

Mock Advanced Test-5 Paper-1

TIME : 3 hrs

M.M. : 261

Read the following Instructions very carefully before you proceed.

A. General

1. This booklet is your Question Paper. Do not break the seals of this booklet before being instructed to do so by the invigilators.
2. Blank papers, clipboards, log tables, slide rules, calculators, cameras, cellular phones, pagers, and electronic gadgets are NOT allowed inside the examination hall.
3. **Using a black ball point pen, darken the bubbles on the upper original sheet.** Apply sufficient pressure so that the impression is created on the bottom sheet.
4. DO NOT TAMPER WITH/MUTILATE THE OMR OR THE BOOKLET.

B. Filling the Right Part of the OMR

6. 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.

C. Question Paper Format & Marking Scheme

The question paper consists of **3 Subjects** (Physics, Chemistry and Mathematics). Each subject consists of three sections i.e., Section I, II & III.

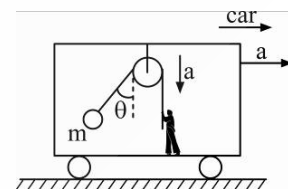
7. **Section I** contains 3 types of questions [**Type 1, Type 2 & Type 3**]
 - **Type 1** contains **5 Multiple Choice Questions**. Each question has four choices (A), (B), (C) and (D) out of which **ONLY ONE CHOICE** is correct.
Marking scheme [3 Marks for Correct answer & -1 NEGATIVE MARKING for wrong]
 - **Type 2** contains **4 Multiple Correct Answer Type Questions**. Each question has 4 choices (A), (B), (C) and (D), out of which **ONE OR MORE CHOICES may be correct**.
Marking scheme [4 Marks for Correct answer & -1 NEGATIVE MARKING for wrong]
 - **Type 3** contains **4 Multiple Choice Questions** relating to two paragraphs with 2 questions on each paragraph. Each question of a particular paragraph has four choices (A), (B), (C) and (D) out of which **ONLY ONE CHOICE is correct**.
Marking scheme [3 Marks for Correct answer & -1 NEGATIVE MARKING for wrong]
8. **Section II** contains **7 Single Integer Value Type Questions**. The answer to each of the questions is a single-digit integer, ranging from 0 to 9 (both inclusive).
Marking scheme [4 Marks for Correct answer & NO NEGATIVE MARKING for wrong]
9. **Section-III** contains **2 Match the following Objective type Questions**. Each question contains statements given in 2 columns. Statements in the column I have to be matched with statements in column II and then option with the appropriate code is to be marked in the answer sheet. **The options for the correct match are provided as (A), (B), (C) and (D) out of which ONE OR MORE CHOICE may be correct**.
Marking scheme [2 Marks for each Correct option & -1 NEGATIVE MARKING for wrong]

SECTION-I/TYPE-1

SINGLE CORRECT ANSWER

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

- The length of a cylinder is measured with the help of a vernier caliper whose smallest division on the main scale is 0.5mm and nine divisions of the main scale are equal to ten divisions of the vernier scale. It is observed that zero of vernier scale lies between 72^{nd} and 73^{rd} division of main scale and sixth division of the vernier scale coincide with a main scale division. Find the length of the cylinder.
 (A) 3.13 cm (B) 3.33 cm (C) 3.63 cm (D) 3.93 cm
- A particle moves with a constant speed u along the curve $y = \sin x$. The magnitude of its acceleration at the point corresponding to $x = \frac{\pi}{2}$ is :
 (A) $\frac{u^2}{2}$ (B) $\frac{u^2}{\sqrt{2}}$ (C) u^2 (D) $\sqrt{2}u^2$
- A bob is hanging over a pulley inside a car through a string. The second end of the string is in the hand of a person standing in the car. The car is moving with constant acceleration a directed horizontally as shown in figure. Other end of the string is pulled with constant acceleration a vertically. The tension in the string is equal to :
 (A) $m\sqrt{g^2 + a^2}$ (B) $m\sqrt{g^2 + a^2} - ma$
 (C) $m\sqrt{g^2 + a^2} + ma$ (D) $m(g + a)$

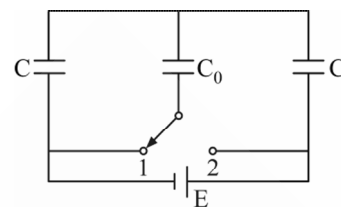


SPACE FOR ROUGH WORK

4. What amount of heat will be generated in the circuit, after the switch is shifted from position 1 to position 2 ?

($C = 2\mu F$, $C_0 = 4\mu F$, $E = 10V$)

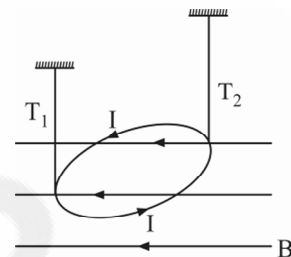
- (A) $25\mu J$
 (B) $50\mu J$
 (C) $100\mu J$
 (D) $75\mu J$



5. A current carrying circular coil having current I of single turn of radius R and mass m is hanging by two identical strings as shown in the figure. A constant magnetic field \vec{B} is setup in the horizontal direction. Then the ratio of tension

(T_1/T_2) in the string will be : [Given $\pi BIR = \frac{mg}{4}$]

- (A) 2 : 1
 (B) 5 : 3
 (C) 4 : 1
 (D) 1 : 2



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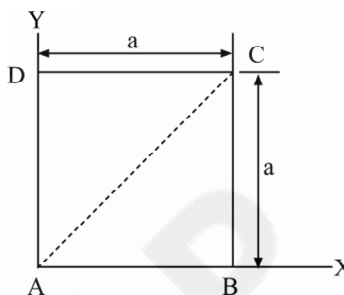
SECTION-I/TYPE-2

MULTIPLE CORRECT ANSWERS

This section contains 4 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct :

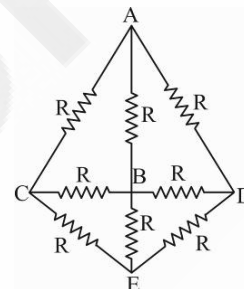
6. A force $\vec{F} = x^2y^2\hat{i} + x^2y^2\hat{j}$ (N) acts on a particle which moves in the XY plane. Choose the correct option(s)

- (A) \vec{F} is a conservative force
 (B) Work done for path ABC is $\frac{a^5}{3}$ (J)
 (C) Work done for path ADC is $\frac{a^5}{3}$ (J)
 (D) Work done for path AC is $\frac{2a^5}{5}$ (J)



7. The adjacent figure shows a resistance network with value of each resistance mentioned. Choose the correct option(s) :

- (A) $R_{CD} = \frac{R}{2}$ (B) $R_{CD} = \left(\frac{2R}{3}\right)$
 (C) $R_{AD} = \left(\frac{8R}{15}\right)$ (D) $R_{AD} = \left(\frac{5R}{9}\right)$

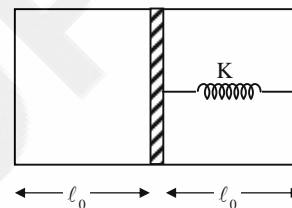


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8. A non-conducting ring of mass m and radius R has a charge Q uniformly distributed over its circumference. The ring is placed on a rough horizontal surface such that the plane of the ring is parallel to the surface. A vertical magnetic field $B = B_0 t^2$ tesla is switched on inside ring. After 2 second from switching on the magnetic field the ring is just about to rotate about vertical axis through its centre. Then :
- (A) the induced electric field is quadratic in time t
 (B) the electric field tangential to the ring induced is $B_0 R t$
 (C) until 2 seconds, the friction force does not come into play
 (D) the friction coefficient between the ring and the surface is $\frac{2B_0 R Q}{mg}$

9. An insulating piston of mass M , cross section area A separate the volume of adiabatic constant inside a horizontal adiabatic cylinder of length $2\ell_0$ in two equal parts. Each chamber contains an ideal gas of adiabatic constant γ and pressure on each side is P . The piston can move without friction and is attached with a spring of spring constant K as shown. Initially the spring is not deformed. The piston is given a small displacement x towards left. Then :

- (A) The pressure in left chamber increases
 (B) The pressure in right chamber decreases
 (C) The piston oscillates with time period $2\pi \sqrt{\frac{M \ell_0}{2P\gamma A + \ell_0 K}}$
 (D) The piston oscillates with time period $2\pi \sqrt{\frac{2M \ell_0}{P\gamma A + \ell_0 K}}$



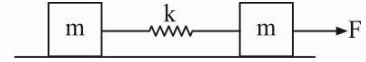
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SECTION-I/TYPE-3
LINK COMPREHENSION TYPE

This section contains 4 multiple choice questions relating to two paragraphs with two questions on each paragraph. Each question has four choices A, B, C and D out of which ONLY ONE choice is correct.

Paragraph for Questions 10 - 11

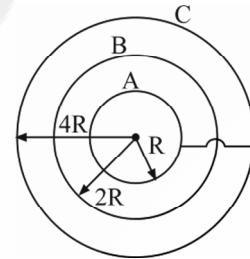
Two blocks of equal mass m are connected by an unstretched spring and the system is kept at rest on a frictionless horizontal surface. A constant force F is applied on the first block pulling it away from the other as shown in figure.



10. The displacement of the centre of mass at time t is:
- (A) $\frac{Ft^2}{2m}$ (B) $\frac{Ft^2}{3m}$ (C) $\frac{Ft^2}{4m}$ (D) $\frac{Ft^2}{m}$
11. If the extension of the spring is x_0 at time t , then the displacement of the first block at this instant is :
- (A) $\frac{1}{2}\left(\frac{Ft^2}{2m} + x_0\right)$ (B) $-\frac{1}{2}\left(\frac{Ft^2}{2m} + x_0\right)$ (C) $\frac{1}{2}\left(\frac{Ft^2}{2m} - x_0\right)$ (D) $\left(\frac{Ft^2}{2m} + x_0\right)$

Paragraph for Questions 12 - 13

There are three concentric spherical conducting shells A, B and C of radii R , $2R$ and $4R$ respectively. A and C is shorted and B is given charge $+Q$



12. Charge on conductor A is :
- (A) $Q/3$ (B) $-Q/3$
(C) $2Q/3$ (D) None of these
13. Potential at B is:
- (A) $\frac{Q}{4\pi\epsilon_0 R}$ (B) $\frac{Q}{16\pi\epsilon_0 R}$ (C) $\frac{5Q}{48\pi\epsilon_0 R}$ (D) None of these

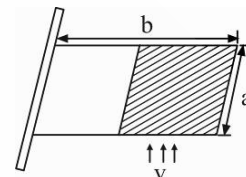
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SECTION - II

SINGLE INTEGER VALUE CORRECT TYPE

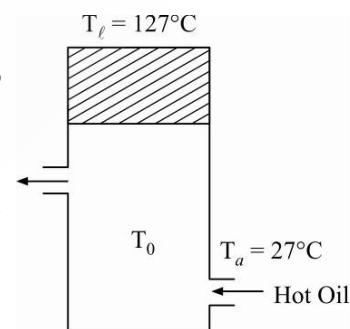
This section contains 7 single Integer Value Correct type Questions. Each question has an integer answer between 0 and 9. Fill the answer bubbles in the OMR Sheet APPROPRIATELY and CAREFULLY.

1. A rectangular plate of mass M and dimension $(a \times b)$ (hinged at left end) is held in horizontal position by striking n small balls (each of mass m) per unit area per second by a velocity v . The balls are striking in the shaded half region of the plate. The collision of the balls with the plate is elastic. What is the value of $(0.1 V)$ in m/s ? (Given $n = 100$, $M = 3 \text{ kg}$, $m = 0.01 \text{ kg}$; $b = 2 \text{ m}$; $a = 1 \text{ m}$; $g = 10 \text{ m/s}^2$.)



2. An artificial satellite is moving in a circular orbit around the earth with a speed equal to half the magnitude of escape velocity from the surface of earth. If the satellite is stopped suddenly in its orbit and allowed to fall freely onto the earth, the speed with which it hits the surface of the earth, is given by $\sqrt{\frac{KGM}{R}}$ where M = mass of earth and R is radius of earth. Find K _____ .
3. A sonometer wire under tension of 64 N vibrating in its fundamental mode is in resonance with a vibrating tuning fork. The vibrating portion of the sonometer wire has a length of 10 cm and a mass of 1 gm . The vibrating tuning fork is now moved away from the vibrating wire with a constant speed and an observer standing near the sonometer hears one beat per second. If the speed with which the tuning fork is moved is v (in m/s) then find $\frac{4v}{3}$ to the nearest integer. (Consider the speed of sound in air is 300 m/s).

4. Hot oil is circulated through an insulated container with a wooden lid at the top whose conductivity $K = 0.149 \text{ J}/(\text{m} \cdot ^\circ\text{C} \cdot \text{sec})$, thickness $t = 5 \text{ mm}$, emissivity = 0.6 . Temperature of the top of the lid is maintained at $T_l = 127^\circ\text{C}$. If the ambient temperature $T_a = 27^\circ\text{C}$, calculate x if the rate of heat loss per unit area (in watt/m^2) due to radiation from the lid is $119x$. (Given $\sigma = \frac{17}{3} \times 10^{-8}$)

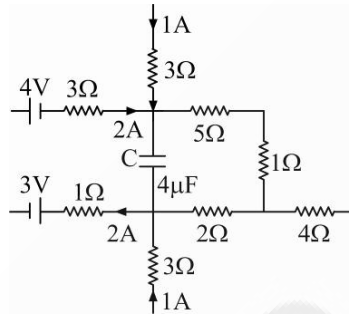


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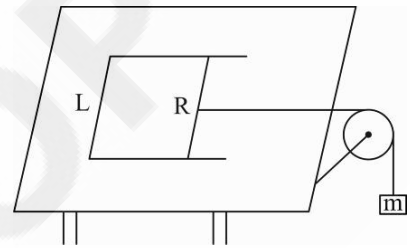
5. The speed of sound in a mixture of $n_1 = 2$ moles of He, $n_2 = 2$ moles of H_2 at temperature $T = \frac{972}{5} K$ is

$100\eta \text{ m/s}$. Find η (Take $R = \frac{25}{3} J/\text{mole-K}$)

6. A part of circuit in steady state along with the current flowing in the branches, the values of resistance etc, is shown in the figure. If the energy (in mJ) stored in the capacitor $C(4\mu F)$ is x . Find $10x$.



7. A pair of parallel horizontal conducting rails of negligible resistance shorted at one end is fixed on a table. The distance between the rail is L . A conducting massless rod of resistance R can slide on the rails frictionlessly. The rod is tied to massless string which passes over a pulley fixed to the edge of the table. A mass m , tied to the other end of the string hangs vertically. A constant magnetic field B exists perpendicular to the table. If the system is released from rest, calculate the acceleration (in m/s^2) of the mass at the instant when the velocity of the rod is half the terminal velocity.



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SECTION - III

MATRIX MATCH TYPE

This section contains 2 questions. Each question contains statements given in two columns which have to be matched. Statements in Column I are labelled as (A), (B), (C) & (D) whereas statements in Column II are labeled as p, q, r, s & t. The answers to these questions have to be appropriately bubbled. More than one choice from Column II can be matched with Column I.

1. Some of the quantities in Column I have the same dimension as quantities in Column II.

Column I		Column II	
(A)	$\frac{ms\ell}{KA}$ <p>m = mass ; s = specific heat capacity ; ℓ = length K = thermal conductivity ; A = area</p>	(p)	$\frac{1}{\sqrt{\mu_0\epsilon_0}}$ <p>μ_0 = permeability of free space ϵ_0 = permittivity of free space</p>
(B)	E/B <p>E = strength of electric field B = strength of magnetic field</p>	(q)	ρgh <p>ρ = density of fluid g = acceleration due to gravity ; h = height of column</p>
(C)	$\frac{1}{2} \epsilon_0 E^2$ <p>E = electric field ϵ_0 = permittivity of free space</p>	(r)	$\sqrt{\frac{GM}{r}}$ <p>G = Newton's gravitation constant M = mass ; r = radius</p>
(D)	$\frac{1}{2} \rho v^2$ <p>ρ = density of fluid ; v = speed of flow</p>	(s)	\sqrt{LC} <p>L = inductance ; C = capacitance.</p>

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2. Using Bohr's model, match the following (where the letters n and Z have usual meaning).

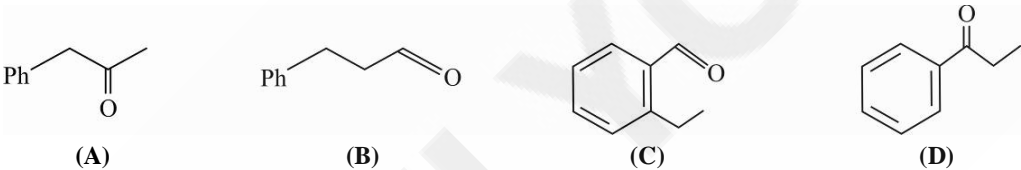
Column I		Column - II	
(A)	Due to revolving electron, the magnetic field produced at its centre is proportional to	(p)	n^{-5}
(B)	Magnetic moment of revolving electron is proportional to	(q)	n
(C)	De-Broglie wavelength of revolving electron is proportional to	(r)	Z^3
(D)	Area velocity of revolving electron about nucleus is proportional to	(s)	Independent of Z
		(t)	Inversely proportional to Z

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SECTION-I/TYPE-1

MULTIPLE CORRECT ANSWERS

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

- At a given instant, there are 25% undecayed radioactive nuclei ($t_{1/2} = 10\text{s}$) in a sample. The time, in which the number of undecayed nuclei will further reduce to 6.25 % of the original number of nuclei, will be :
 (A) 20 s (B) 30 s (C) 40 s (D) 60 s
- Which of the following statement about s-block elements is true?
 (A) Ionization energy increases with increase in atomic number of alkali metals
 (B) Solubility of hydroxides of alkaline earth metals decreases down the group
 (C) Solubility of sulphates of alkaline earth metals increases down the group
 (D) Water of crystallization units in alkaline earth metal salts is more than that in alkali metals salts
- A compound (X) on reaction with $\text{CF}_3\text{CO}_3\text{H}$ gives (Y), an ester. Compound (Y) on hydrolysis gives phenol and propanoic acid. The compound (X) was :

- When an ideal gas is expanded from volume V_1 to V_2 adiabatically, then the correct statement is :
 (A) The entropy change of the universe is more in irreversible expansion than in reversible expansion
 (B) The entropy change of the system in reversible expansion is non-zero
 (C) The magnitude of work involved in irreversible expansion is more than that involved in reversible expansion
 (D) The heat absorbed by the system in reversible expansion is more than that in irreversible expansion
- Which of the following species do not contain two types of bond?
 (A) PCl_5 (B) SF_4 (C) ICl_2^- (D) ClF_3

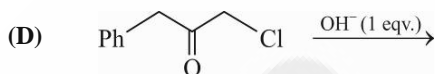
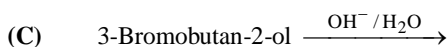
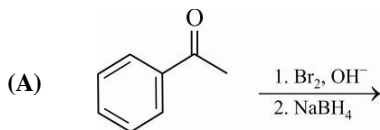
 SPACE FOR ROUGH WORK

SECTION-I/TYPE-1

MULTIPLE CORRECT ANSWERS

This section contains 4 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct :

6. Which of the following reactions yield a product with a three membered ring?



7. On mixing 1 mole of C_6H_6 ($P^\circ = 42 \text{ mm Hg}$) and 2 mole of C_7H_8 ($P^\circ = 36 \text{ mm Hg}$), we can conclude that :

- (A) total vapour pressure of mixture = 38 mm Hg
 (B) mole fraction of vapour of C_6H_6 above liquid mixture is 7/19
 (C) the solution shows positive deviation from Raoult's law
 (D) the solution behaves ideally

8. $\text{R} - \text{C} \equiv \text{CMgX} \xrightarrow{\text{Reagent}} \text{R} - \text{C} \equiv \text{CH}$

Which of the following reagent is(are) suitable reagent(s) to perform the conversion ?

- (A) 2, 4, 6-trinitrophenol (B) Trifluoroacetic acid
 (C) t-butyl chloride (D) Methyl chloride

9. A salt(X) when treated with an alkali, evolves a gas which reduces cupric oxide to metallic copper. The salt(X) may be :

- (A) $(\text{NH}_4)_2\text{CO}_3$ (B) NH_4NO_2 (C) NH_4NO_3 (D) KNO_3

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SECTION-I/TYPE-3

LINK COMPREHENSION TYPE

This section contains 4 multiple choice questions relating to two paragraphs with two questions on each paragraph. Each question has four choices A, B, C and D out of which ONLY ONE choice is correct.

Paragraph for Questions 10 - 11

Characteristic functional groups are tested by specific reagents/tests.

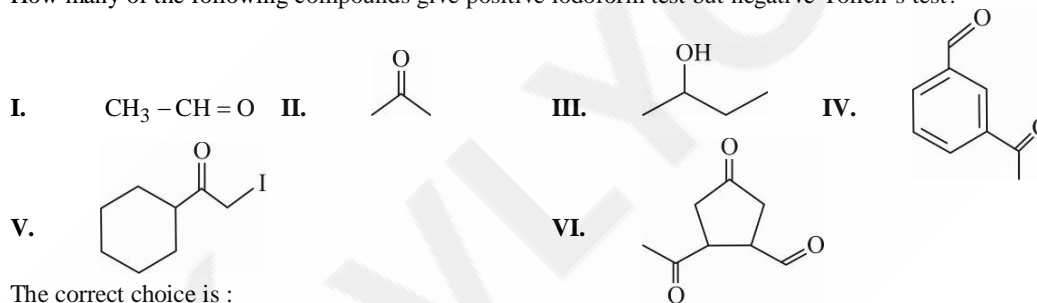
In iodoform test, a compound with $\begin{array}{c} -\text{CH}-\text{CH}_3 \\ | \\ \text{OH} \end{array}$ or $\begin{array}{c} -\text{C}-\text{CH}_3 \\ || \\ \text{O} \end{array}$ structural unit, is reacted with I_2 and alkali to form yellow

hexagonal crystals of CHI_3 (M.P. 119°C).

Tollen's reagent (ammoniacal silver nitrate) can oxidize aldehydes to corresponding carboxylic acid salts and itself reduces to give silver mirror (which deposits on the inner side of the test tube).

Fehling's test [Fehling's solution: Fehling's (A)- CuSO_4 and Fehling's (B)- NaOH + Sodium potassium tartarate] is given by aliphatic aldehyde (not by ketones and aromatic aldehydes) to give red precipitate of Cu_2O along with acid carboxylate.

10. How many of the following compounds give positive iodoform test but negative Tollen's test?



The correct choice is :

- (A) 1, 2, 3 and 5 (B) 2, 3 and 5 (C) 1, 4, 5 and 6 (D) 2, 3, 5 and 6

11. Which of the following is a correct statement?

- (A) $\text{CH}_3\text{COCH}_2\text{CH}_3$ gives Tollen's test
 (B) Glyoxal gives Fehling's test
 (C) Tollen's reagent is a stronger oxidizing agent than Fehling's solution
 (D) PhCHO gives Fehling's test but no Tollen's test

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Paragraph for Questions 12 - 13

Xenon forms three binary fluorides XeF_2 , XeF_4 and XeF_6 . All the three fluorides are colourless crystalline solids sublimating at 295 K. They are powerful fluorinating agents and they are readily hydrolysed by water.

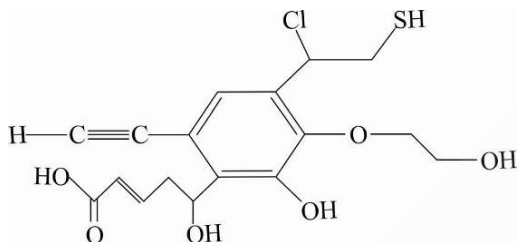
12. XeF_4 exists whereas XeCl_4 is not stable. This is because :
- (A) Electron affinity of Cl is greater than that of F
 - (B) Bond dissociation enthalpy of Cl_2 is greater than that of F_2
 - (C) The size of F is smaller than that of Cl
 - (D) None of these
13. XeO_3 is a colourless explosive solid, prepared by :
- (A) hydrolysis of XeF_2
 - (B) hydrolysis of XeF_4
 - (C) hydrolysis of XeF_6
 - (D) both (B) and (C)

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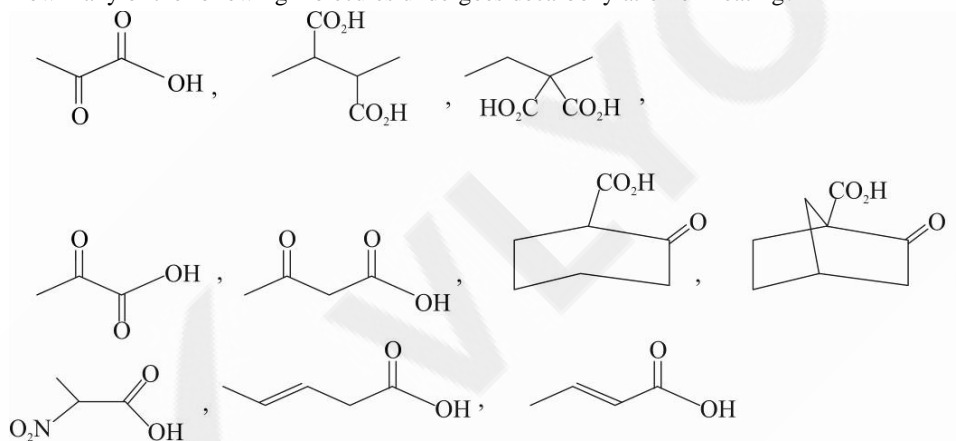
SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

This section contains 7 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. How many moles of H_2 gas will be liberated when 1 mole of the following compound is treated with excess Na?



2. How many milliliters of 0.05 M $K_4[Fe(CN)_6]$ solution are required for titration of 60 ml of 0.01 M $ZnSO_4$ solution, when the product of reaction is $K_2Zn_3[Fe(CN)_6]_2$?
3. How many of the following molecules undergoes decarboxylation on heating?

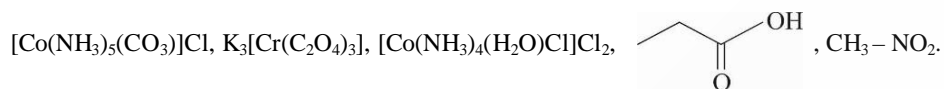


4. The number of effective atoms in diamond type lattice of an element (silicon) is _____.

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5. How many of the following ores are carbonate type? Cuprite, Malachite, Siderite, Bauxite, Zincite, Calamine, Limonite, Azurite, Cerussite, Carnalite, Dolomite.

6. The number of compounds that can show structural isomerism among following, are _____.



7. A compound with molecular formula C₉H₂₄N₄ is converted by the action of acetyl chloride to a compound with molecular mass 314. The number of NH₂ groups in the compound is _____.

SPACE FOR ROUGH WORK

SECTION - III
MATRIX MATCH TYPE

This section contains 2 questions. Each question contains statements given in two columns which have to be matched. Statements in Column I are labelled as (A), (B), (C) & (D) whereas statements in Column II are labeled as p, q, r, s & t. The answers to these questions have to be appropriately bubbled. More than one choice from Column II can be matched with Column I.

1. **MATCH THE COLUMN :**

Column I		Column 2	
(A)	$\text{NO}_2 + \text{H}_2\text{O} \rightarrow$	(p)	One of the products is a reducing agent.
(B)	$\text{PCl}_3 + \text{H}_2\text{O} \rightarrow$	(q)	One of the products is tribasic and reducing
(C)	$\text{HNO}_3 + \text{P}_4\text{O}_{10} \rightarrow$	(r)	Oxidation state of the central atom is +5 in one/both of the products
(D)	$\text{H}_3\text{PO}_3 \xrightarrow{\Delta} \rightarrow$	(s)	Oxidation state of the central atom is +3 in one of the products.

2. **MATCH THE COLUMN :**

Column I		Column 2	
(A)	5 \longrightarrow 1 transition in hydrogen atom	(p)	Spectral line lies in IR region
(B)	7 \longrightarrow 3 transition in hydrogen atom	(q)	Spectral line lies in visible region
(C)	Last line of Balmer series in hydrogen atom	(r)	Spectral line lies in ultra violet region
(D)	4 \longrightarrow 2 transition in He^+ ion	(s)	One spectral line will be observed

SPACE FOR ROUGH WORK

SECTION-I/TYPE-1

SINGLE CORRECT ANSWER

This section contains 5 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONLY ONE Choice is Correct:

1. If $1, \omega_1, \omega_2, \dots, \omega_6$ are 7th roots of unity then $Im(\omega_1 + \omega_2 + \omega_4)$ is equal to :
- (A) $\frac{1}{\sqrt{7}}$ (B) $\frac{\sqrt{7}}{8}$ (C) $\frac{\sqrt{7}}{2}$ (D) None of these
2. $f : [-1, 1] \rightarrow \left[-\frac{1}{2}, \frac{1}{2}\right]$ $f(x) = \frac{x}{1+x^2}$. The area bounded by $y = f^{-1}(x)$, x-axis, $x = \frac{1}{2}$, $x = -\frac{1}{2}$ is :
- (A) $\frac{1}{2} \ln e$ (B) $\ln\left(\frac{e}{2}\right)$ (C) $\frac{1}{2} \ln e$ (D) $\frac{1}{2} \ln\left(\frac{e}{2}\right)$
3. A real valued function $f(x)$ is given as $f(x) = \begin{cases} \int_0^x 2\{x\} dx & x + \{x\} \in 1 \\ x^2 - x + \frac{1}{2} & \frac{1}{2} < x < \frac{3}{2} \text{ and } x \neq 1 \\ x^2 - \frac{x}{3} + \frac{1}{6} & \text{otherwise} \end{cases}$

Where $[.]$ denotes greatest integer less than or equal to x and $\{.\}$ denotes fractional part function of x . Which of the following is true ?

- (A) $f(x)$ is continuous and differentiable in $x \in \left[-\frac{1}{2}, \frac{1}{2}\right]$
- (B) $f(x)$ is continuous and not differentiable in $x \in \left(-\frac{1}{2}, \frac{1}{2}\right)$
- (C) $f(x)$ is continuous and differentiable in $x \in \left[\frac{1}{2}, \frac{3}{2}\right]$
- (D) $f(x)$ is continuous but not differentiable in $x \in (0, 1)$

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4. A doctor is called to see a sick child. The doctor knows (prior to the visit) that 90% of the sick children in that neighborhood are sick with the flu, denoted by F, while 10% are sick with the measles, denoted by M. A well-known symptom of measles is a rash, denoted by R. The probability of having a rash for a child sick with the measles is 0.95. However, occasionally children with the flu also develop a rash, with conditional probability 0.08. Upon examination the child, the doctor finds a rash. Then what is the probability that the child has the measles ?
- (A) $91/165$ (B) $90/163$ (C) $82/161$ (D) $95/167$
5. Let $x^2 + 3y^2 = 3$ be the equation of an ellipse in the x - y plane. A and B are two points whose position vectors are $-\sqrt{3}\hat{i}$ and $-\sqrt{3}\hat{i} + 2\hat{k}$. Then the position vector of a point P on the ellipse such that $\angle APB = \frac{\pi}{4}$ is :
- (A) $\pm\hat{j}$ (B) $\pm(\hat{i} + \hat{j})$ (C) $\pm\hat{i}$ (D) None of these

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SECTION-I/TYPE-2

MULTIPLE CORRECT ANSWERS

This section contains 4 Multiple Choice Questions. Each Question has 4 choices A, B, C & D, out of which ONE or MORE Choices may be Correct :

6. Let $f(x)$ be an increasing function defined on $(0, \infty)$ if $f(2a^2 + a + 1) > f(3a^2 - 4a + 1)$ then possible integers in the range of a is(are) :
 (A) 1 (B) 2 (C) 3 (D) 4
7. If the quadratic equation $ax^2 + bx + c = 0 (a > 0)$ has $\sec^2 \theta$ and $\operatorname{cosec}^2 \theta$ as its roots, then which of the following must hold good ?
 (A) $b + c = 0$ (B) $c^2 - 4ac \geq 0$ (C) $c \geq 4a$ (D) $4a + b > 0$
8. If A and B are two events such that $P(A) = \frac{3}{4}$ and $P(B) = \frac{5}{8}$ then :
 (A) $P(A \cup B) \geq \frac{3}{4}$ (B) $P(A' \cap B) \leq \frac{1}{4}$
 (C) $\frac{3}{8} \leq P(A \cap B) \leq \frac{5}{8}$ (D) $\frac{1}{8} \leq P(A \cap B') \leq \frac{3}{8}$
9. $f(x) = \lim_{n \rightarrow \infty} \frac{x}{x^{2n} + 1}$ then :
 (A) $f(1^+) + f(1^-) = 0$ (B) $f(1^+) + f(1) + f(1^-) = \frac{3}{2}$
 (C) $f(-1^+) + f(-1^-) = -1$ (D) $f(1^+) + f(-1^-) = 0$

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SECTION-I/TYPE-3
LINK COMPREHENSION TYPE

This section contains 4 multiple choice questions relating to two paragraphs with two questions on each paragraph. Each question has four choices A, B, C and D out of which ONLY ONE choice is correct.

Paragraph for Questions 10 - 11

Number of ways of arranging 12 boys and 12 girls are as follows :

a_1 = a line such that boys and girls sit alternatively.

a_2 = around a circular table alternatively.

a_3 = around an equilateral triangular table alternatively and eight on each side.

a_4 = around a square table alternatively and six on each side.

(For a_3 and a_4 on a corner if on one side it's a boy then on the other side it should be a girl to maintain alternation).

Now answer the following questions :

- 10.** Which of the following is true ?
- | | |
|---|---|
| <p>(A) $a_1 > a_2 > a_3 > a_4$</p> <p>(C) $a_1 > a_3 > a_4 > a_2$</p> | <p>(B) $a_4 > a_3 > a_2 > a_1$</p> <p>(D) $a_1 > a_4 > a_3 > a_2$</p> |
|---|---|
- 11.** Which of the following is true if $P(a_r)$ is the probability of arranging boys and girls in their ways explained in the paragraph.
- | | |
|--|--|
| <p>(A) $P(a_1) > P(a_2) > P(a_3) = P(a_4)$</p> <p>(C) $P(a_1) > P(a_3) > P(a_4) > P(a_2)$</p> | <p>(B) $P(a_1) = P(a_2) = P(a_3) = P(a_4)$</p> <p>(D) $P(a_1) > P(a_2) = P(a_3) = P(a_4)$</p> |
|--|--|

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Paragraph for Questions 12 - 13

If a_{ij} is the element of i^{th} row and j^{th} column of a 3×3 matrix A and

- (i) If $(i < j)$ then a_{ij} is number of ways of distributing $(j + 1)$ identical objects to $(i + 1)$ person so that each one may receive none, one or more.
- (ii) If $(i > j)$ then a_{ij} is the number of ways of distributing $(i + 1)$ distinct objects to $(j + 1)$ persons so that each one may receive any number of objects.
- (iii) If $i = j$ then $a_{ij} = \max[i^{j+1}, (i + 1)^j]$ then.

12. The value of $\left| \frac{\det(\text{adj } A)}{12 \det(A)} \right|$ is :

- (A) 2 (B) 4 (C) 6 (D) 7

13. Two planes are :

$$P_1 : a_{11}x + a_{12}y + a_{13}z = 11$$

$$P_2 : a_{21}x + a_{22}y + a_{23}z = 28$$

The unit vector in the direction of the line of intersection of P_1 and P_2 is :

- (A) $\frac{15\hat{i} + 10\hat{j} + 14\hat{k}}{\sqrt{521}}$ (B) $\frac{15\hat{i} + 10\hat{j} - 14\hat{k}}{\sqrt{521}}$ (C) $\frac{-15\hat{i} + 10\hat{j} - 14\hat{k}}{\sqrt{521}}$ (D) None of these

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SECTION - II
SINGLE INTEGER VALUE CORRECT TYPE

This section contains 7 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. If the area bounded by $y = f(x)$, $x = \frac{1}{2}$, $x = \frac{\sqrt{3}}{2}$ and the X-axis is A sq. unit where

$$f(x) = x + \frac{2}{3}x^3 + \frac{2}{3} \cdot \frac{4}{5}x^5 + \frac{2}{3} \cdot \frac{4}{5} \cdot \frac{6}{7}x^7 + \dots, |x| < 1; \text{ then the value of } [4A] \text{ is } \dots. \text{ (where } [.] \text{ is G.I.F.)}$$

2. If a point P denoting the complex number z moves on the complex plane such that, $|Re z| + |Im z| = 1$ then area bound by locus of z is _____.

3. Let $A_1 = \int_n^{n+1} (\min\{|x-n|, |x-(n+1)|\}) dx$, $A_2 = \int_{n+1}^{n+2} (|x-n| - |x-(n+1)|) dx$,

$$A_3 = \int_{n+2}^{n+3} |x-(n+4)| - |x-(n+3)| dx$$

Then the value of $[A_1 + A_2 + A_3]$ is _____. [where $[.]$ denotes the greatest integer function]

4. Let $y(x)$ be a function satisfying $\frac{d^2y}{dx^2} - \frac{dy}{dx} + e^{2x} = 0$, $y(0) = 2$ and $y'(0) = 1$. If maximum value of $y(x)$ is $y(\alpha)$, then integral part of 2α is _____.

5. All the face cards are removed from a pack of 52 cards. From the remaining cards half of the cards are removed without looking at them. Now if the probability of 2 cards being ace drawn from remaining half of cards without replacement is $\frac{\alpha \cdot {}^\beta C_{20}}{{}^\gamma C_{20} \cdot {}^{20}C_\delta}$, then unit digit of $\beta^\alpha + \delta^\gamma$ is _____.

6. Let \vec{r} be a vector in the plane of $\hat{i} - 2\hat{j} + \hat{k}$ and $\hat{i} - \hat{j} - \hat{k}$ such that $\vec{r} \cdot (\hat{i} + \hat{j}) + 2 = 0$ and maximum length of projection of \vec{r} on $\hat{i} - \hat{j}$ is $8\sqrt{2}$, then the maximum value of $\left[\left(\vec{r} \cdot (\vec{r} + 3\hat{i} + 2\hat{j} + \hat{k}) \right)^{1/3} \right]$ (where $[.]$ denotes greatest integer function) is _____.

7. If $K = \sum_{n=1}^{\infty} \frac{6^n}{(3^n - 2^n)(3^{n+1} - 2^{n+1})}$, then last digit of $(K + 6)^{((k+6)!)}$.

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SECTION - III
MATRIX MATCH TYPE

This section contains 2 questions. Each question contains statements given in two columns which have to be matched. Statements in Column I are labelled as (A), (B), (C) & (D) whereas statements in Column II are labeled as p, q, r, s & t. The answers to these questions have to be appropriately bubbled. More than one choice from Column II can be matched with Column I.

1. MATCH THE FOLLOWING LISTS :

	Column I		Column II
(A)	The sum of abscissa and ordinate of the point on the parabola $y = x^2 + 7x + 2$ which is nearest to the straight line $y = 3x - 3$ is equal to	(p)	1
(B)	If a circle is drawn with variable chord $x + ay - 5 = 0$ ('a' being a parameter) of the parabola $y^2 = 20x$ as diameter, then it always touches the line $x + k = 0$, where k is equal to	(q)	-10
(C)	The foot of perpendicular from a point P on the parabola to its directrix is M . If R is the mid-point of SM ($S \equiv$ focus), then the angle between PR and SM is equal to $\frac{\pi k}{2}$, where k is equal to	(r)	5
(D)	If the normals at the end points of a variable chord AB of the parabola $y^2 - 4y - 2x = 0$ are perpendicular, then the tangents at A and B will intersect at the line $2x + k = 0$, where k is equal to	(s)	-5

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2. MATCH THE FOLLOWING LISTS :

	Column I		Column II
(A)	If exactly two real common tangents can be drawn to the circles $x^2 + y^2 - 2x - 2y = 0$ and $x^2 + y^2 - 8x - 8y + 6\lambda = 0$ for $\lambda \in Z$ then the greatest possible value of λ equals	(p)	2
(B)	$\int_{-2\pi}^{2\pi} \{ \sin x + \cos x \} dx$ equals	(q)	3
(C)	The slope of a curve at (x, y) is $-\frac{x+y}{x}$ and it passes through the points $\left(3, -\frac{1}{6}\right)$ and $(\lambda, 1)$ then one of the values of λ is	(r)	1
(D)	$(\lambda, 6, 2)$ is a point on the plane passing through the line $\frac{x+1}{2} = \frac{y-1}{-1} = \frac{z+3}{1}$ and parallel to the line of intersection of the planes $x - y - 5z = 6$ and $3x + 5y + 3z = 4$. Then λ is	(s)	16

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End of Mock JEE Advanced-5/PAPER-1