{g(x)} = \frac{\pi}{6}$
 - D) There is an $x \in \mathbb{R}$ such that $(g \circ f)(x) = 1$
-

SECTION – III
(PARAGRAPH TYPE)

This section contains **2 groups of questions**. Each group has 2 multiple choice questions based on a paragraph. Each question has 4 choices A), B), C) and D) for its answer, out of which **ONE OR MORE** is/are correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -2 in all other cases.

Paragraph for Question Nos. 57 to 58

Let $f(x) = \frac{1}{a\sqrt{2\pi}} e^{-\frac{1}{2}\left(\frac{x-a}{b}\right)^2}$; $-\infty < x < \infty$ Where a and b are real constants

$(-\infty < a < \infty, b > 0)$ and $\int_0^{\infty} x^{\alpha-1} e^{-x} dx = I(\alpha)$ with $I\left(\frac{1}{2}\right) = \sqrt{\pi}$. Now answer the following

57. Number of local extreme values of $f(x)$ is m and number of sign changes in $f''(x)$ is n . Then the value of $n^2 - m + 2 =$ _____

- A) 5 B) 4 C) 0 D) 3

58. The value of $I_{3/2} =$ _____

- A) $\sqrt{}$ B) $\frac{1}{2}\sqrt{}$ C) $\sqrt{\frac{1}{2}}$ D) None of these

Paragraph for Question Nos. 59 to 60

In a ΔABC ; $BC = a$, $CA = b$ and $AB = c$. R is circum radius and r is in radius and s is semi perimeter and $\left(\cot \frac{A}{2}\right)^2 + \left(2\cot \frac{B}{2}\right)^2 + \left(3\cot \frac{C}{2}\right)^2 = \left(\frac{6s^2}{7\Delta}\right)^2$. where Δ is the area of ΔABC . Then answer the following

59. The ratio of sides $a:c:b$ of ΔABC is ___

- A) 40 : 13 : 35 B) 13 : 45 : 40 C) 30 : 35 : 14 D) 55 : 23 : 35

60. The greatest angle of the triangle ABC is

- A) $\cos^{-1} \frac{13}{15}$ B) $\pi - \cos^{-1} \frac{2}{3}$ C) $\pi - \cos^{-1} \left(\frac{16}{65}\right)$ D) $\frac{\pi}{2} + \sin^{-1} \frac{1}{7}$

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