

### Mock Advanced Test-11 Paper-2

TIME : 3 hrs	M.M. : 210
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Read the following Instructions very carefully before you proceed.

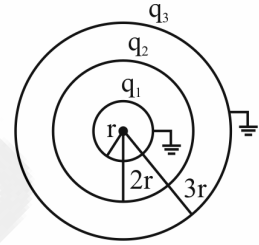
- The question paper consists of 3 subjects (Subject I: Physics, Subject II: Chemistry, Subject III: Mathematics). Each Subject consists of three sections (Section I, Section II & Section III).
- Section I** contains **10 Multiple Choice Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONLY ONE** is correct.
  - *Marking scheme* [3 Marks for All Correct answers and zero mark if no bubbles are darkened. In all other cases, minus one (-1) mark will be awarded]
- Section II** contains **6 Questions**. The answer to each question is a **Single Digit Integer**, ranging from 0 to 9 (both inclusive).
  - *Marking scheme* [4 marks if you darken all the bubble corresponding to the correct answer ONLY. In all other cases zero (0) marks will be awarded. No negative marks will be awarded for incorrect answer]
- Section III** contains **2 "Match the following"** type questions and you will have to match entries in Column I with the entries in Column II.
  - *Marking scheme* [For each question you will be awarded 2 marks for each row in which you have darken ALL the bubble(s) corresponding to the correct answer(s) ONLY and zero marks otherwise. Thus each question in this section carries a maximum of 8 Marks. There are no negative marks in this section]
- 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.
- No candidate is allowed to carry any textual material, printed or written, bits of papers, pager, mobile phone, any electronic device, etc., except the Admit Card inside the examination hall/room.
- 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.

SECTION - I

SINGLE CORRECT ANSWER TYPE

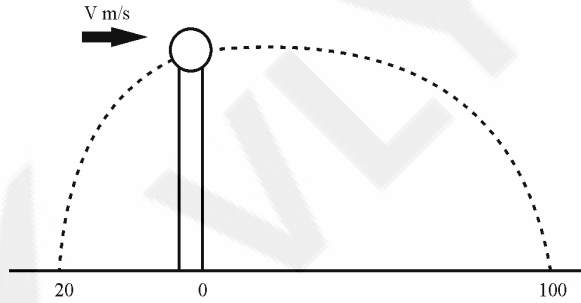
This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choices is Correct:

1. Three concentric conducting spherical shells have radii  $r, 2r$  and  $3r$  and total charges  $q_1, q_2$  and  $q_3$  respectively where innermost and outermost shells are already earthed as shown. Select the incorrect alternative :



- (A)  $q_1 + q_3 = -q_2$                       (B)  $q_1 = \frac{-q_2}{4}$   
 (C)  $\frac{q_3}{q_1} = 3$                                   (D)  $\frac{q_3}{q_2} = \frac{-1}{3}$

2. A ball of mass  $0.2 \text{ kg}$  rests on a vertical post of height  $5 \text{ m}$ . A bullet of mass  $0.01 \text{ kg}$ , traveling with a velocity  $V \text{ m/s}$  in a horizontal direction, hits the centre of the ball. After the collision, the ball and bullet travel independently. The ball hits the ground at a distance of  $100 \text{ m}$  and the bullet at a distance of  $20 \text{ m}$  behind the foot of the post. The initial velocity  $V$  of the bullet is : (Take  $g = 10 \text{ ms}^{-2}$ )



- (A)  $2020 \text{ m s}^{-1}$       (B)  $2000 \text{ m s}^{-1}$       (C)  $1900 \text{ m s}^{-1}$       (D)  $1980 \text{ m s}^{-1}$

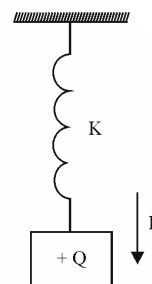
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3. The density of a solid ball is to be determined in an experiment. The diameter of the ball is measured with a screw gauge, whose pitch is 0.5 mm and there are 50 divisions on the circular scale. The reading on the main scale is 1.5 mm and that on the circular scale is 30 divisions. If the measured mass of the ball has a relative error of 3%, the relative percentage error in the density is :

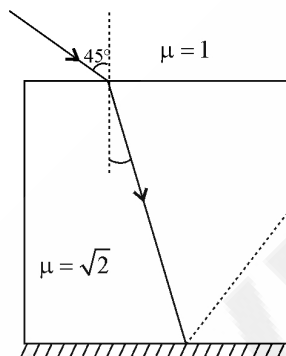
(A) 1.2%                      (B) 3.2%                      (C) 4.7%                      (D) 3.5%

4. A wooden block of mass  $m$  attached with a massless spring performs SHM vertically in air-resistance free space with frequency,  $\nu_0$ . The block carries a charge  $+Q$  on its surface. If now a uniform electric field  $\vec{E}$  is switched-on as shown, then the SHM of the block will be :

(A) of the same frequency and with shifted mean position.  
 (B) of the same frequency and with the same mean position.  
 (C) of changed frequency and with shifted mean position.  
 (D) of changed frequency and with the same mean position.



5. Bottom face of the glass cube is silvered as shown. A ray of light is incident on top face of the cube as shown. The deviation of the ray when it comes out of the glass cube is :



(A)  $0^\circ$                       (B)  $90^\circ$                       (C)  $180^\circ$                       (D)  $270^\circ$

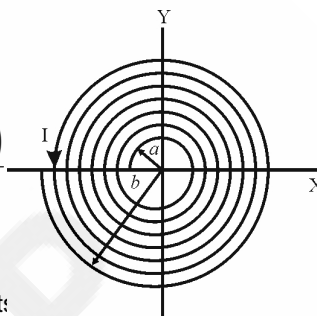
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6. A satellite is moving with a constant speed ' $V$ ' in a circular orbit about the earth near surface. The extra mechanical energy given to the satellite so that it revolves around the earth in circular orbit of radius  $2R$  is :

(A)  $\frac{1}{2}mV^2$       (B)  $\frac{mV^2}{4}$       (C)  $\frac{3}{2}mV^2$       (D)  $2mV^2$

7. A long insulated copper wire is closely wound as a spiral of ' $N$ ' turns. The spiral has inner radius ' $a$ ' and outer radius ' $b$ '. The spiral lies in the  $X$ - $Y$  plane and a steady current ' $I$ ' flows through the wire. The  $Z$ -component of the magnetic dipole moment of the spiral is :

(A)  $\frac{\pi IN (b^3 - a^3)}{3(b-a)}$       (B)  $\frac{\pi IN (b^3 - a^3)}{b-a}$   
 (C)  $\frac{\pi IN (b^4 - a^4)}{b-a}$       (D)  $\pi IN (b^2 - a^2)$



8. A point mass is subjected to two simultaneous sinusoidal displacement:

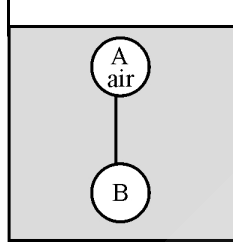
$x_1(t) = A \sin \omega t$  and  $x_2(t) = A \sin \left( \omega t + \frac{\pi}{2} \right)$ . Adding a third sinusoidal displacement

$x_3(t) = B \sin(\omega t + \phi)$  brings the mass to a complete rest. The values of  $B$  and  $\phi$  are :

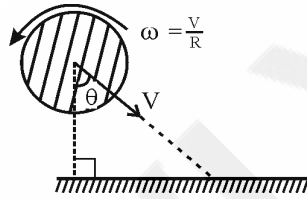
(A)  $\sqrt{2}A, \frac{5\pi}{4}$       (B)  $A, \frac{4\pi}{3}$       (C)  $\sqrt{3}A, \frac{5\pi}{6}$       (D)  $A, \frac{\pi}{3}$

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9. A solid sphere  $B$  of mass  $m$  and a massless air balloon  $A$  of equal volumes are connected by a massless string. They are fully immersed in a fluid of density  $\rho_f$ . They get arranged into an equilibrium state as shown in the figure with a tension in the string. The arrangement is possible only if tension ( $T$ ) in string and buoyant force ( $B$ ) on the sphere or balloon are :



- (A)  $T = \frac{mg}{4}$       (B)  $T = mg$       (C)  $B = mg$       (D)  $B = \frac{mg}{2}$
10. A reverse spinning thin uniform disc of mass  $m$  and radius  $R$  having velocity  $V$  and angular velocity  $\frac{V}{R}$  makes an oblique collision with horizontal rough surface of coefficient of friction as  $\mu$  and comes to complete stop. The value of  $\mu$  and  $\theta$  are :



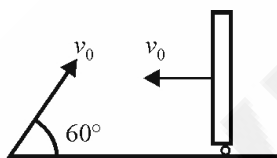
- (A)  $\mu = \sqrt{3}$       (B)  $\mu = \frac{1}{\sqrt{3}}$       (C)  $\theta = 45^\circ$       (D)  $\theta = 60^\circ$

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**SECTION - II**  
**SINGLE INTEGER VALUE CORRECT TYPE**

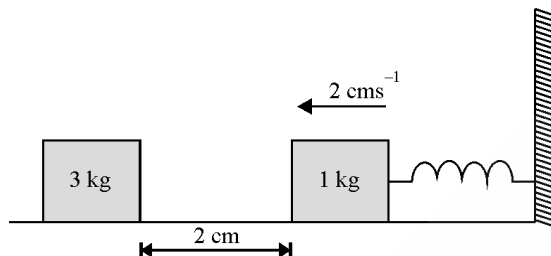
This section contains 6 Single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. A series  $R$ - $C$  combination is connected to an AC voltage of frequency  $f = \frac{250}{\pi}$  Hz. If the impedance of the  $R$ - $C$  circuit is  $R\sqrt{5}$ , the time constant (in millisecond) of the circuit is \_\_\_\_\_.
2. A silver sphere of radius  $r$  and work function  $\phi$  in eV is suspended from an insulating thread in free-space. It is under continuous illumination of  $\lambda$  wavelength light. As photoelectrons are emitted, the sphere gets charged and acquires a potential. The maximum number of photoelectrons emitted from the sphere is  $N_{\max} = \frac{x^2 \pi \epsilon_0 r \left( \frac{hc}{\lambda} - \phi \right)}{e^x}$ . Find value of  $x$  \_\_\_\_\_.
3. A particle is projected at an angle of  $60^\circ$  from the horizontal with initial velocity  $v_0$  towards a wall moving with same speed. Assuming perfectly elastic collision and particle hits the ground after collision from wall at the point of projection. The time interval between the instant of projection and the instant of collision of particle with wall is  $\frac{N\sqrt{3}v_0}{6g}$ . Find  $N$  \_\_\_\_\_.



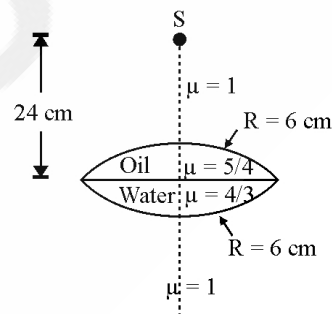
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4. A block of mass  $1\text{ kg}$  is attached to a spring of force-constant  $4\text{ N/m}$ , over a smooth horizontal surface. Initially the spring is compressed by  $1\text{ cm}$  and the block is moving with speed  $2\text{ cm s}^{-1}$ . The block slides a distance of  $2\text{ cm}$  collides and sticks with a block of mass  $3\text{ kg}$  kept at rest. The amplitude of SHM of the combined mass is  $\frac{\sqrt{N}}{2}\text{ cm}$ . Find  $N$  \_\_\_\_\_.



5. Two binary stars having masses  $m$  and  $4m$  are rotating about their centre of mass under the effect of mutual interaction. What will the ratio of their angular momentum  $\left(\frac{L_m}{L_{4m}}\right)$ .

6. Water lens (with refractive index  $=\frac{4}{3}$ ) has  $6\text{ cm}$  radius. Oil of refractive index  $\frac{5}{4}$  lies on water lens making a convex surface of radius of curvature ' $R = 6\text{ cm}$ ' as shown. Consider Oil and water to act as thin lenses. An object ' $S$ ' is placed  $24\text{ cm}$  above water-oil interface. The location of its final image is at ' $x$ ' cm from the interface. If ' $x$ ' is  $\frac{36}{N}\text{ cm}$ , then find  $N$  \_\_\_\_\_.

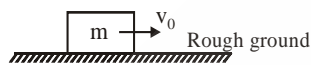
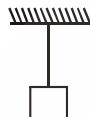
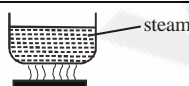


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**SECTION - III**  
**MATRIX MATCH TYPE**

The section contains 2 "Match the following" type questions and you will have to match entries in Column I with the entries in Column II.

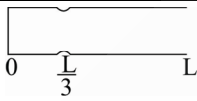
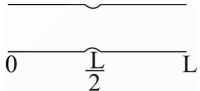
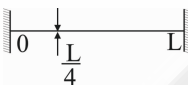
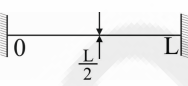
1. In List 1, statement about heat given to the system, work done and change of internal energy are given. Symbols have their usual meaning use first law of thermodynamics in form  $\Delta Q = \Delta U + W$ . Match the situations in List 2 with statements in List 1.

List 1		List 2	
(A)	$\Delta Q > 0$	(p)	 <p>Block is the system. Assume no heat is lost to surrounding till the block comes to rest</p>
(B)	$\Delta Q < 0$	(q)	 <p>A block is released from rest from massless elastic string at natural length. After a few oscillations, block comes to rest. The string is the system</p>
(C)	$W > 0$	(r)	 <p>Water is boiled in a closed container with a movable light piston. The container with its contents is the system</p>
(D)	$\Delta U > 0$	(s)	A monatomic ideal gas undergoes a process $PT^{-3} = \text{constant}$ . Gas is the system. Pressure increases during the process
		(t)	In isothermal expansion of an ideal gas

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2. Column I shows four systems, each of the same length  $L$ , for producing standing waves. The lowest possible natural frequency of a system is called its fundamental frequency, whose wavelength is denoted as  $\lambda_f$ . Match the following :

Column I		Column II	
(A)	Pipe open at one end and open at $\frac{L}{3}$ point 	(p)	Longitudinal waves
(B)	Pipe open at both ends and at mid-point 	(q)	Transverse waves
(C)	Stretched wire clamped at both ends and at $\frac{L}{4}$ point 	(r)	$\lambda_f = L$
(D)	Stretched wire clamped at both ends and at mid-point 	(s)	$\lambda_f = \frac{L}{2}$
		(t)	$\lambda_f = \frac{4L}{3}$

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## SECTION - I

## SINGLE CORRECT ANSWER TYPE

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choices is Correct:

1. In which of the following diagrams is the aufbau principle and Hund principle both are violated ?



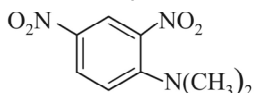
(A)

(B)

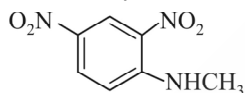
(C)

(D)

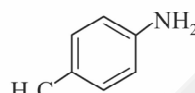
2. Amongst the compounds given, the one that would form a yellow precipitate on treatment with acetone in presence of acid as catalyst is :



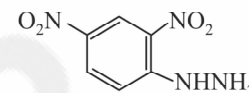
(A)



(B)

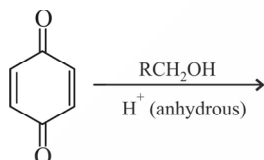


(C)



(D)

3. The major product of the following reaction is :



(A)

a hemiketal

(B)

a ketal

(C)

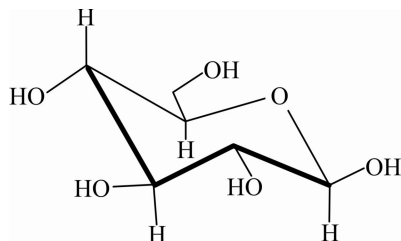
an ether

(D)

an ester

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4. The following carbohydrate :



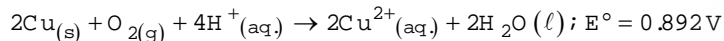
- (A) do not form silver mirror with Tollen's reagent.  
 (B) do not form pentaacetate on reaction with excess of  $\text{CH}_3\text{COCl}$ .  
 (C) is a cyclic hemiacetal.  
 (D) is cyclic form of L-aldopentose.
5. Oxidation state of the metal in the minerals iron pyrite and copper pyrite respectively, are :  
 (A) IV in iron pyrite and II, II in copper pyrite  
 (B) II in iron pyrite and II, II in copper pyrite  
 (C) II in iron pyrite and I, III in copper pyrite  
 (D) IV in iron pyrite and I, II in copper pyrite
6. Which of the following is correct regarding complex  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{Ni}(\text{CO})_4]$ ?  
 (A) Two complexes have same structure and possess same magnetic behaviour.  
 (B) Two complexes have different structure but possess same magnetic behaviour .  
 (C) Two complexes have different structure and possess different magnetic behaviour.  
 (D) Two complexes have same structure but possess different magnetic behaviour

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7. Passing HCl gas into a mixture of  $\text{Pb}^{2+}$ ,  $\text{Ag}^+$ ,  $\text{Cu}^{2+}$  and  $\text{Hg}^{2+}$  ions in an aqueous solution precipitates :

(A)  $\text{PbCl}_2$  and  $\text{CuCl}_2$  (B)  $\text{PbCl}_2$  and  $\text{AgCl}$   
 (C)  $\text{CuCl}_2$  and  $\text{HgCl}_2$  (D)  $\text{AgCl}$  and  $\text{HgCl}_2$

8. Consider the following cell reaction :

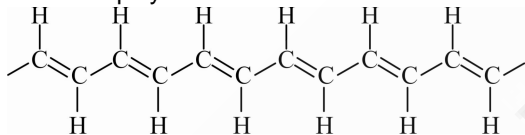


At  $[\text{Cu}^{2+}] = 10^{-3}\text{M}$ ,  $P_{\text{O}_2} = 0.1\text{atm}$  and  $\text{pH} = 3$ , the cell potential at  $25^\circ\text{C}$  is :

$$\left[ U_{\text{se}} \frac{2.303RT}{F} = 0.059 \right]$$

- (A) 0.877 V (B) 0.788 V (C) 0.686 V (D) 0.995 V
9. Reduction of the nitrogen atom in  $\text{HNO}_3$  involves :
- (A) 1 electron in conc.  $\text{HNO}_3$  (B) 5 electrons in dil  $\text{HNO}_3$   
 (C) 1 electron in dil.  $\text{HNO}_3$  (D) 3 electrons in conc.  $\text{HNO}_3$

10. Part of a polymer structure is shown below.



The INCORRECT statement regarding above polymer is :

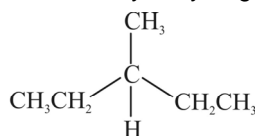
- (A) It is polymer of ethylene (B)  $\text{C}=\text{C}$  are in trans configuration  
 (C) Under special conditions, this polymer conducts electricity  
 (D) On ozonolysis this polymer produce, mainly glyoxal.

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**SECTION - II**  
**SINGLE INTEGER VALUE CORRECT TYPE**

This section contains 6 Single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. The maximum number of isomeric (including stereoisomers) of alkenes that can produce following compound on catalytic hydrogenation, is \_\_\_\_\_.



2. The total number of C-H  $\sigma$  bonds in DDT is \_\_\_\_\_.
3. Among the following, the number of compounds that can react with conc.  $\text{HNO}_3$  to give  $\text{NO}_2$  is \_\_\_\_\_.  $\text{Cu}, \text{I}_2, \text{C}, \text{S}_8, \text{P}_4, \text{HCl}(\text{conc.}), \text{Al}, \text{Zn}, \text{Pt}$
4. The volume (in mL) of  $0.1\text{M AgNO}_3$  required for complete precipitation of chloride ions present in 30 mL of  $0.01\text{M}$  solution of carnallite as silver chloride is close to \_\_\_\_\_.
5. If the density of some lake water is  $1.25\text{g mL}^{-1}$  and contains 92 g of  $\text{Na}^+$  ions per kg of water, calculate the molality of  $\text{Na}^+$  ions in the lake \_\_\_\_\_.
6. Copper commonly occurs as the sulphide mineral  $\text{CuS}$ . The first step in extracting copper from  $\text{CuS}$  is to dissolve the mineral in nitric acid, which oxidizes the sulphide to sulphate and reduces nitric acid to nitric oxide. The number of nitric oxide molecules involved in the balanced chemical equation is \_\_\_\_\_.

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**SECTION - III**  
**MATRIX MATCH TYPE**

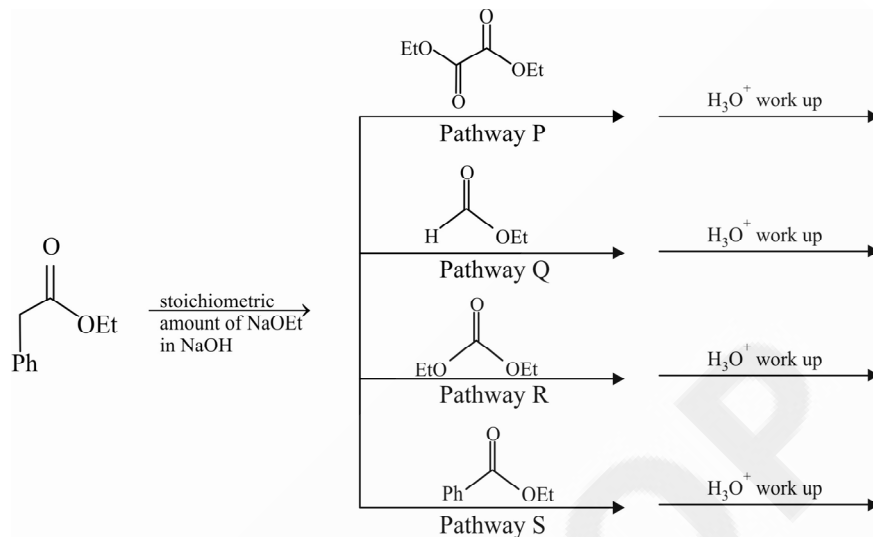
The section contains 2 "Match the following" type questions and you will have to match entries in Column I with the entries in Column II.

1. Match the transformations in column I with appropriate options in Column II

Column I		Column II	
(A)	$\text{H}_2\text{O}(\ell) \rightarrow \text{H}_2\text{O}(\text{s})$	(p)	phase transition
(B)	$3\text{O}_2(\text{g}) \rightarrow 2\text{O}_3(\text{g})$	(q)	Allotropic change
(C)	$\text{C}_{(\text{solid, diamond})} \rightarrow \text{C}_{(\text{solid, graphite})}$	(r)	$\Delta H$ is positive
(D)	$\text{NH}_4\text{Cl}(\text{s}) \rightarrow \text{NH}_3(\text{g}) + \text{HCl}(\text{g})$	(s)	$\Delta S$ is positive
		(t)	$\Delta S$ is negative

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2. Different crossed claisen condensation pathways are shown below. Match each pathway from List-I with an appropriate product from List-II.



List I		List II	
(A)	Pathway P	(p)	
(B)	Pathway Q	(q)	
(C)	Pathway R	(r)	
(D)	Pathway S	(s)	

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## SECTION - I

## SINGLE CORRECT ANSWER TYPE

This section contains 10 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choices is Correct:

1. If  $\lim_{x \rightarrow 0} \left[ 1 + x \log(1 + K^2) \right]^{\frac{1}{2x}} = \sqrt{2K} \cos \theta, K > 0$  and  $\theta \in [-\pi, \pi]$  then  $\theta$  is :
- (A)  $-\pi/2$       (B)  $0$       (C)  $\pi/2$       (D)  $\pi$
2. Let  $f(x) = 2\sqrt{x}$  and  $g(x) = 2\sqrt{1-x}$  be two functions and let  $f_1(x) = \max\{f(t), 0 \leq t \leq x, 0 \leq x \leq 1\}$  and  $g_1(x) = \min\{g(t), 0 \leq t \leq x, 0 \leq x \leq 1\}$ , then the area bounded by  $f_1(x) = 0, g_1(x) = 0$  and x-axis is :
- (A)  $\frac{1}{3\sqrt{2}}$  sq. unit      (B)  $\frac{3}{2\sqrt{2}}$  sq. unit      (C)  $\frac{3}{\sqrt{2}}$  sq. unit      (D)  $\frac{4}{3\sqrt{2}}$  sq. unit
3. Let  $f(x) = x^2$  and  $g(x) = \cos x$  for all  $x \in \mathbb{R}$ . Then the set of all  $x$  satisfying  $(f \circ g \circ g \circ f)(x) = (g \circ g \circ f)(x)$ , where  $(f \circ g)(x) = f(g(x))$ , is :
- (A)  $\pm\sqrt{n\pi}, n \in \mathbb{N}$       (B)  $\pm\sqrt{n\frac{\pi}{2}}, n \in \mathbb{W}$
- (C)  $\pm\sqrt{(2n+1)\frac{\pi}{2}}, n \in \mathbb{W}$       (D)  $\pm\sqrt{(2n+1)\frac{\pi}{2}}, n \in \mathbb{N}$

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SPACE FOR ROUGH WORK



4. Let  $(x, y)$  be any point on the parabola  $x^2 = y$ . Let  $P$  be the midpoint of the line segment from  $(0, 0)$  to  $(x, y)$ . Then find the locus of  $P$ .
- (A)  $y = x^2$       (B)  $y = 2x^2$       (C)  $y^2 = x$       (D)  $2y = x^2$
5. Let  $P(3, 2)$  be a point on the hyperbola  $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ . If normal at  $P$  intersect the  $y$ -axis at  $(0, 3)$ , then the eccentricity of hyperbola is :
- (A)  $\sqrt{2}$       (B)  $\sqrt{3}$       (C) 2      (D)  $\sqrt{5}$
6. Let  $\omega \neq 1$  be a cube root of unity and  $S$  be the set of all singular matrices of the form
- $$\begin{bmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \omega & 1 \end{bmatrix}$$
- where each of  $a, b, c$  is either  $\omega$  or  $\omega^2$ . Then the number of distinct matrices in the set  $S$  is :
- (A) 5      (B) 6      (C) 7      (D) 8
7. The circle passing through  $(0, 4)$  and touching the  $x$ -axis at  $(8, 0)$  also passes through the point.
- (A)  $(2, 2)$       (B)  $(5, -6)$       (C)  $(0, 0)$       (D)  $(1, 4)$

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8. Let  $f : (0,1) \rightarrow \mathbb{R}$  be defined by  $f(x) = \frac{b-2x}{3+bx}$  where  $b$  is a constant such that  $0 < b < 1$ , then :
- (A)  $f$  is non invertible on  $(0,1)$                       (B) Range of  $f$  is  $\mathbb{R}$   
 (C)  $f$  is invertible    (D) Range of  $f$  is  $(-1,1)$
9. Let  $L$  be the normal to the parabola  $x^2 = 4y$ . If  $L$  passes through  $(6, 9)$  then  $L$  is given by :
- (A)  $x - y + 2 = 0$     (B)  $x + 2y - 24 = 0$     (C)  $x - y + 3 = 0$     (D)  $x + y = 15$
10. Let  $E$  and  $F$  be two independent events. The probability that exactly one of them occurs is  $\frac{2}{9}$  and none of them occurs is  $\frac{1}{9}$ . If  $P(T)$  denotes the probability of occurrence of the event  $T$ , Then  $P(E)$  and  $P(F)$  satisfy the equation
- (A)  $9x^2 - 14x + 6 = 0$                                       (B)  $x^2 + 6x - 9 = 0$   
 (C)  $9x^2 + 14x + 6 = 0$                                       (D) None of these

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SPACE FOR ROUGH WORK

**SECTION - II**  
**SINGLE INTEGER VALUE CORRECT TYPE**

This section contains 6 Single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

- Let  $\vec{a} = \hat{i} + \hat{k}$ ,  $\vec{b} = -\hat{i} + \hat{j}$  and  $\vec{c} = \hat{i} + \hat{j} - 3\hat{k}$  be three given vector. If  $\vec{r}$  is a vector such that  $\vec{r} \times \vec{b} = \vec{c} \times \vec{b}$  and  $\vec{r} \cdot \vec{a} = 0$  then  $|\vec{r} \cdot \vec{b}|$  is \_\_\_\_\_.
- Straight line  $2x + 3y = 6$  divides the circular region  $x^2 + y^2 \leq 12$  then the number of integral points (both co-ordinates integers) lying inside the smaller part is \_\_\_\_\_.
- Let  $z = e^{-\frac{4\pi}{3}}$  and  $a, b, c, x, y, z$  be non-zero complex numbers such that
 
$$a + bz + cz^2 = x$$

$$a + bz^2 + cz = y$$

$$a + b + c = z$$
 Then value of  $|x|^2 + |y|^2 + |z|^2 - 3(|a|^2 + |b|^2 + |c|^2)$  is \_\_\_\_\_.
- The number of distinct real roots of the equation  $3x^4 - 2x^3 + 15x^2 + 2x - 3 = 0$  is \_\_\_\_\_.
- Let  $f: \mathbb{R} \rightarrow \mathbb{R}$  be a function satisfying the relation  $f\left(\frac{x+y}{2}\right) = \frac{f(x) + f(y)}{2}$  for all  $x, y \in \mathbb{R}$ . If  $f(0) = 1$  and  $f'(0)$  exists and is equal to  $-1$ , then  $f(-2)$  is equal to \_\_\_\_\_.
- Let  $M$  be a  $3 \times 3$  matrix satisfying  $M \begin{bmatrix} -1 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 3 \\ 1 \\ -2 \end{bmatrix}$ ,  $M \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix} = \begin{bmatrix} 1 \\ 2 \\ 3 \end{bmatrix}$ ,  $M \begin{bmatrix} -1 \\ 1 \\ -1 \end{bmatrix} = \begin{bmatrix} 2 \\ 1 \\ 1 \end{bmatrix}$  Then find |trace| of  $M$  \_\_\_\_\_.

SPACE FOR ROUGH WORK

**SECTION - III**  
**MATRIX MATCH TYPE**

The section contains 2 "Match the following" type questions and you will have to match entries in Column I with the entries in Column II.

1. Match the statements given in column-I with values given in column-II.

Column I		Column II	
(A)	Angle between $\bar{a}$ and Internal angle bisector of $\bar{a}$ and $\bar{b}$ , where $\bar{a} = \hat{j} - \sqrt{3}\hat{k}, \bar{b} = \hat{j} + \sqrt{3}\hat{k}$	(p)	$\frac{\pi}{6}$
(B)	If $\int_a^b [f(x) - 9x] dx = -\frac{7}{2}(b^2 - a^2)$ then $f\left(\frac{\pi}{12}\right)$ is	(q)	$\frac{\pi}{3}$
(C)	The value of $\left[ \int_0^1 \cos(\pi x) \cos([2x]\pi) dx \right]^{-1}$	(r)	$\frac{\pi}{2}$
(D)	Max. Arg z if $ z - 2\sqrt{2}  = 2$	(s)	$\frac{\pi}{4}$

SPACE FOR ROUGH WORK

2. Match the statements given in Column-I with the intervals/union of intervals given in Column II

Column I		Column II	
(A)	The set $\left\{ \operatorname{Re} \left( \frac{z}{1-z^2} \right) : z \text{ is a complex number }  z =1, z \neq \pm 1 \right\}$ is	(p)	0
(B)	The domain of the function $f(x) = \cos^{-1} \left[ \frac{2^{x+1}}{1+2^{2x}} \right]$	(q)	$\left[ \frac{1}{6}, \infty \right)$
(C)	If $f(\theta) = \begin{vmatrix} 1 & \cot\theta & 1 \\ -\cot\theta & 1 & \cot\theta \\ -1 & -\cot\theta & 1 \end{vmatrix}$ then the range of $f(\theta)$ is $0 < \theta \leq \frac{\pi}{2}$	(r)	$R$
(D)	If $f(x) = \sqrt{x}(10x-5), x \geq 0$ then $f(x)$ increasing in	(s)	$[2, \infty)$

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End of Mock JEE Advanced-11 | PAPER-2