VMC Vidyamandir Classes SINCE 1986
IIT JEE | MEDICAL | FOUNDATION

CODE A

JEE Advanced Revision Test-1 | Paper – 1 | JEE 2024

Date: 15/02/2024 **Maximum Marks: 180**

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

General Instructions

1. The question paper consists of 3 Subjects (Subject I: **Physics**, Subject II: **Chemistry**, Subject III: **Mathematics**). Each subject 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. 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.**

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.

Syllabus: Complete Class XII Syllabus

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**.
- **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 : PHYSICS 60 MARKS

SECTION-1

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 parallel plate capacitor of capacitance C has vacuum between its plates (area A), whose separation is d. A dielectric slab of dielectric constant K, cross-section area equal to that of the plates, and thickness $\frac{d}{2}$ is inserted between the plates and then the capacitor is charged to a potential difference V_0. Now, the voltage source is disconnected from the capacitor plates and the dielectric slab is removed from the capacitor. Let the work done in removing the slab be W and let the potential difference across the capacitor plates after the removal of the slab be V. Which of these options is/are correct?

(A) $W = \frac{5}{9}CV_0^2$ if $K = 5$ **(B)** $W = \frac{18}{25}CV_0^2$ if $K = 9$

(C) $V = \frac{5}{3}V_0$ if $K = 5$ **(D)** $V = \frac{9}{4}V_0$ if $K = 9$

2. Two cylindrical conductors A and B, made of the same material, but of length L and $2L$, and diameter d and $\frac{d}{2}$, are connected in parallel across a battery. The drift speed of charge carriers inside the conductors is v_A and v_B respectively, and the rate of heat dissipation in the conductors is H_A and H_B respectively. Which of these options is/are correct?

(A) $\frac{v_A}{v_B} = \frac{1}{2}$ **(B)** $\frac{v_A}{v_B} = 2$ **(C)** $\frac{H_A}{H_B} = 4$ **(D)** $\frac{H_A}{H_B} = 8$

SPACE FOR ROUGH WORK

3. A spherical volume of radius R centred at the origin is filled with charge of uniform density ρ except for a spherical cavity of radius $r\left(<\frac{R}{2}\right)$ centred at the point $\left(0,0,\frac{R}{2}\right)$. Let the points A and B have the coordinates $(0,0,R)$ and $(0,0,-R)$ respectively. Let the electric field at A and B be denoted by $\vec{E}_A$ and $\vec{E}_B$ respectively, and let the potential at A and B be denoted by V_A and V_B respectively. Which of these options is/are correct?

(A) $\vec{E}_A=\frac{\rho R}{3\varepsilon_0}\left(1-\frac{8r^3}{R^3}\right)\left(\hat{k}\right)$

(B) $\vec{E}_B=\frac{\rho R}{3\varepsilon_0}\left(1-\frac{4r^3}{9R^3}\right)\left(-\hat{k}\right)$

(C) $V_A=\frac{\rho R^2}{3\varepsilon_0}\left(1-\frac{2r^3}{R^3}\right)$

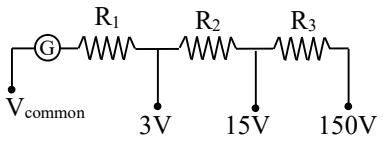
(D) $V_B=\frac{\rho R^2}{3\varepsilon_0}\left(1-\frac{4r^3}{3R^3}\right)$

SPACE FOR ROUGH WORK

SECTION-2

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 voltmeter of variable ranges $3V$, $15V$, $150V$ is to be designed by connecting resistances R_1, R_2, R_3 in series with a galvanometer of resistance $G = 20\,\Omega$, as shown in figure. The galvanometer gives full scale deflection for 1 mA current through its coil. Then, the resistances R_1, R_2 and R_3 (in kilo ohms) should be, respectively:



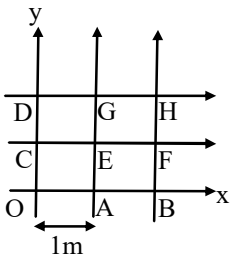
(A) 3, 12, 135

(B) 2.98, 12, 135

(C) 2.98, 14.98, 149.98

(D) 3, 15, 150

5. The grid (each square of 1m × 1m), represents a region in space containing a uniform electric field. If potentials at point O, A, B, C, D, E, F, G, H are respectively 0, –1, –2, 1, 2, 0, –1, 1 and 0 volts. find the electric field intensity.

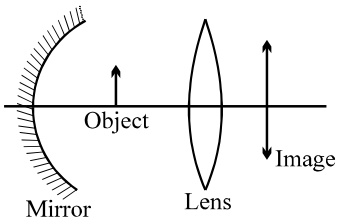


(A) $(\hat{i}+\hat{j})V/m$ **(B)** $(\hat{i}-\hat{j})V/m$

(C) $(-\hat{i}+\hat{j})V/m$ **(D)** $(-\hat{i}-\hat{j})V/m$

SPACE FOR ROUGH WORK

6. A mirror-lens combination forms two real images of an object, of same size and at same location. One image is upright and the other is inverted. Both images are 1.5 times longer than the object. The lens has a focal length of 10 cm. The lens and the mirror are separated by 40.0 cm. The focal length of the mirror is :



(A) $\frac{70}{3}$ cm **(B)** $\frac{70}{6}$ cm **(C)** $\frac{105}{6}$ cm **(D)** $\frac{105}{3}$ cm

7. Imagine an atom made of a nucleus of charge (Ze) and a hypothetical particle of same mass but double the charge of the electron. Apply the Bohr atom model and consider all possible transitions of this hypothetical particle to the ground state. The longest wavelength of photon that will be emitted has wavelength λ. (Given in terms of Rydberg constant R) equal to :

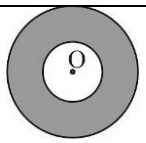
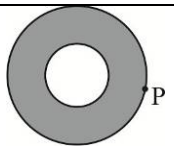
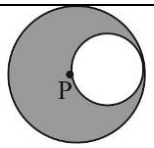
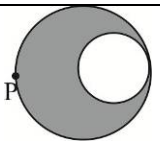
(A) $\frac{1}{4Z^2R}$ **(B)** $\frac{1}{3Z^2R}$ **(C)** $\frac{4}{3Z^2R}$ **(D)** $\frac{4}{Z^2R}$

SPACE FOR ROUGH WORK

SECTION-3

Section 3 contains **4** Matching List sets. Each set has **TWO** lists: **List I** and **List II**. **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. List I contains four possibilities after removing an infinite cylinder of radius $R/2$ from an infinite cylinder of radius R and carrying current I of uniform density $\left(I = j\pi R^2\right)$. List II contains the magnitude of magnetic field at the centre (O) or a point at the perimeter (P) due to systems in List I. Select the correct answer using the codes given below the list:

List-I			List-II	
(P)	Axis of cavity lies on the axis of cylinder. The magnetic field on the axis of cylinder (B_0) is		**(1)**	Zero
(Q)	Axis of cavity lies on the axis of cylinder. The magnetic field on the surface of cylinder (B_P) is		**(2)**	$\frac{\mu_0 I}{4\pi R}$
(R)	Cavity's axis is R/2 away from the original cylinder's axis. The magnetic field on the axis of cylinder (B_0) is		**(3)**	$\frac{3\mu_0 I}{8\pi R}$
(S)	Cavity's axis is R/2 away from the original cylinder's axis. The magnetic field on the surface of cylinder at P as shown.		**(4)**	$\frac{5\mu_0 I}{12\pi R}$

(A) P-1; Q-3; R-4; S-2 **(B)** P-1; Q-3; R-2; S-4

(C) P-3; Q-1; R-2; S-4 **(D)** P-1; Q-2; R-3; S-3

SPACE FOR ROUGH WORK

9. List I gives certain situations in which a straight metallic wire of resistance R is used and List II gives some resulting effects.

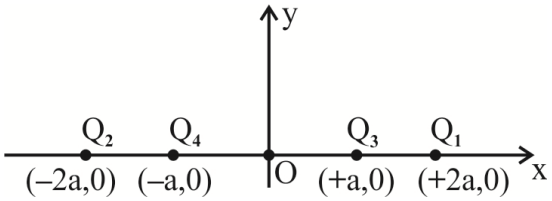
List-I		List-II	
(P)	A charged capacitor is connected to the ends of the wire	**(1)**	A constant current flows through the wire
(Q)	The wire is moved perpendicular to its length with a constant velocity in a uniform magnetic field perpendicular to the plane of motion	**(2)**	Thermal energy is generated in the wire
(R)	The wire is placed in a constant electric field that has a direction along the length of the wire	**(3)**	A constant potential difference develops between the ends of the wire
(S)	A battery of constant emf is connected to the ends of the wire	**(4)**	Charges of constant magnitude appear at the ends of the wire

(A) P-2; Q-1,2; R-4; S-2,3 **(B)** P-1,3; Q-1,2,3; R-3; S-1,2,4

(C) P-2; Q-2,3,4; R-2,4; S-1,2,3 **(D)** P-1; Q- 2,3,4; R-4; S-3

SPACE FOR ROUGH WORK

10. The electric field E and electric potential V are measured due to some charge distribution at point P $(0,d,0)$ as shown in figure.



The four charges Q_1, Q_2, Q_3 and Q_4 are of equal magnitude. List-I describes the nature of charges Q_1, Q_2, Q_3 and Q_4 and List-II contains the corresponding electric field and electric potential. Match the charge distribution in List-I with the corresponding values of E and V in List-II

List - I		**List - II**	
P	Q_1, Q_2 are +ve and Q_3, Q_4 are –ve	**1**	E is along +y-axis; $V > 0$
Q	Q_1, Q_2 are –ve and Q_3, Q_4 are –ve	**2**	E is along –x-axis; $V = 0$
R	Q_1, Q_3 are +ve and Q_2, Q_4 are –ve	**3**	E is along +x-axis; $V = 0$
S	Q_1, Q_3 are –ve and Q_2, Q_4 are +ve	**4**	E is along –y-axis; $V < 0$

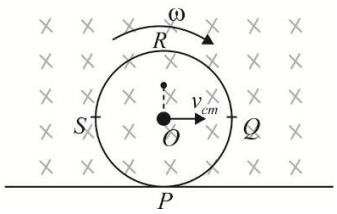
(A) P-4; Q-2; R-1; S-3 **(B)** P-4; Q-1; R-2; S-3

(C) P-1; Q-4; R-3; S-2 **(D)** P-1; Q-2; R-3; S-4

SPACE FOR ROUGH WORK

11. A conducting disc of radius R is rotating as well as translating on a smooth horizontal surface, where a uniform magnetic field B is present. Velocity of centre of mass is given as $v = 2R\omega,$ where ω is the angular velocity of the ring. Match the following cases.

Motional emf across



List-I		List-II	
(P)	*PR*	**(1)**	$5BRv/4$
(Q)	*PS*	**(2)**	BRv
(R)	*PO*	**(3)**	$2BRv$
(S)	*RO*	**(4)**	$3BRv/4$

(A) P-2; Q-4; R-3; S-1 **(B)** P-3; Q-2; R-4; S-1

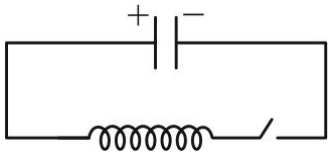
(C) P-4; Q-3; R-2; S-1 **(D)** P-4; Q-1; R-2; S-3

SPACE FOR ROUGH WORK

SECTION-4

This section consists of 6 NON-NEGATIVE INTEGER Type Questions. The answer to each question is a NON-NEGATIVE INTEGER.

1. A capacitor of capacitance $10\ \mu F$ is charged to a potential difference 60V and connected to a coil of inductance 4 mH as shown. The resistance in the circuit is negligible. After the switch is closed, the maximum current (in Amperes) in the circuit is _____.



2. A plane electromagnetic wave propagates in vacuum. The amplitude of the magnetic field of the wave is $5\times10^{-7}\ T$. The intensity (in W/m^2) of the wave is _____.

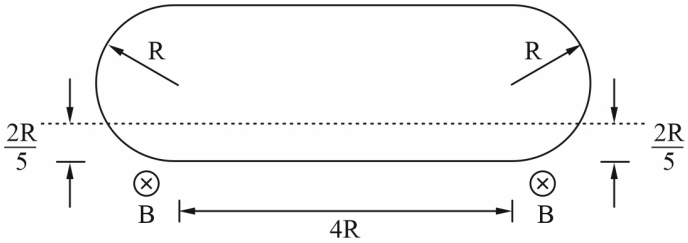
(Permeability of vacuum, $\mu_0 = 1.25\times10^{-6}\ m\ kg\ s^{-2}\ A^{-2}$)

(Speed of light in vacuum, $c = 3\times10^{8}\ m/s$)

3. A series LCR combination with $C = 20\ \mu F$ and $R = 80\ \Omega$ is connected across an AC voltage source of angular frequency 500 rad/s. The value of the inductance (in mH) that must be chosen so that the current in the circuit leads the voltage by phase $\frac{\pi}{4}$ is _____.

SPACE FOR ROUGH WORK

4. A conducting loop consisting of two parallel sides of length $4R$ each and two semi-circular ends of radius R each is fixed. There exists a uniform magnetic field of magnitude B directed normally into the plane of the loop ONLY in the region below the dotted line parallel to the lower side of the loop as shown. If a steady current I is set up in the loop, the magnetic force it experiences is $\frac{n}{5}(BIR)$, where n is _____.



5. A total charge $10^{-3}\ C$ is distributed uniformly over the bottom one-third of the length of a thin insulating rod of mass 1 kg. The rod is pivoted at its top end such that it can rotate freely in the vertical plane. A horizontally directed uniform electric field of magnitude $1200\ V/m$ is introduced. The rod makes an angle θ with the vertical in equilibrium. The value of $\tan\theta$ is $\frac{n}{10}$, where n is_____. $(g = 10\ \text{m/s}^2)$

6. Suppose we have an unlimited number of identical bulbs. Each bulb consumes power 4 W if a potential difference 40 V is applied across it. We also have a battery of emf 60 V and internal resistance $8\ \Omega$. The minimum number of bulbs that must be connected in parallel across this battery such that each bulb consumes power less than 4 W is _____.

SPACE FOR ROUGH WORK

SUBJECT II : CHEMISTRY 60 MARKS

SECTION-1

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 ether(s) cannot be prepared by direct Willamson's synthesis in good yield?

(A) $CH_3CH_2CH_2 - O - CH_2CH_2CH_3$ **(B)** $Ph - O - CH_2CH_3$

(C) $(CH_3)_3C - O - C(CH_3)_3$ **(D)** $CH_3CH = CH - O - CH = CH_2$

2. Lucas test of alcohols involves following reaction:

$$R - OH + \underset{\text{conc.}}{HCl} \xrightarrow[ZnCl_2]{\text{anhydrous}} \underset{\substack{\text{White}\\ \text{turbidity}}}{RCl} + H_2O$$

Select the correct statement(s) for the Lucas test.

(A) ROH behaves as a base.

(B) Lesser is the acidic character of alcohol, greater is its reactivity towards Lucas reagent.

(C) Reactivity of 1°, 2°, 3° alcohol, lies in the following sequence (for Lucas reaction) 3°>2°>1°.

(D) CH_3OH gives Lucas test most quickly.

3. Which of the following will give yellow precipitate with excess $NaOH / I_2$?

(A) $Ph - \underset{\displaystyle OH}{\underset{|}{CH}} - Me$ **(B)** $CI_3 - CHO$

(C) $Me - \overset{\displaystyle O}{\overset{\|}{C}} - \overset{\displaystyle O}{\overset{\|}{C}} - OH$ **(D)** EtOH

SPACE FOR ROUGH WORK

SECTION-2

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 0.12 g sample of a saturated monohydric alcohol when added to methyl magnesium iodide, liberates 44.48 ml of colourless gas at STP. The alcohol also gives yellow precipitate with I_2 and alkali. The possible structural formula of the alcohol is:

(A) CH_3CH_2OH **(B)** $CH_3CH(OH)CH_3$

(C) $CH_3CH(OH)C_2H_5$ **(D)** $CH_3CH_2CH_2OH$

5. Which of the following is INCORRECT for 3D crystal systems?

(A) Cubic system: a = b = c, $\alpha = \beta = \gamma = 90°$

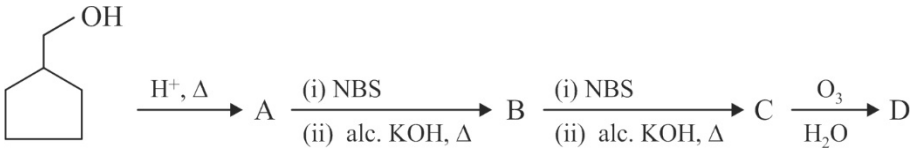
(B) Tetragonal system: a = b $\neq$ c, $\alpha = \beta = \gamma = 90°$

(C) Rhombic system: a $\neq$ b $\neq$ c, $\alpha = \beta = \gamma \neq 90°$

(D) Monoclinic system: a $\neq$ b $\neq$ c, $\alpha = \beta = 90° \neq \gamma$

SPACE FOR ROUGH WORK

6. Consider the following sequence of reactions.



Choose the INCORRECT option:

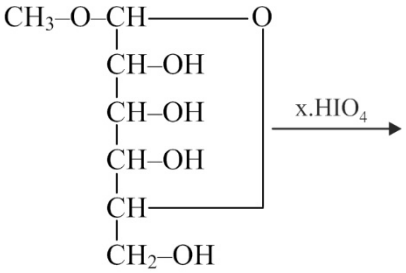
(A) D is dibasic acid

(B) C can undergo electrophilic substitution reaction

(C) D can be oxidised using $KMnO_4 / H^+$ on heating

(D) Double bond equivalence of B is 2

7. What is the value of x in the following reaction?



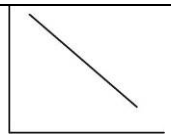
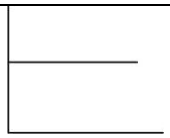
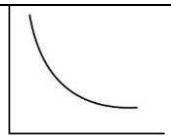
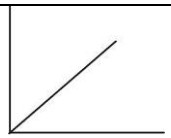
(A) 1 **(B)** 2 **(C)** 3 **(D)** 4

SPACE FOR ROUGH WORK

SECTION-3

Section 3 contains **4** Matching List sets. Each set has **TWO** lists: **List I** and **List II**. **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. Match the following List:

List-I (Graphs for reaction : A $\rightarrow$ Products)		**List-II (Co-ordinates, y-axis vs x-axis)**	
I.		**P.**	ln[A] vs t (order = 1)
II.		**Q.**	$t_{1/2}$ vs $[A_0]$ (order =1)
III.		**R.**	r vs t (order = 0)
IV.		**S.**	$t_{1/2}$ vs $[A_0]$ (order > 1)
		T.	r vs [A] (order = 1)

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

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

SPACE FOR ROUGH WORK

9. Match the compound in List I with the observation in List II and choose the correct option :

List-I		List-II	
I.	o-Nitrophenol	**P.**	Neutral $FeCl_3$ test
II.	p-Aminobenzaldehyde	**Q.**	Silver mirror test
III.	Methyl orange	**R.**	Sodium fusion extract of the compound on boiling with $FeSO_4$ followed by acidification with conc. H_2SO_4 gives Prussian blue colour
IV.	$CO + NaOH \xrightarrow[(ii)\ H^+]{(i)\ 473K,10atm} X$ 'X' gives	**S.**	Sodium fusion extract of the compound on treatment with Fe^{3+} ions give blood red colour
		T.	Sodium fusion extract of the compound gives violet colour on treatment with $Na_2[Fe(CN)_5NO]$

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

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

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10. Match the complexes given in list -I and the characteristic(s) given in list -II

List-I (Complexes)		List-II (Characteristics)	
(A)	$\left[Ni(CO)_4\right]$	**(p)**	Tetrahedral
(B)	$\left[Fe(NO)_2(CO)_2\right]$	**(q)**	π back bonding
(C)	$\left[Ni(PF_3)_4\right]$	**(r)**	Diamagnetic
(D)	$\left[PtCl_3(C_2H_4)\right]^-$	**(s)**	One of the ligand is three electron donor

(A) A-p,q,r; B-p,q,r,s; C-p,q,r; D-q,r **(B)** A-s,q,r; B-p,q,r; C-p,q,r; D-q,r

(C) A-p,q,r; B-p,q,r,s; C-p,q,r,s; D-q,r **(D)** A-p,q,r,s; B-p,q,r,s; C-p,q,r; D-q,r

11. Match the list I with list II and mark the correct option from the codes given below.

List-I (Organic Compounds)		List-II (Characteristics)	
(A)	Pentanal	**(p)**	Treatment with H_2 / Ni gives achiral alcohol
(B)	3-pentanone	**(q)**	Treatment with butyl magnesium bromide followed by hydrolysis gives achiral alcohol
(C)	Pent-1-en-3-ol	**(r)**	Treatment with methyl magnesium bromide followed by hydrolysis gives chiral alcohols
(D)	2-pentanone	**(s)**	Treatment with ethyl magnesium bromide followed by hydrolysis gives chiral alcohols

(A) A-p,q,r,s; B-p,q; C-p,r,s; D-s **(B)** A-p,q; B-r; C-s; D-q

(C) A-p,r; B-q; C-p,s; D-q **(D)** A-q,r; B-p; C-q; D-r

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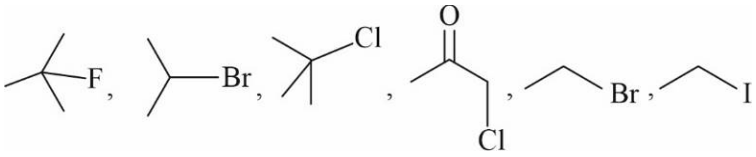
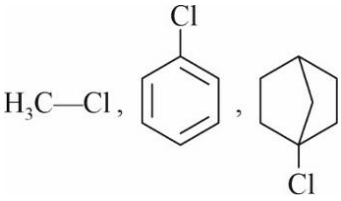
SECTION-4

This section consists of 6 NON-NEGATIVE INTEGER Type Questions. The answer to each question is a NON-NEGATIVE INTEGER.

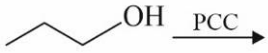
1. Number of compound which are more reactive than $H_3C-\underset{\underset{CH_3}{|}}{CH}-Cl$ by S_N2 mechanism?

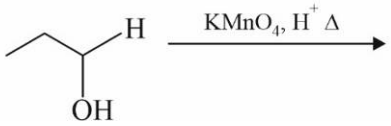




2. Consider following reactions.

(I) $CH_2=CH_2 \xrightarrow{HBr} \xrightarrow{KCN} \xrightarrow{H^+/H_2O}$ (II) $H_2C=CH_2 \xrightarrow[H_2O_2]{HBr} \xrightarrow[(ii)\ CO_2\ (iii)\ H^+]{(i)\ Mg/ether}$

(III) $H_3C-\underset{\underset{O}{\|}}{C}-CH_3 \xrightarrow[(ii)\ H^+]{(i)\ NaOH + I_2}$ (IV) 

(V) 

Number of reactions which can produce propanoic acid as major product are

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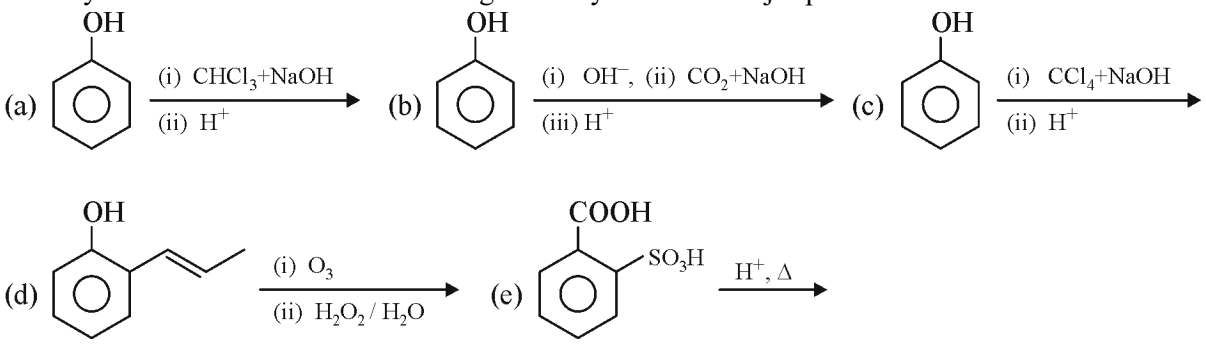
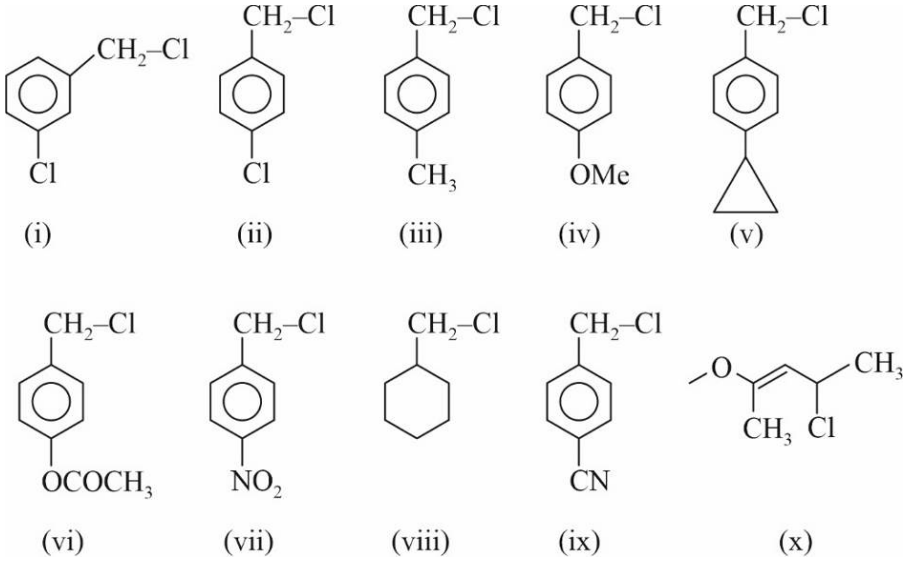
3. Total number of moles of P–H bond(s) in product(s) when one mole of white phosphorus completely reacts with NaOH solution:

4. Identify number of reactions that would give salicylic acid as major product



5. How many of the following undergo solvolysis reaction faster than benzyl chloride?



6. Find the sum of the total number of P = O and P – O – P linkages in $H_4P_2O_7$, $H_4P_2O_6$ and Cyclic trimer of HPO_3 _____.

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SUBJECT III: MATHEMATICS 60 MARKS

SECTION-1

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 $f(x)=\begin{cases} x+a, & x<0 \\ |x-1|, & x\geq 0 \end{cases}$ and $g(x)=\begin{cases} x+1, & x<0 \\ (x-1)^2+b, & x\geq 0 \end{cases}$

where a and b are non negative numbers. If $gof(x)$ is continuous for all real x, where $gof(x)$ denote $g(f(x))$, then which of the following is(are) true ?

(A) For $x\in(-1,1)$ $gof(x)$ is even function **(B)** $gof(x)$ differentiable at $x=2$

(C) $gof(x)$ is differentiable at $x=-1$ **(D)** $(gof)'(5)=6$

2. If $\lim\limits_{x\to\infty}\dfrac{a(2x^3-x^2)+b(x^3+5x^2-1)-c(3x^3+x^2)}{a(5x^4-x)-bx^4+c(4x^4+1)+2x^2+5x}=1$, then which of the following is/are correct?

(A) Value of a is $\dfrac{2}{109}$ **(B)** Value of b is $\dfrac{46}{109}$

(C) Value of c is $\dfrac{14}{109}$ **(D)** All real values of a, b, c are possible

3. Consider the function $f(x)=e^{\left(\sin^{-1}x+\frac{\cos^{-1}x}{4}\right)}$. Which of the following is/are correct?

(A) Maximum value of $f(x)$ is $e^{\pi/2}$ **(B)** Maximum value of $f(x)$ is $e^{\pi/4}$

(C) Minimum value of $f(x)$ is $e^{-\pi/2}$ **(D)** Minimum value of $f(x)$ is $e^{-\pi/4}$

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SECTION-2

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. If $f(x) = |1 - x|$, then the points where $sin^{-1}(f|x|)$ is non-differentiable are :

(A) $\{0, 1\}$ **(B)** $\{0, -1\}$ **(C)** $\{0, 1, -1\}$ **(D)** None of these

5. If m is the slope of a line which is tangent to $y^3 = x^4$ and a normal to $x^2 - 2x + y^2 = 0$, then $\left(\frac{3m}{4}\right)^3$ is equal to: $(m \neq 0)$

(A) 3 **(B)** $\frac{4}{3}$ **(C)** 4 **(D)** $\frac{3}{4}$

6. If $\lim\limits_{x\to 1} \frac{a\sin(x-1) + b\cos(x-1) + 4}{x^2 - 1} = -2$, then (a, b) is equal to :

(A) $(2, -4)$ **(B)** $(-4, -4)$ **(C)** $(-4, 2)$ **(D)** $(4, -4)$

7. If the equation $x^3 + px^2 + qx + 1 = 0, (p < q)$ has only one real root x_0,

then value of $2\tan^{-1}(\text{cosec}\, x_0) + \tan^{-1}(2\sin x_0 \sec^2 x_0)$ is :

(A) $-\pi$ **(B)** π **(C)** $\frac{\pi}{2}$ **(D)** 0

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SECTION-3

Section 3 contains **4** Matching List sets. Each set has **TWO** lists: **List I** and **List II**. **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. If A and B are two independent events, such that $P(A)=\frac{1}{3}$ & $P(B)=\frac{1}{4}$.

List-I		List-II	
I.	If $P\left(\frac{A}{B}\right)=\lambda_1$, then $12\lambda_1$ is	**P.**	A prime number
II.	If $P\left(\frac{A}{A\cup B}\right)=\lambda_2$, then $9\lambda_2$ is	**Q.**	A composite number
III.	If $P[(A\cap\overline{B})\cup(\overline{A}\cap B)]=\lambda_3$ then $12\lambda_3$ is	**R.**	A natural number
IV.	If $P(\overline{A}\cup B)=\lambda_4$, then $12\lambda_4$ is	**S.**	A perfect number

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

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

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9. Let $f(x)$ denotes the determinant $f(x)=\begin{vmatrix} x^2 & 2x & 1+x^2 \\ x^2+1 & x+1 & 1 \\ x & -1 & x-1 \end{vmatrix}$. On expansion $f(x)$ is seen to be a 4^{th} degree polynomial given by $f(x)=a_0x^4+a_1x^3+a_2x^2+a_3x+a_4$. Using differentiation of determinant or otherwise match the entries in list I with one or more entries of the elements of list II.

List-I		**List-II**	
I.	$a_0^2+a_1$ is divisible by	**P.**	2
II.	$a_2^2+a_4$ is divisible by	**Q.**	3
III.	$a_0^2+a_2$ is divisible by	**R.**	4
IV.	$a_4^2+a_3^2+a_1^2$ is divisible by	**S.**	5

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

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

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10. Let $f(x)=\sin^{-1}(2x-1)+\cos^{-1}\left(2\sqrt{x-x^2}\right)+\tan^{-1}\left(\frac{1}{1+\lfloor x^2\rfloor}\right)$ where [k] denotes greatest integer less than or equal to k.

List-I		List-II	
(A)	$f\left(\frac{1}{6}\right)$ is equal to	**(p)**	$\frac{\pi}{6}$
(B)	$f\left(\frac{3}{4}\right)$ is equal to	**(q)**	$\frac{\pi}{4}$
(C)	$\sin^{-1}(\tan(f(1)))$ is equal to	**(r)**	$\frac{\pi}{3}$
(D)	$\sum_{r=1}^{10} f\left(\frac{r}{20}\right)$ is equal to	**(s)**	$\frac{7\pi}{12}$
		(t)	$\frac{5\pi}{2}$

(A) A-q; B-s, C-p; D-r **(B)** A-q; B-s, C-p; D-t

(C) A-t; B-s, C-p; D-r **(D)** A-t; B-s, C-p; D-t

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11. Match the list:

List-I		List-II	
(A)	If $g:[1,3]\to[1,3]$ is a continuous decreasing function, then $\int_1^3\left(g(x)-g^{-1}(x)\right)dx$ is equal to	**(p)**	0
(B)	If $f(x)=\frac{5-\cos 3x}{3+\cos 5x}$, then maximum value of $f(x)$ is	**(q)**	1
(C)	Let $f:R\to R$ be a function defined by $f(x)=x^3+px^2+qx-3$. If f is monotonic decreasing in the interval (1, 3) only, $(p+q)$ is equal to:	**(r)**	2
(D)	If $\lim\limits_{n\to\infty}\sum\limits_{r=1}^{n}\frac{n}{(n+r)(2n+r)}=\ln\left(\frac{a}{b}\right)$ where a and b are co-prime, then $\lvert a-b\rvert$ is equal to	**(s)**	3
		(t)	8

(A) A-t; B-r, C-t; D-r **(B)** A-p; B-s, C-p; D-t

(C) A-t; B-r, C-t; D-q **(D)** A-p; B-s, C-s; D-q

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SECTION-4

This section consists of 6 NON-NEGATIVE INTEGER Type Questions. The answer to each question is a NON-NEGATIVE INTEGER.

1. Let $f(1) = -2$ and $f'(x) \geq 4.2$ for $1 \leq x \leq 6$. The smallest possible value of $f(6)$ is_____.

2. If $f : [-1, 1] \to R$ be a continuous function satisfying $f(2x^2 - 1) = (x^3 + x) f(x)$, then $\lim\limits_{x \to 0} \dfrac{f(\cos x)}{\sin x}$ is _____.

3. The number of solutions of the equation $e^{-\sqrt{|\ln\{x\}|}} - \{x\}^{1/\sqrt{|\ln\{x\}|}} = [\operatorname{sgn}(x)]$ (where [.] is greatest integer function and {.} is fractional part function) is(are)_____.

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4. Let m and n be two positive integers greater than '1'. If $\lim\limits_{\alpha\to 0}\left(\dfrac{\ln(\tan(\alpha^n)+1)}{\cos(\alpha^m)-1}\right)=-2$. Then the value of $\dfrac{m+n}{m}=$ _____ .

5. Number of points where $f(x)=\begin{cases}\max\left(|x^2-x-2|, x^2-3x\right) & ; \quad x\geq 0\\ \max\left(\ell n(-x), e^x\right) & ; \quad x<0\end{cases}$ is non-differentiable will be:

6. If $f(x)$ be a differentiable function satisfying $f(y).f\left(\dfrac{x}{y}\right)=f(x)\ \forall x,\ y\in R,\ y\neq 0$ and $f(1)\neq 0,\ f'(1)=3$, then $f(x)=x$ has exactly how many solutions:

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