VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

Mock JEE Advanced-3 (CBT) | Paper – 1 | JEE 2024

Date: 12/05/2024 **Maximum Marks: 180**

Timing: 10:00 AM to 1:00 PM **Duration: 3.0 Hours**

General Instructions

1. The question paper consists of 3 Subject (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**). Each Part has **FOUR** sections (Section 1, Section 2, Section 3 & Section 4).

Section 1 contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer. For each question, choose the option corresponding to the correct answer.

Section 2 contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s). For each question, choose the option(s) corresponding to (all) the correct answer(s).

Section 3 contains **THREE (03)** question stems. There are **TWO (02)** questions corresponding to each question stem. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value corresponding to the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Section 4 contains **THREE (03**) questions. The answer to each question is a **NON-NEGATIVE INTEGER.** For each question, enter the correct integer corresponding to the answer.

2. For answering a question, an ANSWER SHEET (OMR SHEET) is provided separately. Please fill your **Test Code, Roll No.** and **Group** properly in the space given in the ANSWER SHEET.

3. No candidate 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.

4. Rough work is to be done on the space provided for this purpose in the Test Booklet only.

5. 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**.

6. **Do not fold or make any stray mark on the Answer Sheet (OMR).**

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ Invigilator's Signature _____

MARKING SCHEME

SECTION-1

- This section contains **FOUR (04)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +3 If ONLY the correct option is chosen;
  Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered);
  Negative Marks : –1 In all other cases.

SECTION-2

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4 If only (all) the correct option(s) is(are) chosen;
  Partial Marks : +3 If all the four options are correct but ONLY three options are chosen;
  Partial Marks : +2 If three or more options are correct but ONLY two options are chosen, both of which are correct;
  Partial Marks : +1 If two or more options are correct but ONLY one option is chosen and it is a correct option;
  Zero Marks : 0 If unanswered;
  Negative Marks : –2 In all other cases.
- For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then
  choosing ONLY (A), (B) and (D) will get +4 marks;
  choosing ONLY (A) and (B) will get +2 marks;
  choosing ONLY (A) and (D) will get +2 marks;
  choosing ONLY (B) and (D) will get +2 marks;
  choosing ONLY (A) will get +1 mark; choosing ONLY (B) will get +1 mark;
  choosing ONLY (D) will get +1 mark;
  choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
  choosing any other option(s) will get –2 marks.

SECTION-3

- This section contains **THREE (03)** question stems.
- There are **TWO (02)** questions corresponding to each question stem.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct numerical value corresponding to the answer.

- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +2 If ONLY the correct numerical value is entered at the designated place;
  Zero Marks : 0 In all other cases.

SECTION-4

- This section contains **THREE (03**) questions.
- The answer to each question is a **NON-NEGATIVE INTEGER.**
- For each question, enter the correct integer corresponding to the answer.
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4 If ONLY the correct integer is entered;
  Zero Marks : 0 In all other cases.

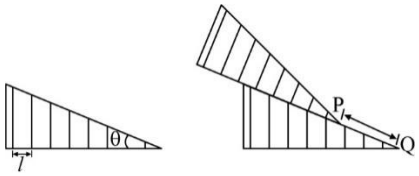
SUBJECT I : PHYSICS **60 MARKS**

SECTION-1

This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer. For each question, choose the option corresponding to the correct answer.

1. Consider a cardboard cut in the shape a right angled triangle with θ being the angle of inclination. Equally spaced markings are made onto it with *l* being the least spacing between them as shown below. If two such identical triangles are used as a vernier scale to measure the length of a rod *PQ* as shown below, then find the least count of the scale.

Take $\theta = 3.6°,\ l = 5cm$ and $\pi = \sqrt{10}$ unit



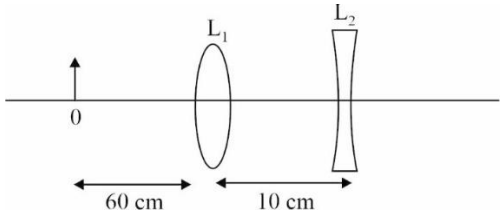
(A) 0.5 *mm* **(B)** 0.36 *mm* **(C)** 0.05 *mm* **(D)** 0.1 *mm*

2. If a monoatomic gas undergoes a thermodynamic process for which its molar heat capacity is equal to the universal gas constant. The process in terms of V and T is

(A) $VT^{-1/2}$ = constant **(B)** $VT^{1/2}$ = constant

(C) $V^2 T^2$ = constant **(D)** VT = constant

3. An extended object *O* is placed 60 *cm* in front of a convex lens L_1 and a concave lens L_2 is 10 *cm* behind it, as shown in the figure. The radii of curvature of all the curved surfaces in both the lenses are 15 *cm*. The refractive index of both the lenses is 1.5.



By what distance should L_2 be moved towards right keeping *O* and L_1 fixed, such that the final image also moves by the same distance towards left?

(A) 20 *cm* **(B)** 30 *cm* **(C)** 40 *cm* **(D)** 17.5 *cm*

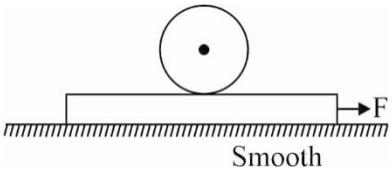
4. A radioactive element has decay constant λ. Initially a sample of this element contains N_0 nuclei. If nuclei in the sample is also being produced at a constant rate R starting from $t = 0$, what will be the number of radioactive nuclei in the sample after one half-life?

(A) $\frac{R}{2\lambda}$ **(B)** $\frac{No}{2}$ **(C)** $\frac{R}{2\lambda}+\frac{No}{2}$ **(D)** $\frac{No}{2}-\frac{R}{2\lambda}$

SECTION-2

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s). For each question, choose the option(s) corresponding to (all) the correct answer(s).

5. There is a solid sphere of mass M and radius R which is placed on a rough plank of the same mass M. The plank is placed on a smooth horizontal surface. A force, F = kt starts acting on the plank in the horizontal direction as shown below. Coefficient of friction between them is μ.



Assuming the plank to be of sufficient length, choose the correct statement(s) regarding the moment the ball starts slipping relative to the plank.

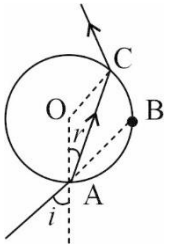
(A) The time instant, $t = 3.5\,\dfrac{\mu Mg}{k}$.

(B) Acceleration of center of the sphere is μg.

(C) Angular acceleration of the sphere is $2.5\dfrac{\mu g}{R}$

(D) Acceleration of the plank is 4.5 μg

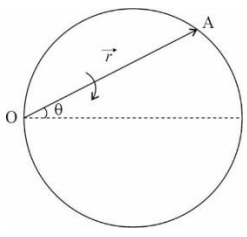
6. A sphere of radius *R* with center *O* made of glass of refractive index $n = \sqrt{6}$ is kept in air. A ray of light travelling in air directed along *AB* is incident on the sphere at *A*. It emerges out of the glass from point *C* as shown below. Arc lengths AB and BC are found to be equal.



Which of the following statement(s) is/are correct?

(A) $\sin i = \dfrac{\sqrt{3}}{2}$ **(B)** $\sin r = \dfrac{1}{3}$ **(C)** $\sin i = \sqrt{\dfrac{2}{3}}$ **(D)** $\sin r = \dfrac{1}{2}$

7. A particle *A* of mass *m* is constrained to move along a circle of radius *R* such that its radius vector $\vec{r}$ relative to point *O* rotates with the constant angular velocity ω. magnitude of its velocity, angular momentum and torque with respect to *O* the moment $\vec{r}$ makes an angle $\theta = 30°$ with the diameter of the circle are represented by V, L and τ respectively. Which of the following statement(s) is/are correct?

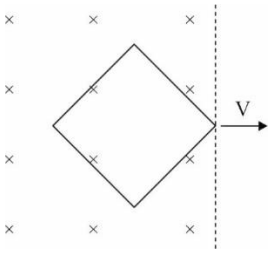


(A) $V = R\omega$ **(B)** $V = 2R\omega$ **(C)** $L = 3m\omega R^2$ **(D)** $\tau = O$

8. An electron in hydrogen atom first jumps from third excited state to first excited state and then jumps from first excited state to ground state. Let the ratio of wavelength, momentum and energy of photons released in the first case to that of second case be α, β and γ respectively, then choose the correct statement(s).

(A) $\alpha = \beta$ **(B)** $\beta = \gamma$ **(C)** $\alpha\beta = 1$ **(D)** $\alpha = \gamma$

9. A square wire frame with side length *l* has total resistance R. It is being pulled towards right with constant speed *V* out of a region where there is a uniform magnetic field $\vec{B}$ pointing into the page. $\vec{B}$ exists only on the left half of the page. Sides of the frame make 45° angle with its velocity vector. (Consider the moment the frame starts moving out of the region containing the field as $t = 0$). Which of the following statement(s) is/are correct?



(A) Induced emf around the loop, E as a function of time can be expressed as

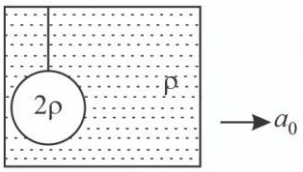
$$E(t) = \begin{cases} BV^2 t & \text{for } 0 \le t < \dfrac{l}{\sqrt{2}V} \\ BV^2\left(\dfrac{\sqrt{2}l}{V} - t\right) & \text{for } \dfrac{l}{\sqrt{2}V} \le t < \sqrt{2}\,\dfrac{l}{V} \end{cases}$$

(B) Total charge flown around the loop is $\dfrac{Bl^2}{R}$

(C) Total heat generated in the wire is $\dfrac{2\sqrt{2}\,B^2Vl^3}{3R}$

(D) Total heat generated in the wire is $\dfrac{\sqrt{2}\,B^2Vl^3}{3R}$

10. A closed cylindrical vessel containing liquid of density ρ is accelerated horizontally with constant acceleration a_0. A perfect rigid sphere of radius of *R* and density 2ρ is floating in the liquid which is tied to the vessel lid with the help of a vertical light string as shown below.
Which of the following statement(s) is/are correct?



(Assume the liquid to be at rest relative to the vessel)

(A) The sphere exerts $\dfrac{8}{3}\pi R^3\rho a_0$ of force on the wall of the vessel

(B) The sphere exerts zero force on the wall of the vessel

(C) tension in the string is $\frac{4}{3}\pi R^3 \rho g$

(D) The sphere exerts $\frac{4}{3}\pi R^3 \rho \sqrt{a_0^2 + g^2}$ of net force on the liquid

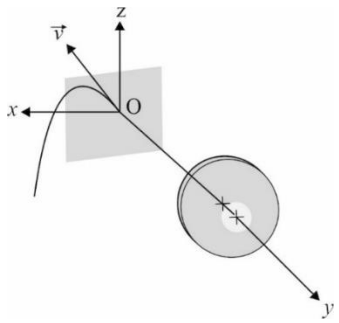
SECTION-3

This section contains **THREE (03)** question stems. There are **TWO (02)** questions corresponding to each question stem. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value corresponding to the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Question Stem for Question Nos. 1 to 2

A convex lens of focal length f is placed at $(0, 4f, 0)$ with its principal axis lying along the y-axis. A point particle is projected from the origin with velocity, $\vec{v} = u\hat{i} + 2u\hat{j} + \frac{u}{2}\hat{k}$

(Take + Z-axis as vertically upward direction and $f = \frac{u^2}{g} = 20\ cm$)

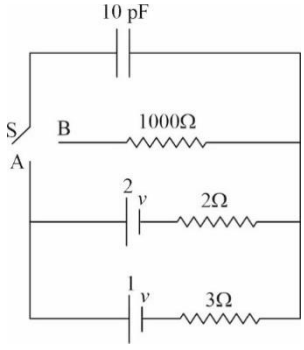


1. Coordinate of image of the particle the moment the particle is launched is (x_1, y_1, z_1) where x_1, y_1 and z_1 are in centimeter. Write $(x_1 + 3y_1 + z_1)$ as your answer.

2. Coordinate of image of the particle at its highest point of the trajectory of image is (x_2, y_2, z_2) where x_2, y_2 and z_2 are in centimeter. Write $(x_2 + y_2 + 4z_2)$ as your answer.

Question Stem for Question Nos. 3 to 4

In the circuit shown below, the switch S is connected to position A for a long time so that the charge on the capacitor is QpC. Then S is switched to position B and the capacitor starts discharging.

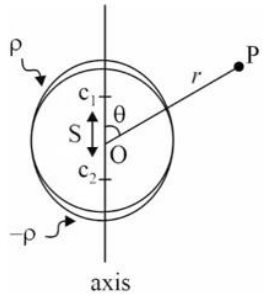


Suppose someone claims that the capacitor is never really completely discharged. One might find out how long it would take the charge to be reduced to one electron. Let it takes $t\ \mu s$ for the charge on the capacitor to be reduced to one electron. (Take $\ln 10 = 2.3$ and charge on an electron, $e = 1.6\times10^{-19} C$)

3. The magnitude of Q is _____.

4. The value of *t* is _____.

Question Stem for Question Nos. 5 to 6



Two spheres each of radius *R* carry uniform volume charge density ρ and $-\rho$. They overlap and their centres are separated by a distance *S* (*S* << *R*). *O* is the mid-point of the line joining the two centre and the axis shown below is the axis of symmetry. Consider a point $P(r,\theta)$ situated outside both the spheres where *r* is its distance from O and θ is the angle made by the line *OP* with the axis (r >>R). Net electric field at P is found to be perpendicular to the axis.

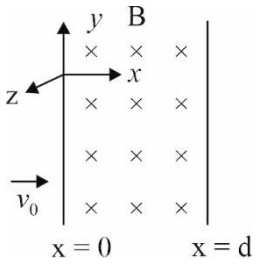
5. What is the value of $\tan^2\theta$?

6. If the net electric field at P is $\sqrt{\beta}\,\frac{\rho SR^3}{3\in_0 r^3}$, then β is equal to_____.

SECTION-4

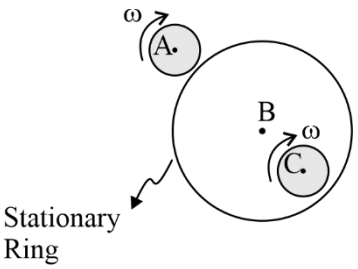
This section contains **THREE (03)** questions. The answer to each question is a **NON-NEGATIVE INTEGER.** For each question, enter the correct integer corresponding to the answer.

7. A positively charged particle having charge $1\mu c$ and mass 1 *mg* moving with velocity $V_0\hat{i}$ enters a region in which uniform magnetic field $\vec{B} = -B_0\hat{k}$ exist which extends from $x = 0$ to $x = d$ as shown below. The angle of deviation (in degrees) suffered by the particle when it leaves the region containing the field is_____.



($d = 1\,m, B_\circ = 1T, V_\circ = 2\ m/s$)

8. In the figure, the radius of circle *A* and *C* are *R* each where as that of circle *B* is 3*R*. Starting from the position shown in the figure, circle *A* rolls around circle *B* and circle *C* also rolls around *B*. If *A* makes '*a*' rotation and *C* makes '*c*' rotations before centre of *A* and *C* reach their respective starting position for the first time. Mark your answer as $(2a+c)$.



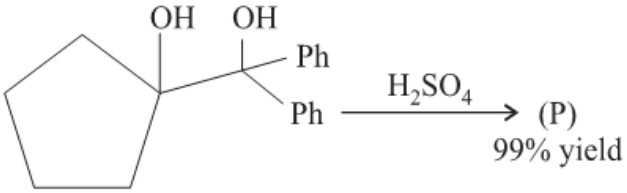
9. A solid body is initially at temperature $T_\circ$. It is kept in an atmosphere of constant temperature $\frac{T_0}{2}$. It cools according to Newton's law of cooling. If its temperature falls to 90% of its initial temperature after time t_0, then its temperature will fall to _____% of its initial temperature after another time $t_\circ$.

SUBJECT II : CHEMISTRY **60 MARKS**

SECTION-1

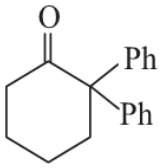
This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer. For each question, choose the option corresponding to the correct answer.

1.

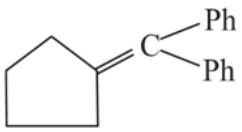


Unknown (P) in the reaction is:

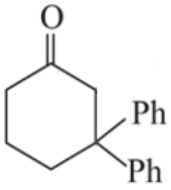
(A)



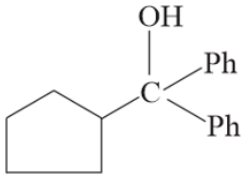
(B)



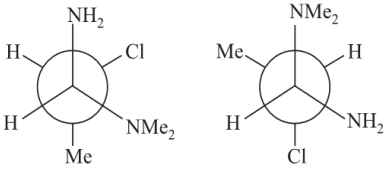
(C)



(D)



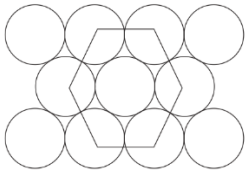
2. What is the relation between following molecules:



(A) Enantiomers **(B)** Constitutional isomers

(C) Mesomers **(D)** Diastereomers

3. The arrangement of the atoms in 2-D close packed layer is as follows:



The packing fraction is approximately:

(A) 0.74 **(B)** 0.91 **(C)** 0.78 **(D)** 0.63

4. Which one of the following shows maximum paramagnetic character?

(A) $[Cr(H_2O)_6]^{3+}$ **(B)** $[Fe(CN)_6]^{4-}$

(C) $[Zn(H_2O)_6]^{2+}$ **(D)** $[Mn(H_2O)_6]^{2+}$

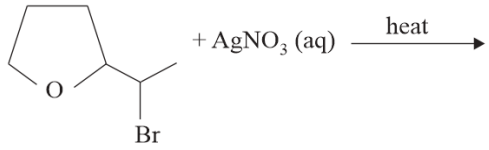
SECTION-2

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s). For each question, choose the option(s) corresponding to (all) the correct answer(s).

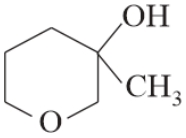
5. Which of the following compounds given below yields tetra hydroxy dicarboxylic acid on reaction with warm HNO_3?

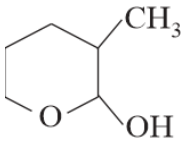
(A) Galactose **(B)** Fructose **(C)** Mannose **(D)** Ribose

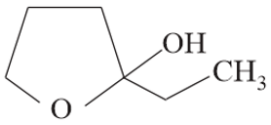
6. In the following reaction.

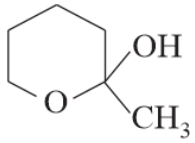


The possible substitution product (s) is/are:

(A) 

(B) 

(C) 

(D) 

7. Which of the following statements are correct?

(A) The smaller the gold number of lyophobic colloid, the larger will be its protective power

(B) Lyophilic sols, in contrast to lyophobic sols are easily coagulated on addition of small amounts of electrolytes.

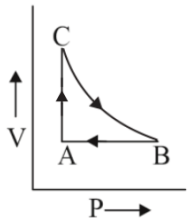
(C) Ferric chloride solution is used to stop bleeding from a fresh cut because it coagulates the blood.

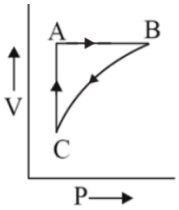
(D) The flocculation value of arsenious sulphide sol is independent of the anion of the coagulating electrolyte.

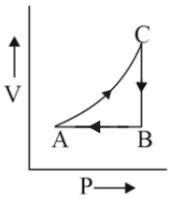
8. One mole of an ideal gas defined by the state A(300 K, 2 atm) is subjected to the following change of state $(C_v = 1.5R)$.

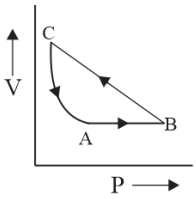
$$A \xrightarrow[\text{heating}]{\text{Isochoric}} B(5.0\,\text{atm}) \xrightarrow[\text{Reversible expansion}]{\text{Adiabatic}} C \xrightarrow[\text{Compression}]{\text{Isothermal reversible}} A$$

Which of the following P-V diagram describes the above mentioned cyclic process most appropriately.

(A) 

(B) 

(C) 

(D) 

9. Metal oxide + syngas $\rightarrow$ Metal + H_2O

$$\underset{\text{(Impure)}}{M} + 4CO \xrightarrow{50°C-60°C} \underset{\substack{\text{Metal}\\\text{carbonyl}\\\text{complex}}}{X} \xrightarrow{200°C-230°C} \underset{\text{(pure)}}{\text{Metal}} + \uparrow CO$$

Which of the following statements are CORRECT about given reaction:

(A) Metal M is Ni

(B) Process is known as Mond's process in which pure metal is obtained

(C) Hybridization of metal in 'X' is sp^3

(D) Maximum five atoms are present in one plane in 'X'

10.
$$\underset{\substack{\text{Orange}\\\text{colour}\\\text{compound}}}{(A)} \xrightarrow{(B)+\text{conc.}H_2SO_4} \underset{\text{Red gas}}{(C)} \xrightarrow{NaOH+AgNO_3} \underset{\text{Red ppt.}}{(D)} \xrightarrow[\text{Solution}]{NH_3} \text{Yellow solution}$$

$$(B) \xrightarrow[\Delta]{NaOH} \underset{\substack{\text{(Gives white}\\\text{fumes with HCl)}}}{F\uparrow}$$

Identify (B) and (F) respectively.

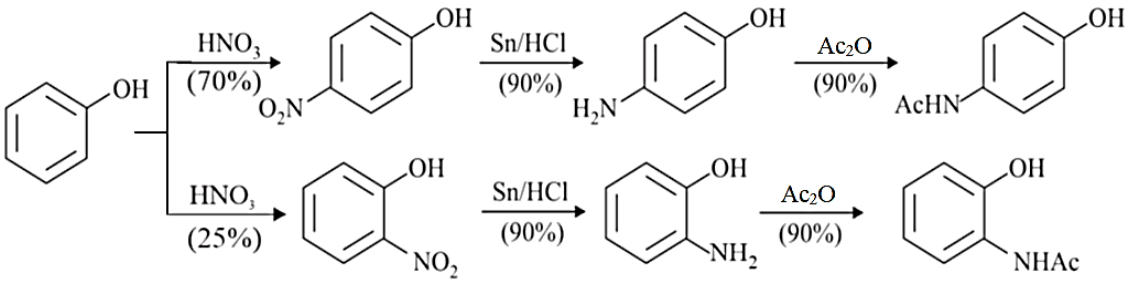
(A) $AgCl, Cl_2$ **(B)** NH_4Cl, NH_3 **(C)** Hg_2Cl_2, NH_3 **(D)** $CHCl_3, NH_3$

SECTION-3

This section contains **THREE (03)** question stems. There are **TWO (02)** questions corresponding to each question stem. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value corresponding to the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Question Stem for Question Nos. 1 to 2

Consider the following reaction sequence:



1. The overall yield for the formation of p-hydroxyacetanilide is _____%.

2. The overall yield for the formation of o-hydroxy acetanilide is _____%.

Question Stem for Question Nos. 3 to 4

Work done by the system in isothermal reversible process is $W_{rev} = -2.303nRT\log\frac{V_2}{V_1}$. Also in case of adiabatic reversible process work done by the system is given as $W_{rev} = \frac{nR}{\gamma - 1}[T_2 - T_1]$. During the expansion disorder increases and the increase in disorder is expressed in terms of change in entropy $\Delta S = \frac{q_{rev}}{T}$. Both entropy and enthalpy changes obtained for a process were taken as a measure of spontaneity of process.

3. The heat of vaporisation and heat of fusion of H_2O are 540 Cal/g and 1440 Cal/mol. The ratio of $\frac{\Delta S_{vap}}{\Delta S_{fusion}}$ for water is _____.

4. $Ag_2O(s) \rightarrow 2Ag(s) + \frac{1}{2}O_2(g)$; attains equilibrium at temperature _____ K. (ΔH and ΔS for the reaction are $30.5\ kJ\ mol^{-1}$ and $60\ J\ mol^{-1}K^{-1}$).

Question Stem for Question Nos. 5 to 6

A sample of sea water contains 3.5% NaCl and 1.5% of $MgCl_2$ by mass. Molal elevation constant (Ebullioscopic constant) K_b of water is $0.51\ K\ kg\ mol^{-1}$ and boiling point of water is $100°C$. Assume that both the salts are completely ionized.

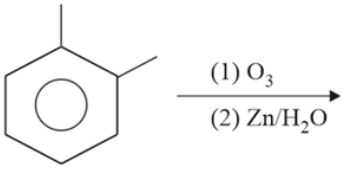
5. Molality of the solution is _____$\times 10^{-2}$ m.

6. The boiling point of a sample of sea water is _____ °C.

SECTION-4

This section contains **THREE (03)** questions. The answer to each question is a **NON-NEGATIVE INTEGER.** For each question, enter the correct integer corresponding to the answer.

7. The maximum number of possible isomers (including stereoisomers) which may be formed on di-bromination of cyclohexane using Br_2 and UV light is _____.

8. 

The ratio of glyoxal to pyruvaldehyde obtained in the above reaction is x : y. The value of x + y is:

9. The total number of possible stereoisomers for $[CrCl_2(NO_2)_2\ (NH_3)_2]$ is _____.

SUBJECT III : MATHEMATICS — 60 MARKS

SECTION-1

This section contains **FOUR (04)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the answer. For each question, choose the option corresponding to the correct answer.

1. A triangle has two of its sides along the axes, its third side touches the circle $x^2+y^2-2ax-2ay+a^2=0$ where $a>0$ If the locus of the circumcentre of the triangle passes through the point (2, –1) then a^2-2a is equal to:

(A) 2 **(B)** 6 **(C)** 8 **(D)** 4

2. The areas $S_0, S_1, S_2, ...,$ bounded by *x*-axis and half-waves of the curve $y=e^{-\alpha x}\sin(\beta x), x\geq 0$ form a geometric progression with a common ratio: (Here the quantities α, β are positive)

(A) $e^{\frac{-\alpha\pi}{\beta}}$ **(B)** $e^{\frac{\alpha\pi}{\beta}}$ **(C)** $e^{\frac{-\beta\pi}{\alpha}}$ **(D)** $e^{\frac{\beta\pi}{\alpha}}$

3. Let $N_{10}=\{1,2,3,...,10\}$. Consider a permutation *p* of N_{10}. A point *k* is fixed by *p*, if $p(k)=k$. A permutation with no fixed point is called derangement. Considering all permutations, what is the expected number of fixed points:

(A) 10 **(B)** 100 **(C)** 50 **(D)** 1

4. Let $z_0, z_1, z_3, ..., z_n$ be complex numbers such that $(k+1)z_{k+1}-i(n-k)z_k=0$ for all $k\in\{0,1,2,...,n-1\}$. Here $i=\sqrt{-1}$. Consider the statements *P* and *Q* below:

P : The z_0 such that: $z_0+z_1+z_2+...+z_{10}=2^{10}$ is $(1-i)^{10}$

Q : $|z_0|^2+|z_1|^2+|z_2|^2+...+|z_{10}|^2\geq\frac{(31)^{10}}{10!}$,

Then:

(A) *P* is true and *Q* is false **(B)** *P* is true and *Q* is true

(C) *P* is false and *Q* is true **(D)** *P* is false and *Q* is false

SECTION-2

This section contains **SIX (06)** questions. Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s). For each question, choose the option(s) corresponding to (all) the correct answer(s).

5. A grasshopper starts at the origin in the coordinate plane and makes a sequence of hops. Each hop has length 5, and after each hop the grasshopper is at a point whose coordinates are both integers; thus, there are 12 possible locations for the grasshopper after the first hop. Then, which of the following is/are true?

(A) The grasshopper can reach the point (7, 7)

(B) The grasshopper can't reach the point (7, 7)

(C) The least number of steps required for the grasshopper to reach (2021, 2021) is 577

(D) The least number of steps required for the grasshopper to reach (2021, 2021) is 578

6. Let $g: R \to \{4\}$ be a function given by $g(x) = x^3(f'(t)-2) + x^2 f''(t) + 4x(f(0)+6) + 4$ and $h(x)$ is defined as:

$$h(x) = \begin{Bmatrix} \int_0^x |f(t)-2|\,dt, & 0 \le x \le 6 \\ (x-6)^2 + 20: & 6 < x \le 12 \end{Bmatrix}$$

Then choose correct statement's:

(A) $h(3) = 15$ **(B)** range of $h(x)$ is [0, 56]

(C) $h(x)$ is not continuous at $x = 4$ **(D)** $h(x)$ is not differentiable at $x = 6$

7. A player tosses a coin. He sets one point for head and 2 points for tail. He plays till he gets the sum of points equal to *n*. If P_n be the probability that his score becomes *n*, Then:

(A) $P_3 = \frac{1}{2}$ **(B)** $P_n = \frac{1}{2}P_{n-1} + \frac{1}{4}P_{n-2}$

(C) $P_4 = \frac{11}{16}$ **(D)** $P_n = \frac{1}{2}\left(P_{n-1} + P_{n-2}\right)$

8. Consider the sum $S_n = \sum_{r=1}^{n} \frac{1}{\sqrt{r}(r+1)}$, then which of the following is/are true?

(A) $S_\infty < 4$ **(B)** $S_\infty < 3$

(C) $S_\infty < 2$ **(D)** S_n is unbounded

9. Consider the sequence $< a_n >_{n \ge 1}$, such that $a_1 = 1$, and $a_{n+1} = a_n + \frac{1}{a_n^2}$ for all $n \ge 1$. Then, which of the following is/are True?

(A) $a_{9000} > 30$ **(B)** $a_{1000} < 10$

(C) For all values of $n, a_n \le 2024$ **(D)** There is some value of *n* for which $a_n > 10000$

10. The complex numbers *a*, *b*, *c* are pairwise distinct and satisfy $|a| = |b| = |c| = 1$ and $|a+b+c| \le 1$. Then, which of the following is/are True?

(A) $|a-b| + |a-c| \ge |a+b| + |a+c|$ **(B)** $|a^2 + bc| < |b+c|$

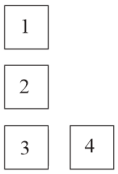
(C) $|a^2 + bc| \ge |b+c|$ **(D)** $|a-b| + |a-c| < |a+b| + |a+c|$

SECTION-3

This section contains **THREE (03)** question stems. There are **TWO (02)** questions corresponding to each question stem. The answer to each question is a **NUMERICAL VALUE.** For each question, enter the correct numerical value corresponding to the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.

Question Stem for Question Nos. 1 to 2

Four boxes are arranged in an L-shape as shown in the diagram. Each box has enough room only for a single book. Each of the boxes has the probability half to receive a book, subject to the requirement that exactly one of the vertical boxes numbered (1 − 3) contains book and exactly one of the horizontal boxes numbered (3 − 4) contains book.



1. The probability that the cornered box (numbered 3) contains a book is _____ .

2. The box which is most likely to contain a book is _____.

Question Stem for Question Nos. 3 to 4

$A(x_1, y_1), B(x_2, y_2), C(x_3, y_3)$ are the vertices of a triangle ABC and $lx + my + n = 0$ is an equation of the line L.

3. If L intersects the sides, BC, CA and AB of the triangle ABC at P, Q, R respectively then $\left|\frac{BP}{PC} \times \frac{CQ}{QA} \times \frac{AR}{RB}\right|$ is equal to _____.

4. If the centroid of the triangle ABC is at the origin and algebraic sum of the lengths of the perpendiculars from the vertices of the triangle ABC on the line L is equal to 1 then sum of the squares of the reciprocal of intercepts made by L on the coordinate axes is equal to _____.

Question Stem for Question Nos. 5 to 6

Let two distinct tangents are drawn from a point $(p, p + 1)$ on the line $y = x + 1$ to the curve $y = 2x^2$. Also k is the least positive integral value of p.

5. The value of k is _____.

6. Sum of slopes of two tangents drawn from the point $(k, k + 3)$ to the curve $y = 2x^2$, is _____.
(here k has the value obtained in above question)

SECTION-4

This section contains **THREE (03)** questions. The answer to each question is a **NON-NEGATIVE INTEGER.** For each question, enter the correct integer corresponding to the answer.

7. The sum of all real values of $'m'$ for which the polynomial $f(x)=\left\{x^2-2mx-4(m^2+1)\right\}\cdot\left\{x^2-4x-2m(m^2+1)\right\}$ has exactly three distinct real linear factors, is _____.

8. If bisector of angle C of an acute ΔABC cuts the side AB at D and circumcircle of ΔABC in E, then $\frac{CE}{DE}=\frac{(a+b)^2}{k.c^p}$, then $k+p$ is equal to _____. $(k, p\in N)$

9. $\vec{a},\vec{b},\vec{c}$ are three unit vectors such that $\vec{a}\cdot\vec{b}=\vec{b}\cdot\vec{c}=\vec{c}\cdot\vec{a}=\frac{1}{3}$. If $\vec{a}\times\vec{b}=p\vec{a}+q\vec{b}+r\vec{c}$ where p,q,r are scalars then $15(p+q+r)^2$ is _____.

End of JEE Advanced Test – 3 | CBT - JEE -2024