

English	(1001CJA106216240182)		Test Pattern
		ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)	JEE(Advanced)
	CLASSROOM CONTACT PROGRAMME (Academic Session : 2024 - 2025)		FULL SYLLABUS 12-02-2025

JEE(Main + Advanced) : ENTHUSIAST COURSE ALL STAR BATCH (SCORE-II)

Time : 3 Hours

PAPER (OPTIONAL)

Maximum Marks : 198

IMPORTANT NOTE : Students having 8 digits **Form No.** must fill two zero before their Form No. in OMR. For example, if your **Form No.** is 12345678, then you have to fill **0012345678**.

READ THE INSTRUCTIONS CAREFULLY



GENERAL :

1. This sealed booklet is your Question Paper. Do not break the seal till you are told to do so.
2. Use the Optical Response Sheet (ORS) provided separately for answering the questions.
3. Blank spaces are provided within this booklet for rough work.
4. Write your name, form number and sign in the space provided on the back cover of this booklet.
5. After breaking the seal of the booklet, verify that the booklet contains **24** pages and that all the **18** questions in each subject and along with the options are legible. If not, contact the invigilator for replacement of the booklet.
6. You are allowed to take away the Question Paper at the end of the examination.

OPTICAL RESPONSE SHEET :

7. The ORS will be collected by the invigilator at the end of the examination.
8. Do not tamper with or mutilate the ORS. **Do not use the ORS for rough work.**
9. Write your name, form number and sign with pen in the space provided for this purpose on the ORS. **Do not write any of these details anywhere else on the ORS.** Darken the appropriate bubble under each digit of your form number.

DARKENING THE BUBBLES ON THE ORS :

10. Use a **BLACK BALL POINT PEN** to darken the bubbles on the ORS.
11. Darken the bubble  **COMPLETELY.**
12. The correct way of darkening a bubble is as : 
13. The ORS is machine-gradable. Ensure that the bubbles are darkened in the correct way.
14. Darken the bubbles **ONLY IF** you are sure of the answer. There is **NO WAY** to erase or "un-darken" a darkened bubble.
15. Take **$g = 10 \text{ m/s}^2$** unless otherwise stated.

QUESTION PAPER FORMAT :

16. The question paper has three parts : Physics, Chemistry and Mathematics.

Please see the last page of this booklet for rest of the instructions

DO NOT BREAK THE SEALS WITHOUT BEING INSTRUCTED TO DO SO BY THE INVIGILATOR

For More Material Join: @JEEAdvanced_2025

SOME USEFUL CONSTANTS

Atomic No. : H = 1, B = 5, C = 6, N = 7, O = 8, F = 9, Al = 13, P = 15, S = 16, Cl = 17, Br = 35, Xe = 54, Ce = 58

Atomic masses : H = 1, Li = 7, B = 11, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, P = 31, S = 32, Cl = 35.5, Ca = 40, Fe = 56, Br = 80, I = 127, Xe = 131, Ba = 137, Ce = 140

- | | |
|------------------------------------|--|
| • Boltzmann constant | $k = 1.38 \times 10^{-23} \text{ JK}^{-1}$ |
| • Coulomb's law constant | $\frac{1}{4\pi\epsilon_0} = 9 \times 10^9$ |
| • Universal gravitational constant | $G = 6.67259 \times 10^{-11} \text{ N-m}^2 \text{ kg}^{-2}$ |
| • Speed of light in vacuum | $c = 3 \times 10^8 \text{ ms}^{-1}$ |
| • Stefan-Boltzmann constant | $\sigma = 5.67 \times 10^{-8} \text{ Wm}^{-2}\text{-K}^{-4}$ |
| • Wien's displacement law constant | $b = 2.89 \times 10^{-3} \text{ m-K}$ |
| • Permeability of vacuum | $\mu_0 = 4\pi \times 10^{-7} \text{ NA}^{-2}$ |
| • Permittivity of vacuum | $\epsilon_0 = \frac{1}{\mu_0 c^2}$ |
| • Planck constant | $h = 6.63 \times 10^{-34} \text{ J-s}$ |

Space for Rough Work

PART-1 : PHYSICS

SECTION-I (i) : (Maximum Marks: 18)

- This section contains **SIX (06)** questions.
- Each question has Four options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- 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)

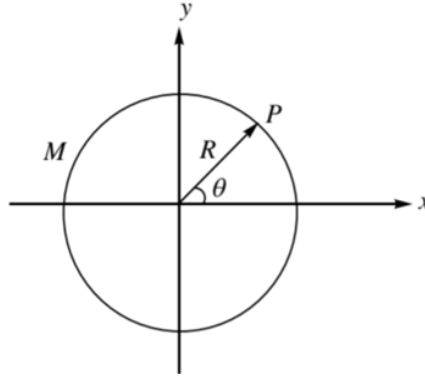
Negative Marks : -1 In all other cases

1. Four students Ram, Shyam, Ghanshyam and Radheshyam perform an optical bench experiment to find focal length of a convex lens. Ram forms image of a distant luminous object on a small screen mounted on the optical bench. Other 3 students perform usual optical bench experiment. Their position of object needle, lens and image needle are given below. Which of the student is most accurate in his result?

Name	Object	Lens	Image
Ram	-	15.0 cm	30.0 cm
Shyam	15.0 cm	75.0 cm	95.0 cm
Ghanshyam	15.0 cm	45.0 cm	75.0 cm
Radheshyam	15.0 cm	60.0 cm	82.5 cm

- (A) Ram
- (B) Ghanshyam
- (C) Radheshyam
- (D) All are equally accurate
2. If the third harmonic vibration in an open air pipe equals the fifth harmonic of vibration in a closed air pipe, the possible values of the length of air column in the closed pipe and open pipe, respectively, are (neglect end corrections) :-
- (A) 240 cm, 120 cm
- (B) 60 cm, 72 cm
- (C) 200 cm, 120 cm
- (D) 180 cm, 150 cm

3. A ring of mass M and radius R lies in x - y plane with its centre at origin as shown. The mass distribution of ring is non-uniform such that at any point P on the ring, the mass per unit length is given by $k = k_0 \left(\cos^2 \theta + \frac{\theta}{\pi} \right)$ (where k_0 is a positive constant, θ is in radians). Then the moment of inertia of the ring about z -axis is



- (A) MR^2 (B) $\frac{1}{2}MR^2$ (C) $\frac{1}{2} \frac{M^2}{k_0} R$ (D) $\frac{1}{\pi} \frac{M^2}{k_0} R$
4. An α particle is moving along a circle of radius R with a constant angular velocity. Point A lies in the same plane at a distance $2R$ from the centre. The point A records magnetic field produced by the α particle. If the minimum time interval between two successive times at which A records zero magnetic field is ' t ', find frequency of revolution of the α -particle.
- (A) $\frac{1}{t}$ (B) $\frac{1}{3t}$ (C) $\frac{1}{6t}$ (D) $\frac{1}{2t}$
5. Consider two coherent monochromatic (wavelength λ) sources S_1 and S_2 separated by distance d . The ratio of intensity of S_1 and that of S_2 at point P , is 4. The distance of point P from S_1 is (if the resultant intensity at point P is equal to $\frac{9}{4}$ times of intensity of S_1)



[Given $\angle S_2S_1P$ is 90°] ($d > 0$, n is a positive integer)

- (A) $\frac{d^2 - n^2\lambda^2}{2n\lambda}$ (B) $\frac{d^2 + n^2\lambda^2}{2n\lambda}$ (C) $\frac{n\lambda d}{\sqrt{d^2 - n^2\lambda^2}}$ (D) $\frac{2n\lambda d}{\sqrt{d^2 - n^2\lambda^2}}$
6. A conducting disc of conductivity σ has radius a and thickness δ . A uniform magnetic field \vec{B} is applied in a direction perpendicular to the plane of the disc. If the magnetic field changes with time at the rate of R , then find the power dissipated in the disc due to the induced current.

- (A) $\frac{\pi \delta \sigma a^4}{8} (R)^2$ (B) $\frac{\pi \delta \sigma a^4}{12} (R)^2$ (C) $\frac{\pi \delta \sigma a^4}{4} (R)^2$ (D) $\frac{\pi \delta \sigma a^4}{6} (R)^2$

SECTION-I (ii) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s)
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If only (all) the correct option(s) is (are) chosen.

Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.

Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen and both of which are correct.

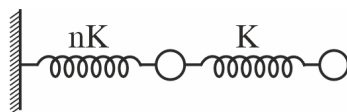
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered).

Negative Marks : -2 In all other cases.

- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

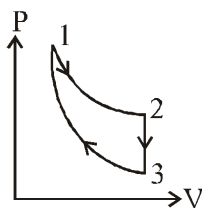
7. The system in figure lies on a frictionless horizontal table. Both masses are m , and the two spring constant are nK (where n is a numerical factor) and K as shown in figure. The springs have the same relaxed length. Assuming that it is possible to set up initial conditions so that the masses oscillate back and forth with the two springs always having equal lengths at any given instant. Choose **CORRECT** statement(s) -



- (A) Relative to mean position, if displacement of left mass is x , then displacement of right mass is $2x$.
 (B) Relative to mean position, if displacement of left mass is x , then displacement of right mass is x .
 (C) Value of n is $\frac{3}{2}$.
 (D) Value of n is $\frac{2}{3}$.

8. In a new system of units, the unit of mass is 1000 kg (1 metric ton), unit of length is 1000m (1km) and unit of time is 3600 s(1hr). Select correct statement (s).
- (A) The numerical value of 500 m in this new system is 0.5.
- (B) The numerical value of 7200 s in this new system is 2.
- (C) The numerical value of $\frac{1}{36}$ J in this new system is 3.6×10^{-4} .
- (D) The numerical value of $\frac{1}{36}$ N in this new system is 0.36.
9. Consider a hypothetical hydrogen like atom. The wavelength of spectral line from p^{th} orbit to ground state is given by $\lambda = \frac{3500p^2}{p^2 - 1}$ in Å. Choose the correct option(s) for considered hypothetical atom. ($hC = 1240$ eV-nm)
- (A) The ionization potential of considered hypothetical atom is 3.54 V approximately
- (B) The ionization potential of considered hypothetical atom is 0.354 V approximately
- (C) The wavelength of least energetic photon in the spectral line series is 466.67 nm approximately
- (D) The wavelength of maximum energetic photon in the spectral line series is 350.00 nm approximately
10. The potential energy function of a particle is given by $U(r) = \frac{A}{2r^2} - \frac{B}{3r}$, where A and B are constants and r is the radial distance from the centre of the force. Choose the correct option(s).
- (A) The equilibrium distance will be $r_0 = \frac{2A}{B}$
- (B) The equilibrium distance will be $r_0 = \frac{3A}{B}$
- (C) If the total energy of the particle is $\frac{B^2}{6A}$, then its radial velocity will vanish at $\frac{r_0}{3}$, where r_0 is the equilibrium distance
- (D) If the total energy of the particle is $\frac{B^2}{6A}$, then its radial velocity will vanish at $\frac{r_0}{2}$, where r_0 is the equilibrium distance
11. Radon decays to polonium according to the decay scheme given by ${}^{222}_{88}\text{Rn} \xrightarrow[3.8 \text{ days}]{\alpha\text{-decay}} {}^{218}_{84}\text{Po}$. State which of the following statement(s) will be true in respect of this decay : (Given : $\ln 2 = 0.693$)
- (A) If the original mass of radon in a closed container was 1mg, the amount of radon left after 11.4 days will be 0.125 mg.
- (B) Activity of radon after 7.6 days will be $\frac{A_0}{4}$ where A_0 is original activity of sample at $t = 0$.
- (C) If the original number of radon in a closed container was 8 atoms, the number of radon left after 7.6 day will be 2 atoms.
- (D) Po is more stable than Rn.

12. Three processes compose a thermodynamic cycle shown in the accompanying PV diagram of an ideal gas.



Process $1 \rightarrow 2$ takes place at constant temperature (300 K). During this process 60 J of heat enters the system.

Process $2 \rightarrow 3$ takes place at constant volume. During this process 40 J of heat leaves the system.

Process $3 \rightarrow 1$ is adiabatic. T_3 is 275 K.

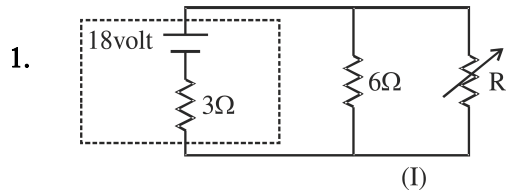
- (A) The change in internal energy of the system during process $3 \rightarrow 1$ is +40 J
- (B) The change in internal energy of the system during process $3 \rightarrow 1$ is 0
- (C) The change in internal energy of the system during cyclic process is 40 J
- (D) The change in internal energy of the system during cyclic process is 0

SECTION-II : (Maximum Marks: 24)

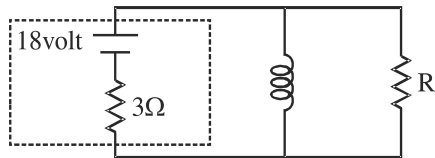
- This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value of the answer in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **Two** decimal places; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct)
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct numerical value is entered.

Zero Marks : 0 In all other cases.

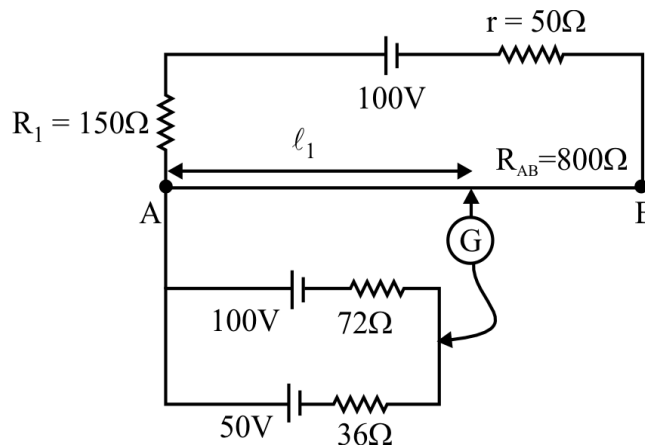


In the given circuit the resistance R can be varied. Battery having emf 18 volt is having internal resistance $3\ \Omega$. The value of R is selected such that power dissipated in it is maximum. Now $6\ \Omega$ resistance is replaced by an inductor having inductance $L = 6\text{mH}$ so circuit will appear like the circuit shown in diagram given below



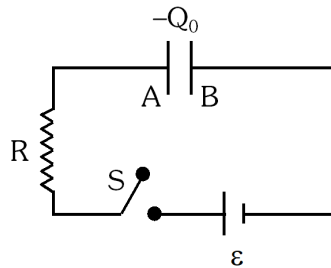
Find time constant for above circuit in milliseconds.

2. An ac ammeter is used to measure current in the circuit. When a given direct current passes through the circuit, the ac ammeter reads 3 amp. When another alternating current passes through the circuit, the ac ammeter reads 4 amp. Then the reading of this ammeter (in Ampere) if both dc and ac flows through the circuit simultaneously is ____.
3. In the circuit shown length of AB is 100 cm. Then find the value of ℓ_1 (in cm). Where ℓ_1 corresponds to null point.



4. In a meter bridge experiment, the unknown resistance was connected in left branch and a resistance box in right branch. The resistance in resistance box is 50Ω (known accurately). There is no end correction. The least count of meter bridge is 1mm. The null point was obtained at 40.0cm from left end. Now the radius of wire was measured by a screw guage with pitch of 1mm and no. of divisions on circular scale as 100. The screw guage read 1 main scale division and 60 circular scale divisions. The length of resistor was measured using a vernier callipers with 1mm as 1 main scale division and 9 main scale division = 10 vernier scale divisions. The length is 2.2 cm as main scale reading and 5th vernier scale division coinciding. The percentage error in measurement of resistivity is.
5. The figure shows a RC circuit with a parallel plate capacitor. Before switching on the circuit, plate A of the capacitor has a charge $-Q_0$ while plate B has no net charge. Now, at $t = 0$, the circuit is switched on. How much time (in second) will elapse before the net charge on plate A becomes zero.

(Given $C = 1\mu\text{F}$, $Q_0 = 1\text{mC}$, $\varepsilon = 1000 \text{ V}$ and $R = \frac{2 \times 10^6}{\ln 3} \Omega$)



6. A rod of length L and mass M is located along the x -axis with ends at $x = 0$ and $x = L$. This rod has a special property such that if we make a cut at any arbitrary $x = a$ coordinate and consider the rod between $x = 0$ and $x = a$, the centre of mass of this portion of the rod is located at $a/4$. If the linear mass density $\lambda(x)$ of the rod as a function of x is given as $\lambda(x) = \frac{kM}{nx^{1/2n}L^{1/4n}}$. Find n .

PART-2 : CHEMISTRY
SECTION-I (i) : (Maximum Marks: 18)

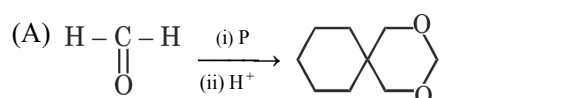
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Full Marks : +3 If **ONLY** the correct option is chosen.

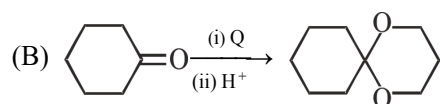
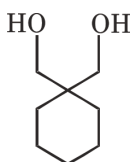
Zero Marks : 0 If none of the options is chosen (i.e. the question is unanswered)

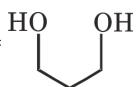
Negative Marks : -1 In all other cases

1. Which of the following statement is **INCORRECT** ?

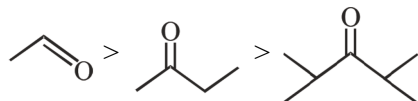


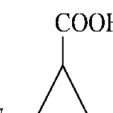
In above reaction compound P is



In above reaction compound Q = 

- (C) Order of rate of nucleophilic addition reaction is

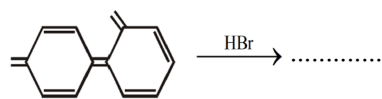


- (D) IUPAC name of compound  is

3-Amino-2-formyl cyclopropane carboxylic acid

2. Which of the following is **CORRECT** ?

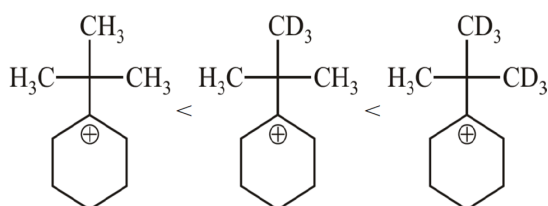
(A) In the reaction



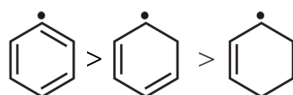
compound is obtained as major product

(B) is more acidic than

(C) Correct order of stability is



(D) Stability of



3. Which of the following statement/relationship is incorrect?

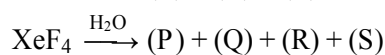
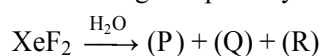
(A) Reducing power in aq. medium : $\text{Li} > \text{K} > \text{Na}$

(B) Solubility in water : $\text{Ca}(\text{OH})_2 < \text{Sr}(\text{OH})_2 < \text{Ba}(\text{OH})_2$

(C) NO is obtained as one of the product when Sn reacts with conc. HNO_3

(D) Lithium carbide produces acetylene gas on hydrolysis whereas aluminium carbide produces methane gas on hydrolysis

4. Considering complete hydrolysis of XeF_2 and XeF_4 ,



Then shape of compound 'S' is

(A) Linear

(B) Trigonal planar

(C) Trigonal pyramidal

(D) T-shape

5. Which of the following sols can not be coagulated by Al^{3+} ion
- (A) Sols of starch
 - (B) As_2S_3 sol
 - (C) Silver sol
 - (D) Methylene blue sol
6. If a certain amount of ideal gas in **state-1** (2L, 5 atm, 300 K) is subjected to expand reversibly and isothermally to **state-2** ($V = 10\text{L}$) and then the gas is restored to its initial **state-1** by compressing it using an external pressure of P_{ext} in single step, then the correct information(s) is/are :
- (Given : $\log 2 = 0.3$, $\log 3 = 0.48$, $\log 5 = 0.7$)
- (A) Work done by the gas during expansion from state 1 to State 2 is 8.06 L-atm (approx.)
 - (B) Heat exchanged in the 2nd step (State 2 to State 1) is -40 J (approx.)
 - (C) Net heat gained by the surrounding is 23.88 L-atm (approx.)
 - (D) Net change in entropy of the system is positive

SECTION-I (ii) : (Maximum Marks: 24)

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

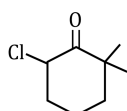
Partial Marks : +1 If two or more options are correct but **ONLY** one option is chosen and it is a correct option.

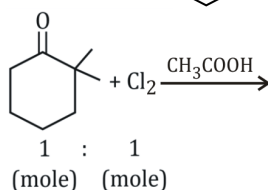
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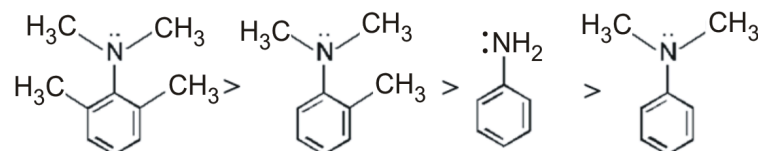
Negative Marks : -2 In all other cases.

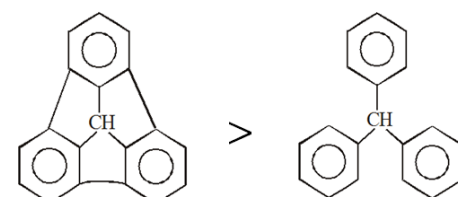
- **For Example :** If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

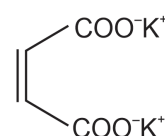
7. Which of the following statement(s) is/are **NOT INCORRECT** ?

(A) compound  is formed in following reaction

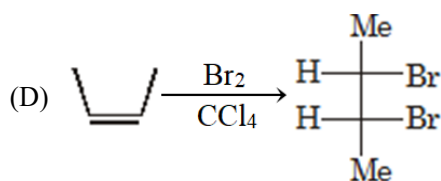
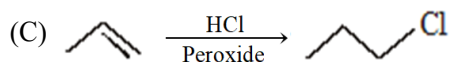
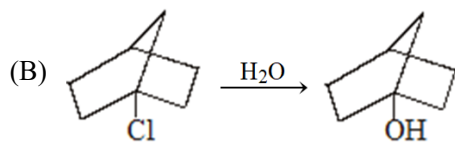
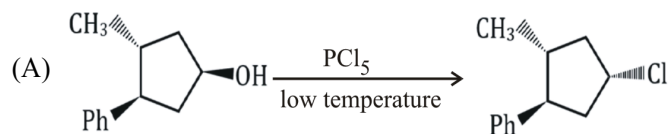


(B) Correct order of basic strength 

(C) Order of acidic strength 

(D) Alkene is obtained during **Kolbe's electrolysis** of compound 

8. Select reaction(s) with **INCORRECT** major product



9. Select correct statement(s)/relationship

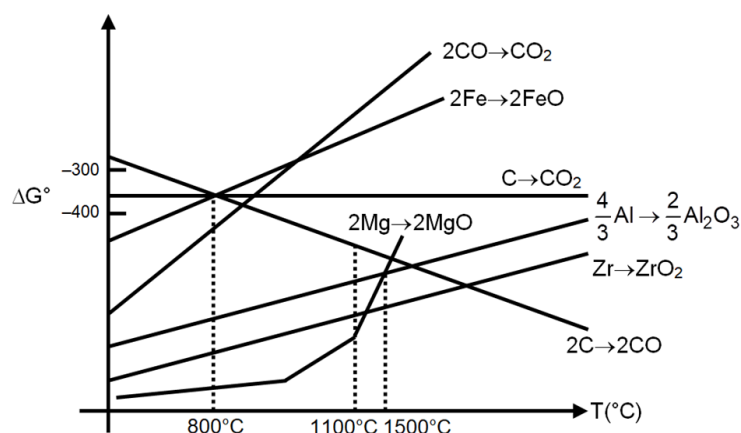
(A) On strong heating NH_4NO_2 produces paramagnetic gaseous substance

(B) Order of thermal stability : $\text{LiNO}_3 < \text{NaNO}_3 < \text{KNO}_3$

(C) SiO_2 is non reactive with NaOH(aq.) whereas it reacts with NaOH(l) on fusion

(D) Fe and Zn are commercially extracted by carbon reduction method

10. Based on the given Ellingham diagram showing the change in free energy (ΔG° in kJ/mole of O_2) for oxide formation vs temperature, select the correct statement(s)



(A) At 1100°C , $\text{CO}_2 + \text{C} \rightarrow 2\text{CO}$ is favourable whereas $\text{Al}_2\text{O}_3 + 3\text{C} \rightarrow 2\text{Al} + 3\text{CO}$ is unfavourable

(B) Al can reduce MgO below 1500°C

(C) Mg can reduce ZrO_2 but Al can not reduce ZrO_2 below 1100°C

(D) CO is better reducing agent than coke at relatively lower (below 800°C) temperatures for reduction of FeO

11. For an electrochemical cell



$E_{\text{cell}} = 0$ and the value of $\Delta_r G^\circ$ is half of $\Delta_r H^\circ$ at 300 K. Considering $\log 2 = 0.3$, $F = 96500 \text{ C mol}^{-1}$ and $R = 8.3 \text{ JK}^{-1}\text{mol}^{-1}$. Select the correct relationship(s)

- (A) E_{cell}° is positive
- (B) $\frac{dE_{\text{cell}}^\circ}{dT}$ is negative
- (C) $\Delta_r S^\circ \simeq -7.65 \text{ JK}^{-1}\text{mol}^{-1}$
- (D) Cell reaction in standard condition and at 300 K is endothermic in nature
12. A 0.252 g sample of monoprotic organic base (amine) is dissolved in water and titrated against 0.07 M H_2SO_4 solution at 25°C . After addition of 20 ml of acid, a pH of 10.7 is recorded. Equivalence point is observed when 40 ml of H_2SO_4 is added. ($\log 2 = 0.3$, $\log 3 = 0.48$, $\log 5 = 0.7$)
- Based on the above information select correct statement(s)
- (A) Molar mass of the organic base is 45 g/mole
- (B) Resultant solution after addition of 20 ml of H_2SO_4 can act as basic buffer solution.
- (C) K_b of the organic base is 5×10^{-4}
- (D) Solution formed at equivalence point is basic in nature.

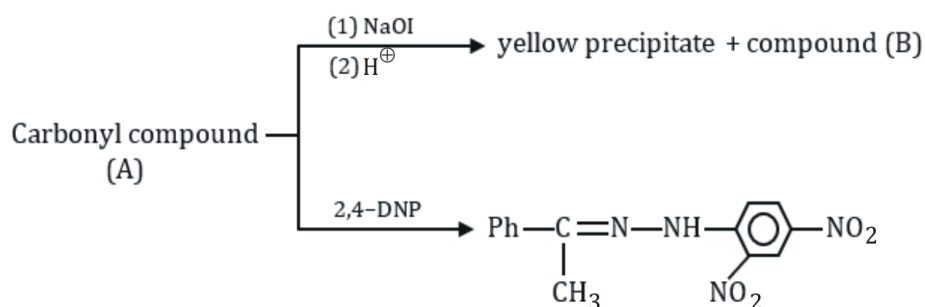
SECTION-II : (Maximum Marks: 24)

- This section contains **SIX (06)** questions. The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value of the answer in the place designated to enter the answer. If the numerical value has more than two decimal places, **truncate/round-off** the value to **Two** decimal places; e.g. 6.25, 7.00, -0.33, -0.30, 30.27, -127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct)
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct numerical value is entered.

Zero Marks : 0 In all other cases.

1. (i) Consider following set of reactions

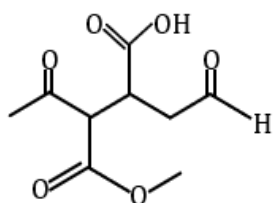


Degree of unsaturation of compound B is 'y'

&

- (ii) During detection of sulphur in **Lassaigne's test**, violet coloured compound with formula " $Na_x [Fe(CN)_5NOS]$ " is formed, then what is the value of $\frac{y}{x}$.

2.



In the above given compound

X = Total number of functional groups that can be reduced by LAH (Lithium aluminium hydride),

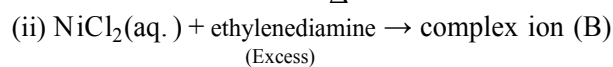
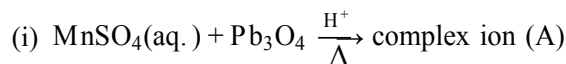
Y = Total number of functional groups that can be reduced by SBH (sodium borohydride)

&

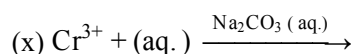
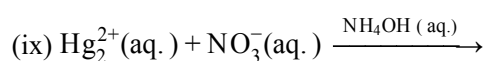
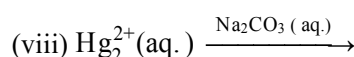
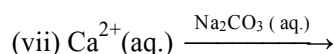
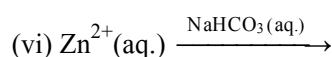
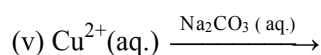
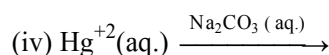
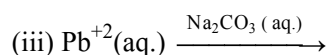
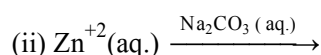
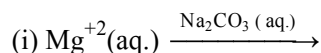
Z = Total number of isomeric alcohols of molecular formula $C_5H_{12}O$ (including stereoisomers) which can give blue colour in **Victor - Meyer test**

Then value of $\left(\frac{X + Y}{Z} \right) = \dots\dots\dots$

3. Find the sum of spin only magnetic moment (in B.M) of the complexes (A, B, C) formed in following processes.



4. Among the following reactions, how many reactions produce precipitate of basic salt?



5. 2.4g of pure carbon is burnt in limited supply of O_2 to produce CO and $\text{CO}_2(\text{g})$. After 100% conversion of carbon into CO and CO_2 , the gaseous mixture is treated with I_2O_5 for the estimation of CO. If liberated I_2 in this process require 300ml of 0.1N hypo solution for complete titration then % by mole of CO in the gaseous mixture of CO and CO_2 is _____
6. 1 m, 1.06 kg of urea solution is kept at temperature 10°C below its freezing point. It is observed that 50% of solvent gets separated. Find the mass (in gm) of solvent freezes out if the same solution is kept at temperature 15°C below its freezing point.

PART-3 : MATHEMATICS
SECTION-I (i) : (Maximum Marks: 18)

- This section contains **SIX (06)** questions.
- Each question has Four options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- 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

- Let $f(x) = 2x - 2x^2$, $x \in [0, 1]$. Let $f_n(x) = \underbrace{f \circ f \circ f \dots \circ f}_{n \text{ times}}(x)$ such that $\int_0^1 f_{2017}(x) dx = \frac{2^p}{2^q + 1}$, then value of $q - p$ is
 (A) 1 (B) 2
 (C) 3 (D) 4
- Let $g : \mathbb{R} \rightarrow \mathbb{R}$ be a differentiable function ($g'(0) \neq 0$), and $f : \mathbb{R} \rightarrow \mathbb{R}$ be a continuous function, such that
 $g(x + y) = g(x) + g(y) + 1 \quad \forall x, y \in \mathbb{R}$ and
 $g(f^2(x) + 2 + x^2 f^2(x)) - g(x^2 f(x) + 3f(x)) = 0, \quad \forall x \in \mathbb{R}.$
 and $f(2023) = f(2024) \neq f(0)$, then the value of $\left(f\left(\frac{1}{2}\right) + f(2) \right)$ can be equal to
 (A) 2 (B) 3
 (C) $\frac{13}{5}$ (D) $\frac{8}{5}$
- If
 $\vec{P} = (\cos x)\hat{i} + (\sin x)\hat{j} + (\cos 2x)\hat{k},$
 $\vec{Q} = (\tan x)\hat{i} + (\sin 3x)\hat{j} + (\cos 4x)\hat{k}$ and
 $\vec{R} = (\cos 3x)\hat{i} + (\sin 5x)\hat{j} + (\cos 6x)\hat{k}$
 are three variable vectors given, then $\int_0^\pi ((\vec{P} \times \vec{Q}) \cdot \vec{R}) dx$ belongs to -
 (A) $(-1, 0)$ (B) $(0, 1)$
 (C) $(-\infty, -1) \cup (1, \infty)$ (D) $(-1, 1)$

4. Let volume of a tetrahedron ABCD is $\frac{81}{2}$ cube unit and volume of parallelopiped whose three cotermious edges are line segments joining centroid of any face of tetrahedron with centroids of its other three faces is V cube unit, then V is
- (A) 9 (B) 8
(C) 7 (D) 3
5. If $f(x) = [2 + 5|n| \sin x]$ where $n \in \mathbb{I}$, $x \in [0, \pi]$ has exactly 19 points of non differentiability then the possible value of $|n|$ is (where $[*]$ represents G.I.F.)
- (A) 1 (B) 2
(C) 3 (D) 4
6. Number of ways in which 4A, 1B, 1C and 1D can be distributed among 4 persons such that no one gets all 4A and every one gets at least one letter is
- (A) 832 (B) 2432
(C) 2077 (D) 608

SECTION-I (ii) : (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- Each question has **FOUR** options. **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s)
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If only (all) the correct option(s) is (are) chosen.

Partial Marks : +3 If all the four options are correct but **ONLY** three options are chosen.

Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen 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 Marks : 0 If none of the options is chosen (i.e. the question is unanswered).

Negative Marks : -2 In all other cases.

- **For Example** : If first, third and fourth are the **ONLY** three correct options for a question with second option being an incorrect option; selecting only all the three correct options will result in +4 marks. Selecting only two of the three correct options (e.g. the first and fourth options), without selecting any incorrect option (second option in this case), will result in +2 marks. Selecting only one of the three correct options (either first or third or fourth option), without selecting any incorrect option (second option in this case), will result in +1 marks. Selecting any incorrect option(s) (second option in this case), with or without selection of any correct option(s) will result in -2 marks.

7. Let A(0, 6, 8) and B(15, 20, 0) are two given points and P(λ , 0, 0) is a point on x-axis such that PA + PB is minimum. If image of origin along plane mirror passing through P, A, B is (α , β , γ) then

(A) $9(\alpha + \beta) = 20$

(B) $9(\beta + \gamma) = 20$

(C) $9(\gamma + \alpha) = 20$

(D) $9(\alpha + \beta + \gamma) = 60$

8. Let F and G be two real-valued functions defined on R (the set of all real numbers).

$$\text{Consider } F(x) = \begin{cases} |x+1| & , \quad x \leq 0 \\ x & , \quad x > 0 \end{cases}, G(x) = \begin{cases} |x|+1 & , \quad x \leq 0 \\ -|x-2| & , \quad x > 0 \end{cases} \text{ and } H(x) = F(x) + G(x).$$

Points of discontinuity of H(x) are

(A) $x = 0$

(B) $x = 1$

(C) $x = 2$

(D) $x = -1$

9. A variable line L intersects the parabola $x^2 = y$ at points A and B whose x -coordinates are α and β with $\alpha < \beta$. The area of figure enclosed by the segment AB and the parabola is always equal to $\frac{4}{3}$. The variable segment AB has its middle point as M . Then the locus of mid point M is a parabola $f(x, y) = 0$, whose focus is S . If from point $P(-2, 0)$ two tangents are drawn to the parabola $f(x, y) = 0$ touching it at the point Q and R , then $16(SQ)(SR)$ is always less than
- (A) 89 (B) 91
(C) 98 (D) 101

10. If A, B, C are the angles of an acute angled triangle ABC and

$$D = \begin{vmatrix} (\tan B + \tan C)^2 & \tan^2 A & \tan^2 A \\ \tan^2 B & (\tan A + \tan C)^2 & \tan^2 B \\ \tan^2 C & \tan^2 C & (\tan A + \tan B)^2 \end{vmatrix},$$

then the value of $\frac{D}{1000}$ can be

- (A) -1 (B) 0
(C) 2 (D) 3
11. Let a, b, c are non-zero real numbers such that $\frac{1}{a}, \frac{1}{b}, \frac{1}{c}$ are in arithmetic progression and $a, b, -2c$ are in geometric progression, then which of the following statement(s) is(are) must be true ?
- (A) $a^2, b^2, 4c^2$ are in geometric progression
(B) $-2a, b, -2c$ are in arithmetic progression
(C) $a^3 + b^3 + c^3 - 3abc = 0$
(D) a^2, b^2, c^2 are in harmonic progression
12. Let $z = a + ib$ (where $a, b, \in \mathbb{R}$) and $i = \sqrt{-1}$ such that $|2z + 3i| = |z^2|$. Identify the correct statement(s)?
- (A) $|Z|_{\text{maximum}}$ is equal to 3.
(B) $|Z|_{\text{minimum}}$ is equal to 1
(C) If $|Z|_{\text{maximum}}$ when $z = \alpha + i\beta$ ($\alpha, \beta \in \mathbb{R}$ and $i = \sqrt{-1}$) then $(\alpha^3 + \beta^3)$ is equal to 27
(D) If $|Z|_{\text{minimum}}$ when $z = x + iy$ ($\alpha, \beta \in \mathbb{R}$ and $i = \sqrt{-1}$) then $(x^2 + 2y^2)$ is equal to 2

SECTION-II : (Maximum Marks: 24)

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- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : +4 If ONLY the correct numerical value is entered.

Zero Marks : 0 In all other cases.

- Let $f : \mathbb{R} \rightarrow \mathbb{R}$ be a function defined as
 $f(x+y) = f(x) + f(y) - 3xy(x+y) - 1 \quad \forall x, y \in \mathbb{R}, f'(0) = -1$.
 Find the least positive integer value of x which satisfies the inequality
 $1 - f(x) - f^3(x) > f(1 - 5x)$.
- A number is chosen at random from the numbers 10 to 99. By seeing the number a man will laugh if product of the digits is 12. If he choose three numbers with replacement then the probability that he will laugh at least once is $1 - \left(\frac{p}{q}\right)^3$. Where (p, q) are co-prime then the value of $\left|\frac{3}{q-p}\right|$ is
- If $f(x) + f(y) = \frac{1}{x} + \frac{1}{y} \quad \forall x, y \in \mathbb{R} - \{0\}$ and $\int_2^3 \frac{3(f(x))^5 - f(x)}{1 - (f(x))^4} dx = \frac{1}{2} \log \frac{2^a}{3^b}$, then $\frac{\beta}{\alpha} =$
- Let $f(x) = x^3 - 3x^2 + 4x - 1$, then the value of $\int_{4/27}^{50/27} f(f(x)) dx$ is
- If $p = \sum_{r=1}^{50} \left\{ \sum_{k=1}^r \left(\frac{(-1)^{r-1}}{k} \cdot {}^{50}C_r \right) \right\}$ then the value of $100(p)$ equals
- If z is a complex number such that $|z| = 1$, then the maximum value of $\frac{|z^4 + z^3 - 2z^2i + z + 1|^2}{5}$ is

Space for Rough Work

NAME OF THE CANDIDATE

FORM NO.

I have read all the instructions
and shall abide by them.

Signature of the Candidate

I have verified the identity, name and Form
number of the candidate, and that question
paper and ORS codes are the same.

Signature of the Invigilator

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