VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

Mock JEE Advanced -1 (CBT) | Paper – 1 | JEE 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: **Mathematics**, Subject II: **Physics**, Subject III: **Chemistry**). Each Part has **four** sections (Section 1, Section 2, Section 3 and Section 4).

2. **Section 1** contains **3 Multiple Correct Answers Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

Section 2 contains **4 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

Section 3 contains **4** Matching List sets. Each set has **TWO** lists: **List I** and **List II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

Section 4 contains **6 Non-Negative Integer Type Questions**. The answer to each question is a **NON-NEGATIVE INTEGER.** For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

3. 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.

Name of the Candidate (In CAPITALS) : _____

Roll Number : _____

OMR Bar Code Number : _____

Candidate's Signature : _____ **Invigilator's Signature** _____

MARKING SCHEME

SECTION – 1 | (Maximum Marks: 12)

- This section consists of **Three (03)** Questions. Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is(are) 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 and 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 Mark:	0 if none of the options is chosen (i.e. the question is unanswered)
Negative Marks:	–2 In all other cases.

SECTION – 2 | (Maximum Marks: 12)

- This section contains **Four (04)** Multiple Choice Questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct 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 – 3 | (Maximum Marks: 12)

- This section contains **Four (04)** Matching List sets. Each set has **TWO** lists: **List I** and **List II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- 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 – 4 | (Maximum Marks: 24)

- This section contains **SIX (06)** Questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**
- For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter 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: MATHEMATICS 60 MARKS

SECTION-1

ONE OR MORE THAN ONE CHOICE QUESTIONS

This section consists of 3 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

1. Let $A=\{1,2,3,4,5\}$ and $B=\{-2,-1,0,1,2,3,4,5\}$. Then which of the following statements is (are) true?

(A) The number of increasing functions from A to B is 56

(B) The number of non-decreasing function from A to B is 792

(C) The number of onto functions from A to A such that $f(i)\neq i$ is equal to 44

(D) The number of onto functions from B to A is 126000

2. Let $T_1 \& T_2$ be two distinct common tangents to the ellipse $E: 3x^2+8y^2=48$ and the parabola $P: y^2=4x$. Suppose that the tangent T_1 touches P and E at the points $A_1 \& A_2$ respectively and the tangent T_2 touches P and E at the points A_4 and A_3 respectively. Then which of the following statements is(are) true?

(A) The area of the quadrilateral $A_1A_2A_3A_4$ is $50\sqrt{2}$ square units

(B) The area of the quadrilateral $A_1A_2A_3A_4$ is $55\sqrt{2}$ square units

(C) The tangents T_1 and T_2 meet the x-axis at the point (–8, 0)

(D) The tangents $T_1 \& T_2$ meet the x-axis at the point (–6, 0)

3. Let a square with vertices at (1, 1), (–1, 1), (–1, –1) and (1, –1) and S be the region consisting of all points inside the square which are nearer to the origin than to any edge. If the area enclosed by region S is $\frac{4}{3}(a\sqrt{2}-b)$ then the value of a and b is equal to: $(a, b \in N)$

(A) $a=4$ **(B)** $b=1$ **(C)** $a=3$ **(D)** $b=5$

SPACE FOR ROUGH WORK

SECTION-2

SINGLE CHOICE QUESTIONS

This section consists of 4 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

4. Let f be a continuous and differentiable function in (k_1, k_2). If $f(x)\cdot f'(x) \geq x\sqrt{1-(f(x))^4}$ and $\lim\limits_{x\to k_1^+}(f(x))^2 = 1$ & $\lim\limits_{x\to k_2^-}(f(x))^2 = \frac{1}{2}$. Then minimum value of $\left[k_1^2 - k_2^2\right]$ is where [.] represents greatest integer function.

(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

5. The vertices of a triangle ABC are $A(2, 0, 2)$, B(–1, 1, 1) and C(1, –2, 4). The points D and E divide the sides AB and CA in the ratio 1 : 2 internally respectively. Another point F is taken in space such that the perpendicular drawn from F to the plane containing ΔABC meets the plane at the point of intersection of the line segment CD and BE. If the distance of F from the plane of triangle ABC is $\sqrt{2}$ units, then the position vector of point F is:

(A) $\hat{j} - 4\hat{k}$ **(B)** $\hat{i} + 4\hat{k}$ **(C)** $4\hat{k} - \hat{i}$ **(D)** $4\hat{k} - \hat{j}$

6. Let the two real number x and y are randomly chosen on the real number line, such that $0 \leq x, y \leq 30$. Then the probability that the absolute difference between the chosen numbers is not greater than 10 is equal to:

(A) 2/3 **(B)** 2/9 **(C)** 5/3 **(D)** 5/9

7. From a fixed-point A, three normal are drawn to the parabola $y^2 = 4ax$ at the points P, Q and R. Two circles C_1 & C_2 be drawn on AP and AQ as diameter. If slope of the common chord of the circles C_1 and C_2 be m_1 and the slope of the tangent to the parabola at the point R be m_2. then $m_1 \times m_2$ is equal to:

(A) –2 **(B)** 2 **(C)** 1/2 **(D)** –1/2

SPACE FOR ROUGH WORK

SECTION-3

MATRIX MATCH QUESTIONS

This section consists of 4 Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple-Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. Consider system of equations $2x+\lambda y+6z=8;\ x+2y+\mu z=5\ ;\ x+y+3z=4$

Column I contain nature of solution of system of equations of the three planes and column II contain values of λ and μ. $(\lambda, \mu \in R)$.

Column I		Column II	
I.	No solution	**P.**	$\lambda = 2, \mu \in R$
II.	Exact three solutions	**Q.**	$\lambda \neq 2, \mu = 3$
III.	Unique solution	**R.**	Not possible
IV.	Infinitely many solutions	**S.**	$\lambda \neq 2, \mu \neq 3$

(A) I – P ; II – Q ; III – R ; IV – S **(B)** I – S ; II – R ; III – Q ; IV – P

(C) I – P ; II – R ; III – Q ; IV – S **(D)** I – Q ; II – R ; III – S ; IV – P

9. Consider the given data with frequency distribution

x_i	2	5	6	8	10	12
f_i	2	8	12	4	8	6

Match entry in Column I to the correct entries in column II:

Column I		Column II	
I.	The mean of the above data is	**P.**	2.1
II.	The median of the above data is	**Q.**	7.5
III.	The mean deviation about the mean of the above data is	**R.**	6
IV.	The mean deviation about the median of the above data is	**S.**	2.3
		T.	2.5

(A) I – Q ; II – R ; III – P ; IV – S **(B)** I – P ; II – R ; III – S ; IV – T

(C) I – R ; II – P ; III – S ; IV – Q **(D)** I – Q ; II – S ; III – T ; IV – P

SPACE FOR ROUGH WORK

10. Let z_1 lies on $|z|=1$ & z_2 lies on $|z|=2$

Match entry in column I to the correct entries in column II:

Column I		Column II	
I.	Maximum value of $\lvert z_1+z_2\rvert$ is	**P.**	2
II.	Minimum value of $\lvert 2z_1-z_2\rvert$ is	**Q.**	3
III.	Maximum value of $\lvert 2z_1+z_2\rvert$ is	**R.**	4
IV.	Minimum value of $\lvert 3z_1-2z_2\rvert$ is	**S.**	0
		T.	1

(A) I – P ; II – Q ; III – R ; IV – T **(B)** I – Q ; II – S ; III – R ; IV – T

(C) I – Q ; II – Q ; III – R ; IV – S **(D)** I – Q ; II – S ; III – R ; IV – S

11. $L_1:\frac{x-1}{2}=\frac{y}{-1}=\frac{z+3}{1}$, $L_2:\frac{x-4}{1}=\frac{y+3}{1}=\frac{z+3}{2}$ and the planes $P_1:7x+y+2z=3$, $P_2:3x+5y-6z=4$.

Let $x+by+cz=d$ be the equation of the plane passing through the point of intersection of lines L_1 and L_2, and perpendicular to planes P_1 & P_2. Match column I with column II:

Column I		Column II	
I.	$d+2b+3c$	**P.**	13
II.	$d+8c$	**Q.**	–3
III.	$d+5b$	**R.**	1
IV.	$-b-5c$	**S.**	–2

(A) I – P ; II – Q ; III – R ; IV – S **(B)** I – Q ; II – R ; III – P ; IV – S

(C) I – R ; II – Q ; III – S ; IV – P **(D)** I – R ; II – P ; III – Q ; IV – T

SPACE FOR ROUGH WORK

SECTION-4

NON-NEGATIVE INTEGER TYPE QUESTIONS

This section consists of 6 NON-NEGATIVE INTEGER Type Questions. For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

1. The number of roots of equation $\sqrt{\sin x} = \cos^{-1}(\cos x)$ in $(0, 3\pi)$ is equal to _____.

2. Let $f(x)\ (x > 1)$ be a differentiable function satisfying $f(x) = (\ln x)^2 - \int_1^e \frac{f(t)}{t} dt$. Then if area bounded by tangent line of $y = f(x)$ at $(e, f(e))$, curve $y = f(x)$ and $x = 1$ is A. Then $\lfloor [A] \rfloor$ is _____. (where [.] represents greatest integer function)

3. Consider the finite series S = 17 + 187 + 1887 + 18887 +…..+ 188…..87, where the last term contains n 8's. A closed form expression for S can be given by $S = \frac{17}{a^2}(10^{n+2} - bn - c)$. Then $a + b + c$ is equal to _____. $(a, b, c \in N)$

4. For a complex number z, let Re(z) denote the real part of z. let S be the set of all complex numbers z satisfying $z^4 - |z|^4 = 4iz^2$, where $i = \sqrt{-1}$. Then the minimum possible value of $|z_1 - z_2|^2$ where $z_1, z_2 \in S$ with $\text{Re}(z_1) > 0$ and $\text{Re}(z_2) < 0$, is _____.

5. Vertices A, B and C of a tetrahedron $ABCD$ are (1, 1, 1), (1, 0, 0), (3, 0, 0) respectively. The altitude from vertex D to the opposite face ABC meets the median line through A of the ΔABC at a point E (where A and E lie on opposite sides of BC). If the length of side AD is 4 and volume of the tetrahedron is $\frac{2\sqrt{2}}{3}$ and length of $EB = \sqrt{k}$. Then the value of k is _____. $(k \in N)$

6. Let k be the coefficient of x^{18} in the polynomial

$f(x) = (1+x)^{20} + x(1+x)^{19} + x^2(1+x)^{18} + ... + x^{18}(1+x)^2$ then the value of $\frac{k}{190}$ is equal to _____.

SPACE FOR ROUGH WORK

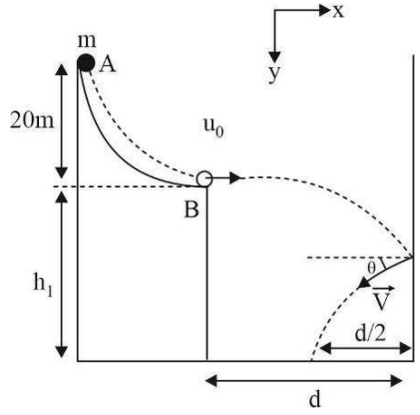
SUBJECT II: PHYSICS 60 MARKS

SECTION-1

ONE OR MORE THAN ONE CHOICE QUESTIONS

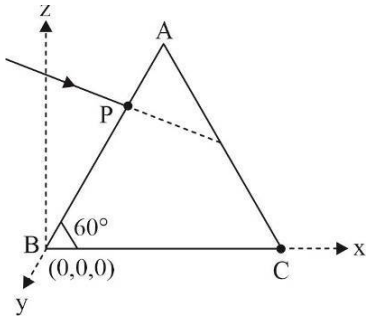
This section consists of 3 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

1. A small ball is released from a cliff of building from point A on a smooth surface. It attains velocity $u_0\hat{x}$ at point B. Ball hits a smooth wall inelastically (e = 1/2) at a distance d from foot of the cliff as shown. It rebounds with velocity $\vec{V}$ making an angle θ from horizontal as shown and finally hits the ground exactly mid-way between building and wall. Which of the following option(s) is/are correct for given data? [d = 100 m, g = acceleration due to gravity $=10\,m/s^2$]



(A) $h_1 = 500\,m$ **(B)** $\theta = \tan^{-1}5$ **(C)** $|\vec{V}| = 10\sqrt{2}\,m/s$ **(D)** $u_0 = 20\,m/s$

2. An equilateral prism ABC is placed in air with its base side BC lying horizontally along x-axis as shown in the figure. A ray given by $\sqrt{3}z + x = 10$ is incident at a point P on face AB of prism. Which of the following option(s) is/are correct?



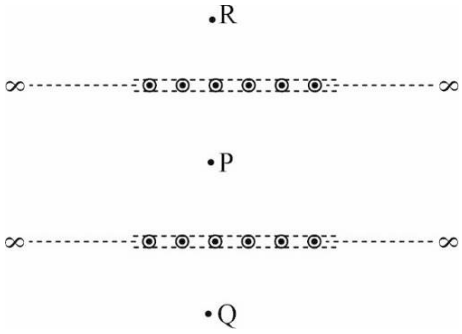
(A) For $\mu = \dfrac{2}{\sqrt{3}}$ the ray grazes the face AC

(B) For $\mu = \dfrac{3}{2}$ finally refracted ray is parallel to z-axis

(C) For $\mu = \dfrac{3}{\sqrt{2}}$ the ray emerges perpendicular to the face AC

(D) For $\mu = \dfrac{3}{2}$ finally refracted ray is parallel to x-axis

3. Two infinite plates shown in cross section carry λ ampere of current out of page per unit width of plate. There are 3-point *P*, *Q*, *R* shown in a figure. Which of the following option(s) is/are correct?



(A) Magnet field at point $P = O$

(B) Magnet filed at point $Q = \mu_0\lambda$ (toward right)

(C) Magnet field at point $Q = \mu_0\lambda$ (toward left)

(D) Magnet field at point $R = \frac{\mu_0\lambda}{2}$

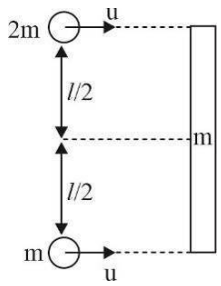
SPACE FOR ROUGH WORK

SECTION-2

SINGLE CHOICE QUESTIONS

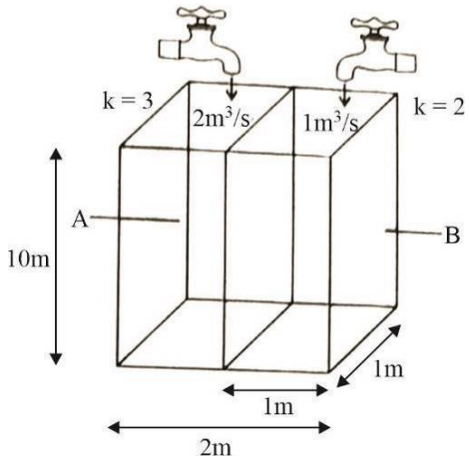
This section consists of 4 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

4. A uniform rod of mass m and length l is kept freely on smooth horizontal surface. Two-point masses of mass m and $2m$ hit the rod simultaneously with velocity u perpendicular to length of rod as shown. Find the angular speed of rod after collision. [Given: m = 2 kg, l = $6m$, u = 6 m/s], (Assume all collisions are elastic)



(A) 5 rad/sec **(B)** 2 rad/sec **(C)** 12/37 rad/sec **(D)** 3 rad/sec

5. A thin metallic partition of negligible thickness is inserted between two metallic plates A and B as shown. The remaining ends are then packed with insulating plates to form a container like structure. 2 taps shown are opened at t = 0 and finally closed at t = 5s. Find capacitance of system between A and B after closing taps. (Assume liquid to be non-conducting). Volumetric flow rates and dielectric constants of liquid are given in the figure below.



(A) $8.85\times10^{-11}F$ **(B)** $8.85\times10^{-10}F$ **(C)** $4.42\times10^{-10}F$ **(D)** $4.42\times10^{-11}F$

6. One mole of an ideal diatomic gas undergoes a process in which the gas pressure relates to its temperature as $P = AT^B$, where A and B are positive constants. Find the value of B for which heat capacity be negative.

(A) $B > \frac{7}{5}$ **(B)** $B > \frac{7}{3}$ **(C)** $B > \frac{7}{2}$ **(D)** $B = 3$

7. Two spherical planets are of same uniform mass density. The radius of first is half of the radius of other. Find the height from the surface of bigger planet at which acceleration due to gravity becomes equal to the acceleration due to gravity on surface of smaller planet. [Assume radius of first planet be R]

(A) $2R\left(\sqrt{2}-1\right)$ **(B)** $2R$ **(C)** $2\sqrt{2}R$ **(D)** R

SECTION-3

MATRIX MATCH QUESTIONS

This section consists of 4 Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple-Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. In column I consider each process just before and just after it occurs. Initial system is isolated from all other bodies. Consider all product particles (even those having rest mass zero) in the system. Match the system in column I with the result they produce in column II:

Column I		Column II	
I.	Spontaneous radioactive decay of an uranium nucleus initially at rest as given by reaction ${}^{238}_{92}U \rightarrow {}^{234}_{90}Th + {}^{4}_{2}He + ...$	**P.**	Number of protons is increased
II.	Fusion reaction of two hydrogen nuclei as given by reaction ${}^{1}_{1}H + {}^{1}_{1}H \rightarrow {}^{2}_{1}H + ...$	**Q.**	Momentum is conserved
III.	Fission of U^{235} nucleus initiated by a thermal neutron as given by reaction ${}^{1}_{0}n + {}^{235}_{92}U \rightarrow {}^{144}_{56}Ba + {}^{89}_{36}K + 3\,{}^{1}_{0}n + ...$	**R.**	Mass is converted to energy or vice versa
IV.	β^- decay (negative beta decay)	**S.**	Charge is conserved

(A) I – Q,R,S ; II – Q,R,S ; III – Q,R,S ; IV – P,Q,R,S

(B) I – P,R,S ; II – Q,R,S ; III – P,Q,R,S ; IV – Q,R,S

(C) I – Q,R,S ; II – P,R,S ; III – P,Q,R,S ; IV – P,Q,R,S

(D) I – P,R,S ; II – P,R,S ; III – Q,R,S ; IV – Q,R,S

9. The maximum intensity in the energy distribution spectrum of the sun is at wavelength 4753 Å and its temperature is 6050 K. Match the temperature given in Column I to Column II.

Column I		Column II	
I.	The temperature of star whose energy distribution shows a maximum at wavelength 9506 Å	**P.**	2000 K
II.	A furnace limits most intensively at wavelength 14450 Å. The temperature of furnace is (approx.)	**Q.**	3025 K
III.	The radiation at peak emission is visible to human eye	**R.**	5000 K
IV.	A body cools from 60°C to 50°C in 10 minutes. If the room temperature is 25°C and assuming Newton's law of cooling to hold good, the temperature of the body at the end of next 10 minutes will be	**S.**	315.85 K
		T.	215.85 K

(A) I – Q ; II – P ; III – R ; IV – S **(B)** I – P ; II – Q ; III – R ; IV – S

(C) I – Q ; II – R ; III – S ; IV – T **(D)** I – S ; II – P ; III – Q ; IV – R

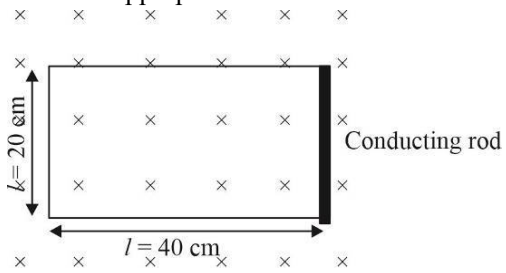
10. In an LCR series AC circuit, voltage across resistance is 2 volt. The inductive and capacitive reactances are 10Ω and 5Ω respectively. The phase difference between voltage across the circuit and current is 30°, then match each entry in Column I with an appropriate value in column II and choose the correct option.

Column I		Column II	
I.	The resistance of resistor (in Ω)	**P.**	$\frac{4}{\sqrt{3}}$
II.	Current in circuit (in A)	**Q.**	10
III.	Voltage of AC source (in V)	**R.**	$5\sqrt{3}$
IV.	Impedance of circuit (in Ω)	**S.**	$\frac{2}{5\sqrt{3}}$

(A) I – Q ; II – R ; III – S ; IV – P **(B)** I – R ; II – P ; III – S ; IV – Q

(C) I – R ; II – S ; III – P ; IV – Q **(D)** I – S ; II – Q ; III – P ; IV – R

11. Figure shows a conducting rod of negligible resistance that can slide on smooth U-shaped rail made of wire of resistance $1\Omega / m$. Position of the conducting rod at t = 0 is shown. A time dependent magnetic field B = 2t tesla is switched on at t = 0. After the magnetic field is switched on, the conducting rod is moved to the left perpendicular to the rails at constant speed 5 cm/s by some external agent. Match each quantity in Column I with an appropriate value from column II and choose the correct option



Column I		Column II	
I.	The current in the loop at t = 0 due to induced emf (in A)	**P.**	0.08
II.	At t = 2s, induced emf (in mV)	**Q.**	0.1
III.	The magnitude of force required to move the conducting rod at constant speed 5 cm/s at t = 2s (in N)	**R.**	0.16
IV.	The current in the loop at t = 2s due to induced emf (in A)	**S.**	80

(A) I – R ; II – P ; III – S ; IV – Q **(B)** I – R ; II – S ; III – Q ; IV – P

(C) I – S ; II – R ; III – P ; IV – Q **(D)** I – R ; II – S ; III – P ; IV – Q

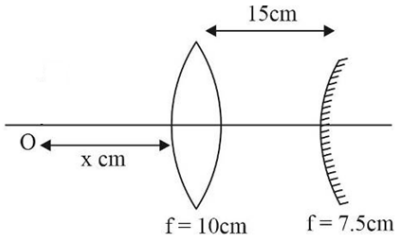
SECTION-4

NON-NEGATIVE INTEGER TYPE QUESTIONS

This section consists of 6 NON-NEGATIVE INTEGER Type Questions. For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

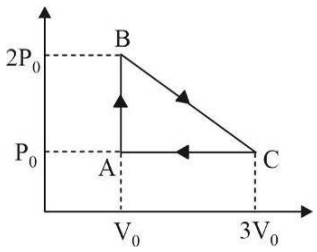
1. A hydrogen like atom has atomic number Z. Photons emitted in the electronic transitions from 6^{th} excited state to 1^{st} excited state, illuminates a photosensitive material having work function 2.75 eV. If the stopping potential of the photoelectron is 10V, then find value of Z. (Round off to nearest integer)

2. Point object O is as shown in diagram. The minimum distance an object should be placed from convex lens such that its final image coincides with it is x cm. Find x.



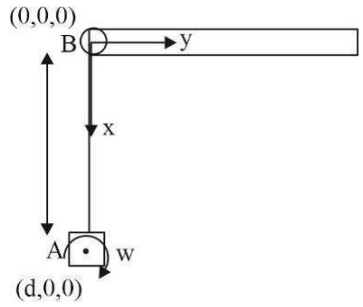
3. Consider a uniform charge distribution with charge density of 2 C/m^3 throughout in space. If a Gaussian sphere has a variable radius which changes at the rate of 2 m/s, then value of rate of change of flux is proportional to r^k (r = radius of sphere). Then, find the value of k.

4. An ideal monoatomic gas follows a cyclic process shown in figure. Point $A(V_0, P_0)$ represents the initial state of gas where U_0 is internal energy of gas. Internal energy of gas is maximum at state (V, P). Then the value of $V = nV_0$. Find value of $2n$.

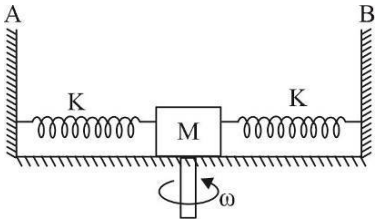


5. For given frame of reference, wall is kept along y-axis and a laser is fixed at point $A(d, 0, 0)$, which rotates with constant angular velocity $\vec{w} = w \cdot (-\hat{z})$. [$\hat{z}$ is unit vector along z-axis]. Initially laser spot is formed at origin on the wall. Find the speed (in m/s) of spot formed on wall at $t = \frac{\pi}{3}$ sec.

[Given : $w = \frac{1}{2}$ rad/sec & $d = 6m$]



6. Two relaxed identical springs are connected to mass as shown in figure. System is rotated with angular speed ω as shown in figure. At what minimum value of ω (in radian/sec) will there be no oscillations if mass is slightly pushed against any spring. [Given: $K = 16$ N/m, $m = 1/2$ kg]



SPACE FOR ROUGH WORK

SUBJECT III : CHEMISTRY 60 MARKS

SECTION-1

ONE OR MORE THAN ONE CHOICE QUESTIONS

This section consists of 3 Multiple Correct Answers Type Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE THAN ONE CHOICE** is correct.

1. Which of the following statements is correct?

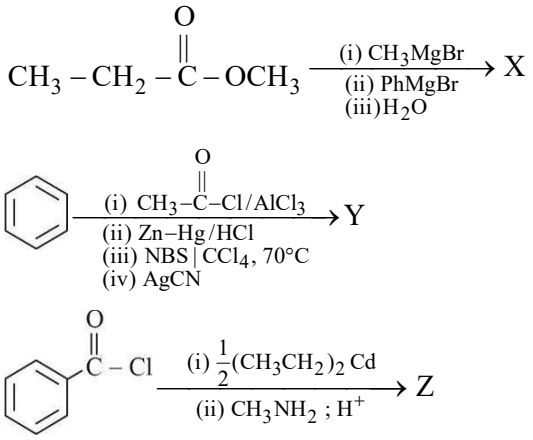
(A) In the metallurgy of aluminium, purified Al_2O_3 is mixed with Na_3AlF_6 and CaF_2 which lowers the melting point of the mixture and also increases the conductivity.

(B) Chalcocite and cinnabar are sulphide minerals

(C) Self reduction technique is not possible during the metallurgy of mercury

(D) Leaching is the method to remove Fe_2O_3 quantitatively from red bauxite

2. In the below reactions X, Y and Z are major products:



Identify correct option(s):

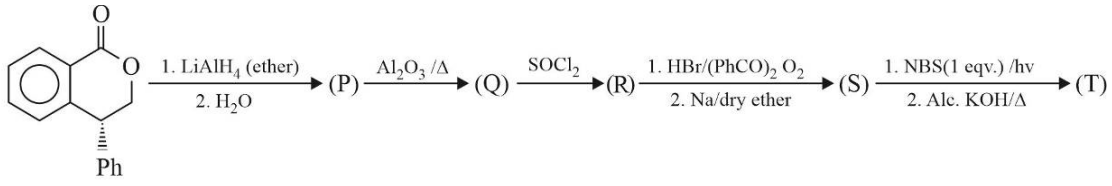
(A) X and Y consists of asymmetric carbon

(B) X, Y and Z can exhibit stereoisomerism

(C) Y is alkyl cyanide

(D) X gives instant turbidity with lucas reagent

3. With reference to the scheme given below, which of the following statement(s) is/are TRUE about the major products P, Q, R, S and T?



(Pure enantiomer)

(A) Only (P) and (S) can exhibit stereoisomerism

(B) (T) is optically active

(C) Degree of unsaturation of (T) is 10

(D) (R) on ozonolysis with one equivalent of ozone in presence of zinc gives product (A) which on treatment with 1 equivalent of $LiAlH_4$ / ether may give a heterocyclic product

SECTION-2

SINGLE CHOICE QUESTIONS

This section consists of 4 Multiple Choice Questions. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE CHOICE** is correct.

4. $Y(s) \xleftarrow{KI} CuSO_4 \xrightarrow{\text{dil. } H_2SO_4} X$ (Blue colour), X and Y are :

(A) $X = I_2, Y = [Cu(H_2O)_4]^{2+}$ **(B)** $X = [Cu(H_2O)_4]^{2+}, Y = I_2$

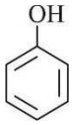
(C) $X = [Cu(H_2O)_4]^{+}, Y = I_2$ **(D)** $X = [Cu(H_2O)_5]^{2+}, Y = I_2$

5. Specific conductance of saturated solution of AgCl is $2.68\times10^{-4}\,Sm^{-1}$ and that of water is $0.86\times10^{-4}\,Sm^{-1}$ at 298 K, Calculate the solubility product in mol/dm^3 unit if λ_m^0 for HNO_3, $AgNO_3$ and HCl are $421\times10^{-4}Sm^2mol^{-1}, 133\times10^{-4}Sm^2mol^{-1}, 426\times10^{-4}Sm^2mol^{-1}$ respectively.

(A) 1.74×10^{-10} **(B)** 1.32×10^{-5} **(C)** 1.32×10^{-2} **(D)** 1.74×10^{-4}

6. Two buffers, X and Y of pH 4.0 and 6.0, respectively are prepared from acid HA and the salt NaA. Both the buffers are 0.50 M in HA. What would be the pH of the solution obtained by mixing equal volumes of the two buffers? The value of K_a for $HA = 1.0\times10^{-5}$. (log 5.05 = 0.7)

(A) 5.0 **(B)** 4.3 **(C)** 4.7 **(D)** 5.7

7. 

$\xrightarrow[\substack{400\,K\\4\,atm}]{CO_2, NaOH} (X) \xrightarrow{H^+} (Y)$

$Y + (CH_3 - CO)_2O \xrightarrow{H^+} Z + CH_3COOH$

The correct statement about Z is:

(A) It is non-narcotic drug **(B)** It is used as antihistamine

(C) It is antifertility drugs **(D)** It is used as preservatives

SPACE FOR ROUGH WORK

SECTION-3

MATRIX MATCH QUESTIONS

This section consists of 4 Matching List Sets. Each set has **ONE** Multiple Choice Question. Each set has **TWO** lists: **List-I** and **List-II**. **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5). **FOUR** options are given in each Multiple-Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.

8. Column I contains elements and compounds in respective properties and column II contains decreasing order of properties.

Column I		Column II	
I.	B Al Ga In 1 2 3 4 (Atomic size)	**P.**	4 > 3 > 2 > 1
II.	NaOH KOH RbOH CsOH 1 2 3 4 (Thermal stability)	**Q.**	4 > 2 > 3 > 1
III.	SiO_2 CO_2 CaO Cs_2O 1 2 3 4 (Basic strength)	**R.**	1 > 2 > 3 > 4
IV.	BeF_2 BaF_2 CaF_2 MgF_2 1 2 3 4 (Solubility in water)	**S.**	4 > 3 > 1 > 2
		T.	2 > 3 > 4 > 1

(A) I – Q ; II – S ; III – P ; IV – T **(B)** I – Q ; II – P ; III – S ; IV – R

(C) I – Q ; II – P ; III – S ; IV – T **(D)** I – P ; II – Q ; III – S ; IV – R

9. Match the following :

Column I		Column II	
I.	$[Ni(CN)_4]^{2-}$	**P.**	Paramagnetic and number of unpaired electrons(s) is/are same as the free metal ion
II.	$K_3[Fe(CN)_6]$	**Q.**	Paramagnetic but number of unpaired electron(s) is/are less than the free metal ion
III.	$[NiCl_4]^{2-}$	**R.**	Free metal ion is paramagnetic but complex is diamagnetic
IV.	$[Ni(NH_3)_6]SO_4$	**S.**	d-orbital(s) is/are involved in hybridization
		T.	Metal in +2 oxidation state
		U.	Metal in +3 oxidation state

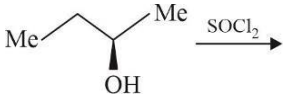
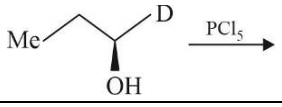
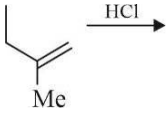
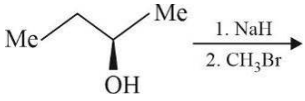
(A) I – Q,S,T ; II – R,S,U ; III – P,S,T ; IV – P,T

(B) I – S,T ; II – Q,S,R ; III – Q,T ; IV – P,T

(C) I – P,T ; II – R,S,U ; III – Q,S,T ; IV – P,T

(D) I – R,S,T ; II – Q,S,U ; III – P,T ; IV – P,S,T

10. Match the following :

Column I		Column II	
I.		**P.**	Optically active product
II.		**Q.**	Inversion of configuration
III.		**R.**	Retention of configuration
IV.		**S.**	Optically inactive product
		T.	Carbocation intermediate

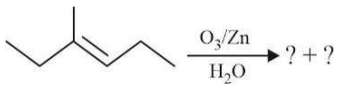
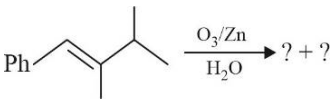
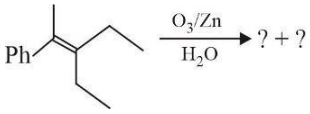
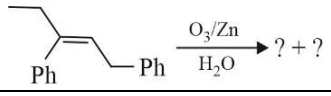
(A) I – P,R ; II – P,Q ; III – S,T ; IV – P,R

(B) I – P,Q ; II – P,R,T ; III – R,T ; IV – P,R

(C) I – P,R ; II – P,R,T ; III – S,T ; IV – P,R,T

(D) I – S,T ; II – P,Q ; III – P,R,T ; IV – P,R

11. Match the following :

Column I		Column II	
I.		**P.**	Fehling's test
II.		**Q.**	Tollen's test
III.		**R.**	Iodoform test
IV.		**S.**	Schiff's test
		T.	Benedict's test

(A) I – P,Q,R,S,T ; II – Q,R,S ; III – R ; IV – P,Q,S,T

(B) I – P,Q,R,S ; II – P,Q,R ; III – R,S ; IV – P,Q,S,T

(C) I – Q,R,S,T ; II – Q,R ; III – S ; IV – P,Q,S

(D) I – R,S,T ; II – P,R ; III – Q,S ; IV – Q,S,T

SECTION-4

NON-NEGATIVE INTEGER TYPE QUESTIONS

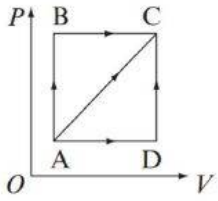
This section consists of 6 NON-NEGATIVE INTEGER Type Questions. For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.

1. The reaction of 471 g of diethyldichlorosilane with water results in trimeric cyclic product X in 50% yield. The weight (in g) of X obtained is _____.

2. One mole of a gas occupies 0.5 L at 27°C. The compressibility factor of gas at this temperature is 0.8. If Van der waal's constant b is $0.02\,\text{L mol}^{-1}$, then what is the value of Van der waal's constant a for the gas? (R = 0.08 L-atm/K-mol) [Round off the answer to nearest integer]

3. A given sample of milk turns sour at room temperature (27°C) in 16 h. In a refrigerator at 7°C, milk can be stored three times as long before it sours. How long (in hours) it takes for milk to sour at 57°C? (ln 2 = 0.7, ln 3 = 1.1)

4. A thermodynamic process is shown in the following figure. The pressure and volumes corresponding to some points in the figure are $P_A = 3\times10^4$ Pa, $P_B = 8\times10^4$ Pa, $V_A = 2\times10^{-3}\,m^3$, $V_D = 5\times10^{-3}\,m^3$. In the process AB, 600 J of heat is added to the system and in BC, 200 J of heat is added to the system. The change in internal energy (in J) of the system in the process AC would be_____.



5. At 298 K, the standard enthalpy of combustion of sucrose is -5737 kJ mol^{-1} and the standard Gibb's energy of the reaction is $-6333\,\text{kJ mol}^{-1}$. The additional (non-expansion) work (in kJ) that may be obtained by raising the temperature to 29°C is _____.

6. o-aminobenzaldehyde is heated with acetone in dilute NaOH solution to produce the major organic product (A) where A doesn't give silver mirror test, which on treatment with catalytic amount of H_2SO_4 produces another major organic product (B). Let, the degree of unsaturation of (A) be x ; the degree of unsaturation of (B) be y ; the number of rings in (A) be z and the number of rings in (B) be p, then, find the value of $\left(\frac{y+z}{x-p}\right)$.

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***** End of Mock JEE Advanced – 1 | JEE 2024 *****