English

(1001CJA102120047)

Test Pattern

ALLEN CAREER INSTITUTE KOTA (RAJASTHAN)

CLASSROOM CONTACT PROGRAMME

JEE(Advanced)
FULL SYLLABUS

SAMPLE PAPER-5

PAPER-1

Time : 3 Hours **Maximum Marks : 198**

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 m/s²** unless otherwise stated.

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

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

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**	$k = 1.38 \times 10^{-23}\ JK^{-1}$
• **Coulomb's law constant**	$\frac{1}{4\pi\varepsilon_0} = 9\times10^9$
• **Universal gravitational constant**	$G = 6.67259 \times 10^{-11}\ N\text{–}m^2\ kg^{-2}$
• **Speed of light in vacuum**	$c = 3 \times 10^8\ ms^{-1}$
• **Stefan–Boltzmann constant**	$\sigma = 5.67 \times 10^{-8}\ Wm^{-2}\text{–}K^{-4}$
• **Wien's displacement law constant**	$b = 2.89 \times 10^{-3}\ m\text{–}K$
• **Permeability of vacuum**	$\mu_0 = 4\pi \times 10^{-7}\ NA^{-2}$
• **Permittivity of vacuum**	$\in_0 = \frac{1}{\mu_0 c^2}$
• **Planck constant**	$h = 6.63 \times 10^{-34}\ J\text{–}s$

Space for Rough Work

HAVE CONTROL ⟶ HAVE PATIENCE ⟶ HAVE CONFIDENCE ⇒ 100% SUCCESS

BEWARE OF NEGATIVE MARKING

PART-1 : PHYSICS

SECTION–I(i) : (Maximum Marks : 18)

- This section contains **SIX** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : –1 In all other cases

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1. Smoke consist of ash particles which acquire terminal velocity under influence of buoyant force and gravity very quickly after coming out of flame. If the steam engine of a train moving with constant velocity $\vec{v}_0$ releases smoke when wind is stationary :

(A) Smoke trail would be vertical and smoke particles would be travelling vertically as seen from ground.

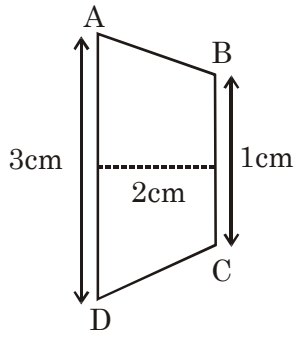
(B) Smoke trail would be at an acute angle to horizontal and smoke particles would be travelling along the smoke trail.

(C) Smoke trail would be vertical but smoke particles would be travelling at an acute angle to the horizontal.

(D) Smoke trail would be at an acute angle to horizontal but smoke particles would be travelling vertically.

Space for Rough Work

2. A plane trapezium is in a plane containing principal axis of a lens. It's real image is formed. The image is of the shape of a square. The side length of square will be :-



(A) 1.5 cm (B) 2 cm (C) 3 cm (D) 6 cm

3. A parachutist descends uniformly at a speed of 8 m/s in calm weather. What will the terminal speed of the parachutist be if there is a 6 m/s crosswind in the horizontal direction?

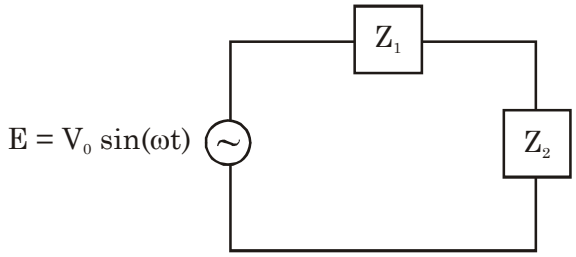
(A) 8 m/s (B) 10 m/s (C) 2 m/s (D) $2\sqrt{7}$ m/s

4. A particle of charge +q and mass m is in a uniform magnetic field $B = B_0\hat{z}$. The initial position of the particle is x = 0, y = 0, z = 0; the magnitude of the momentum of the particle is p_0. The particle is so projected that it crosses the point $\left(x = \frac{p_0}{qB_0}, y = 0, z = 0\right)$. What is the time (in sec) after which it reaches this point? Take $\frac{m}{q} = \frac{12}{\pi}$ SI units and B = 0.2 T.

(A) 10 (B) 20 (C) 30 (D) 15

Space for Rough Work

5. The impedance Z_1 in figure can be regarded as a pure resistance $R_1 = 12\ \Omega$, whereas the impedance Z_2 is associated with a series resistance $R_2 = 8\Omega$ and a capacitance $C = 1\mu F$. If $f = 5000$ Hz and $V_0 = 30V$, what is the power dissipated in Z_2 (in W)? Take $\pi^2 = 10$.



(A) 2.57 (B) 3.12 (C) 257 (D) None of these

6. 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

Space for Rough Work

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

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

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7. The de-broglie wavelength of 2 elementary particles in centre of mass frame is same and is equal to 5/8 times de-broglie wavelength of the lighter particle in lab frame and 5/2 times the de-broglie wavelength of the heavier particle in lab frame. Both particles have either parallel or anti parallel velocities. The possible combinations of particles are :

(A) ${}^{13}_{6}C$ and ${}^{12}_{6}C$ (B) ${}^{13}_{6}C$ and ${}^{4}_{2}He$ (C) ${}^{1}_{1}H$ and ${}^{4}_{2}He$ (D) ${}^{7}_{3}Li$ and ${}^{13}_{6}C$

8. A car has side window made of glass (shear strength 40 M Pa) having size 40 cm × 40 cm. The car is travelling with a velocity of 40 m/s in still air. Density of air can be assumed to be 1.25 kg/m^3. The windows are closed.

(A) If the glass is very thin, it may break and fall into the car.

(B) If the glass is very thin, it may break & fall out of the car.

(C) If we want that glass should not break, it's thickness should be greater than 2.5 μm.

(D) If we want that glass should not break, it's thickness should be greater than 8.75 μm.

Space for Rough Work

9. Two sound waves propagate in a medium. Their equation for displacement are given by

$$S_1 = 1\mu m \sin\left(100\pi t - \frac{\pi}{4}x + \frac{\pi}{3}\right);\ S_2 = 1\mu m \sin\left(\frac{\pi}{4}x - 100\pi t\right)$$

Which of the following statement is/are correct?

(A) The velocity of both waves is the same.

(B) Both the waves are equally intense.

(C) They superimpose to produce a wave of amplitude 1μm.

(D) Both waves are plane waves, propagating in +ve x direction.

10. When heat Q = 600 J is added to a mixture of helium and nitrogen at a constant volume the temperature of the mixture increases by 15 K and if the same amount of heat is given to the same mixture at constant pressure, the temperature of the mixture will increase by 10 K. Take $R = \frac{25}{3}$ Jmol k.

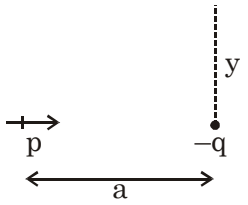
(A) Ratio of number of nitrogen molecules and helium molecules in mixture is 1 : 1.

(B) The internal energy changes more in isochoric process.

(C) Work done by the gas is more in isobaric process.

(D) The total number of moles in the mixture is 2.4 moles.

11. An electric dipole and point charge –q are kept on x axis at a distance a from each other. Assume a is much larger than size of dipole. It is seen that $\vec{E}$ vanishes at a height y above –q.



(A) $y = \sqrt{2}\,a$

(B) $p = \frac{3\sqrt{3}}{2\sqrt{2}}qa$

(C) Potential energy of interaction of dipole with –q is $\frac{-9\sqrt{3}k}{4a}q^2$

(D) Given situation is not possible.

12. In a meter bridge experiment, when we measure the resistance of two resistors connected in series, null point is obtained at 80 cm. When they are in parallel, null point is at 40 cm. What are the approximate null points when each of the resistances are measured ? Assume that resistance of resistance box remains the same.

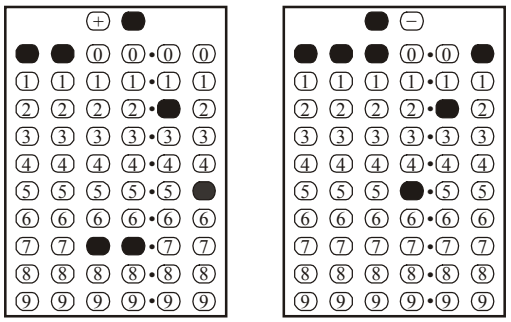
(A) 76 cm (B) 60 cm (C) 46 cm (D) 28 cm

Space for Rough Work

SECTION-II : (Maximum Marks: 24)

- This section contains **SIX** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.

  For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.



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  Zero Marks : 0 In all other cases.

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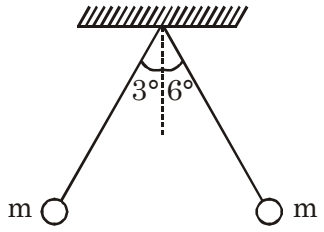
1. In a sample of $^{211}_{86}Rn$ nuclei, 25 percent decay by α-decay to $^{207}_{84}Po$ and the rest decay by electron capture to $^{211}_{85}At$. What is the ratio of the mean life for α-decay, τ_α, to the mean life for electron capture, τ_β ?

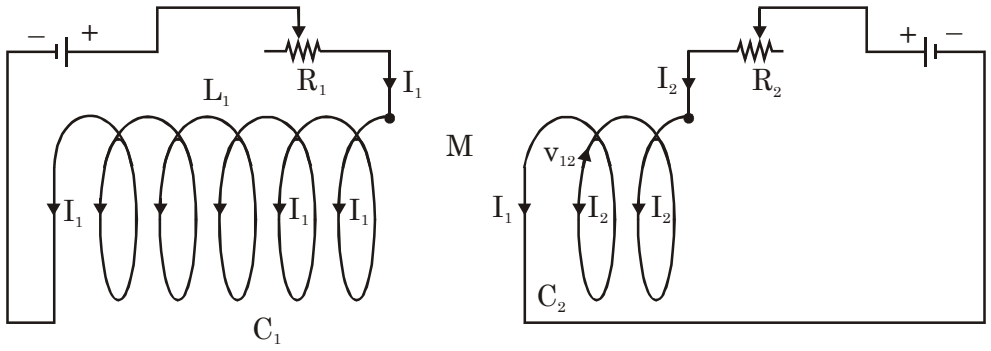
2. Two simple pendulum made of small masses m each are pulled to side as shown and released. The collision is elastic. After what time (in sec) from the release will the left mass first reach point from where it was released ? Length of both strings is 1m, take $g = \pi^2$ m/s^2.



Space for Rough Work

3. Two wavelengths λ_1 and λ_2 are used in the double-slit experiment. If λ_1 is 430 nm, what value must the other have for the fourth-order bright fringe of λ_1 to fall on the sixth-order bright fringe of the λ_2 ?

4. As seen from figure, currents I_1 and I_2 can be independently increased, decreased, or held constant by varying resistances R_1 and R_2. Let L_1 = 50 mH, L_2 = 40 mH, M = 15 mH. I_1 is increased at the rate of 120 A/s and I_2 is decreased at the rate of 200 A/s. Compute $|v_1|$ in volt. (Induced emf in coil-1)



(a) (b)

5. A light ray is incident on one of the faces of a glass prism perpendicularly to it. The angle of emergence of the light ray on another face of the prism is 45°. What is the apex angle A of the prism if the speed of light in this glass prism is 240000 km/s? Fill sinA in OMR sheet.

6. Two conducting plates, each 3 cm × 6 cm, and three slabs of dielectric, each 1cm × 3 cm× 6 cm and having dielectric constants of 1, 2, and 3, are assembled into a parallel plate capacitor with d = 3 cm. Determine the two values of capacitance obtained by the two possible methods of assembling the capacitor. Find $\frac{(C_{higher} - C_{Lower})}{\epsilon_0}$ (in cm).

Space for Rough Work

PART-2 : CHEMISTRY

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1. The **CORRECT** order of first ionization potential among the following is.

(A) $F^- > Cl^-$ (B) $Ga > T\ell$ (C) $Sn < Pb$ (D) $O^- > S^-$

2. At isoelectric point, the amino acid has-

(A) Least viscosity (B) Maximum surface tension

(C) Maximum solubility (D) All of these

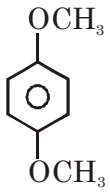
3. Sodium salts are highly soluble in water and hence undergoes complete ionisation in water. If the freezing point of 0.35 molal aq. Na_xA solution is -3.255^oC, the value of 'x' is

(K_f = 1.86 K–kg/mole)

(A) 2 (B) 3 (C) 4 (D) 5

Space for Rough Work

4. The specie among the following which when brought near a charged comb, will attract it.

(A) 

(B) IF_7 (C) SO_3 (D) C_6H_6

5. m-chlorobenzaldehyde on reaction with conc. KOH at room temperature gives –

(A) Potassium m-chlorobenzoate and m-hydroxybenzaldehyde

(B) m-hydroxy benzaldehyde and m-chlorobenzyl alcohol

(C) m-chlorobenzyl and m-hydroxybenzyl alcohol.

(D) Potassium m-chlorobenzoate and m-chlorobenzyl alcohol.

6. Calculate the minimum volume of 1M-HNO_3 solution required to completely dissolve 95.25 gm Cu, producing NO. (Cu = 63.5)

(A) 4.00 L (B) 1.00 L (C) 3.00 L (D) 3.60 L

Space for Rough Work

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7. Which of the following statement(s) regarding REFINING is/are **CORRECT**?

(A) Zone refining is based on the principle that impurities are more soluble in molten state

(B) In liquation, the M.P. of metal should be less than that of impurities

(C) In electrolytic refining, the more basic metal remains in the solution and the less basic ones go to anode mud.

(D) In Van-Arkel method, the metal iodide is decomposed on a Tungsten filament, depositing pure metal at the filament

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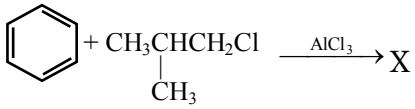
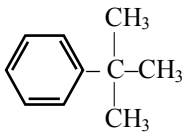
Space for Rough Work

8. Which of the following are linked to the reaction ?



(A) carbocation rearrangement

(B) 

(C) Friedel-Crafts reaction

(D) Methyl shift

9. A lead storage cell is discharged which causes the H_2SO_4 electrolyte to change from a concentration of 40% by weight (density = 1.260 gm/ml) to 28%, by weight. The original volume of electrolyte was one litre. Identify the correct statement(s):

(A) The overall cell reaction is: $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(\ell)$.

(B) A total of 2.0 moles of H_2SO_4 have reacted.

(C) The total charge released from anode of the cell is 1.93×10^5 coulomb.

(D) The mass of electrolytic solution has decreased.

10. Which of the following reactions can be used to produce Boric Anhydride?

(A) $B_2H_6 + 2CO \longrightarrow$

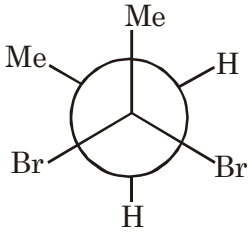
(B) $H_3BO_3 \xrightarrow{\Delta,\ <370K}$

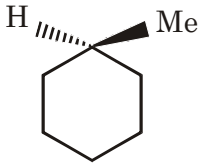
(C) $Na_2[B_4O_5(OH)_4].8H_2O \xrightarrow[\text{heating}]{\text{strong}}$

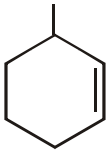
(D) $B_2H_6 + 3O_2 \longrightarrow$

Space for Rough Work

11. Which of the following compound can not exhibit optical isomerism?

(A) 

(B) 

(C) 

(D) CH_3—CH=C=CH_2

12. For H-atom, the wave function for an electron is $\psi = \frac{1}{81}\sqrt{\frac{2}{\pi a_o^2}}.\sigma.(6-\sigma).e^{-\sigma/2}.\cos\theta$, where $\sigma = \frac{2Zr}{n a_o}$ and a_0 = 0.529 Å. Select the **CORRECT** information(s) about the orbital to which this electron belongs.

(A) $3p_z$
(B) Only one angular node
(C) Only one radial node
(D) Nodal plane is XY plane.

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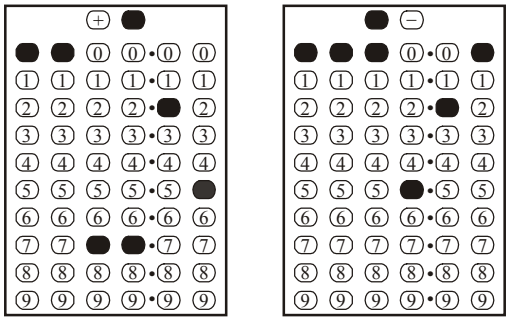

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1. Number of reactions that will produce **BLACK** precipitate among the following.

(i) $2Ag^{+} + H_2S \longrightarrow$

(ii) $Na_2SnO_2 + Bi^{+3} \xrightarrow{OH^-}$

(iii) $2Bi^{3+} + 3H_2S \longrightarrow$

(iv) $Bi^{3+} + 3OH^- \longrightarrow$

(v) $[Cd(CN)_4]^{2-} + H_2S \longrightarrow$

(vi) $AsO_4^{3-} + 12MoO_4^{2-} + 3NH_4^{+} + 24H^{+} \longrightarrow$

(vii) $Fe^{2+} + 2K^{+} + [Fe(CN)_6]^{4-} \longrightarrow$

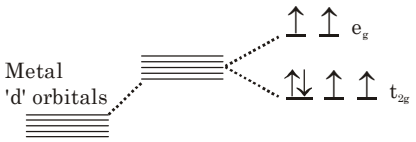
2. The total number of alkenes possible by dehydrobromination of 3-bromo-3-cyclopentylhexane using alcoholic KOH (by E_2 mechanism) is.

Space for Rough Work

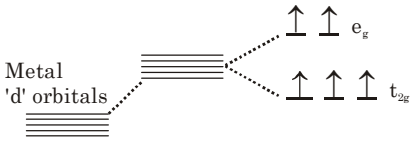
3. The rate of the reaction gets doubled when the temperature changes from 7°C to 17°C. By what factor (times) will it change for the temperature change from 17°C to 27°C?
[Antilog (0.30) = 2.0, Antilog (0.280) = 1.91, Antilog (0.322) = 2.1]

4. Number of splitting configuration(s) against the given complex that is/are **INCORRECTLY** indicated.

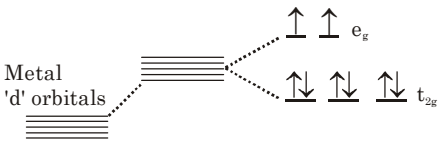
(i) $[Fe(CN)_6]^{4-}$



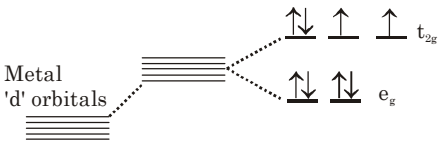
(ii) $[Mn(NH_3)_6]^{2+}$



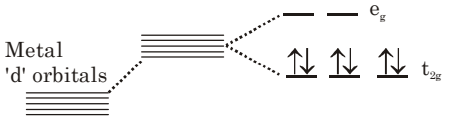
(iii) $[NiCl_4]^{2-}$



(iv) $[PtCl_4]^{2-}$



(v) $[Co(H_2O)_3F_3]$



5. Number of moles of CrO_3 required to oxidise 6 moles of 2-heptanol :

6. Calculate ΔG (in kJ/mol) for the change :
$H_2(g, 300K, 1 bar) \rightarrow H_2(g, 600K, 2 bar)$
Given that $H_2(g)$ is ideal and for $H_2(g)$, $C_{p,m}$ = 28.314 J/K-mol, S_{300K}, 1 bar = 130.0 J/K-mol.
($\ell n2 = 0.70$)

Space for Rough Work

PART-3 : MATHEMATICS

SECTION–I(i) : (Maximum Marks : 18)

- This section contains **SIX** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONLY ONE** of these four options is correct.
- For each question, darken the bubble corresponding to the correct option in the ORS.
- For each question, marks will be awarded in one of the following categories :

Full Marks : +3 If only the bubble corresponding to the correct option is darkened.
Zero Marks : 0 If none of the bubbles is darkened.
Negative Marks : –1 In all other cases

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1. Let $a_1, a_2, a_3, a_4 .... a_n, a_{n+1}, a_{n+2}$ forms an arithmetic progression. If $S_n = \sum_{i=1}^{n} \frac{a_i a_{i+1} a_{i+2}}{a_i + a_{i+2}}$ and $a_1 = 5$ and common difference of progression is 3 then value of S_{10} is

(A) 2637 (B) 2637.50 (C) 2636 (D) 2638

2. A variable chord PQ of parabola $y^2 = 4x$ is drawn parallel to a line $y = x$. Then which of the following point lies on the locus of point of intersection of the normals at P and Q.

(A) (7, 2) (B) (7, 1) (C) (3, 6) (D) (10, 2)

3. If $\lim\limits_{x\to 0^+}\left(\frac{\sin^2 x}{\left[\frac{x}{\pi}\right]+\frac{x^2}{\pi^2}}\right)\times\frac{\sin(\sin x)-\sin x}{ax^5+bx^3+c}=\frac{-\pi^2}{12}$. Then value of b + c is

(Where [.] denotes greatest integer function)

(A) 2 (B) 3 (C) 4 (D) –2

4. The coefficient of x^{70} in the product $(x - 1)(x^2 - 2)(x^3 - 3) ... (x^{12} - 12)$ is

(A) 4 (B) 5 (C) 6 (D) 7

5. If $\hat{i}\times[(\vec{a} - \hat{j})\times\hat{i}] + \hat{j}\times[(\vec{a} - \hat{k})\times\hat{j}] + \hat{k}\times[(\vec{a} - \hat{i})\times\hat{k}] = 0$ and let $\vec{b} = 2(\hat{i}+\hat{j}+\hat{k})$ then $(\vec{a}\,.\,\vec{b})$ is

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

6. If $z \in C$ then area enclosed by the curve $2|z^2 + |z|^2| + 3|z^2 - |z|^2| = 6|z|$, $z \neq 0$ is

(Where C denotes set of complex number)

(A) 3 unit^2 (B) 6 unit^2 (C) 3π unit^2 (D) 6π unit^2

Space for Rough Work

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

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

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7. A curve $y = f(x)$ satisfies differential equation $(1 + x^2)\frac{dy}{dx} + 2yx = 4x^2$ and passes through origin then

(A) The function $y = f(x)$ is increasing $\forall\ x \in R$

(B) The function $y = f(x)$ has minima but no maxima

(C) The area enclosed by $y = f^{-1}(x)$, the x-axis and line $x = \frac{2}{3}$ is $\frac{3}{2}\ell n2$

(D) The area enclosed by $y = f^{-1}(x)$, the x-axis and line $x = \frac{2}{3}$ is $\frac{2}{3}\ell n2$

Space for Rough Work

8. If a variable tangent of the circle $x^2 + y^2 = 1$ intersect the ellipse $x^2 + 2y^2 = 4$ at the points P and Q. If locus of point of intersection of tangents at P and Q is a conic C. Then which of the following is are true

(A) C is hyperbola

(B) C is ellipse

(C) eccentricity of C is $\frac{\sqrt{3}}{2}$

(D) eccentricity of C is 1

9. ABC is a triangle in which $\angle C = 2\angle B$. D is a point on BC such that AD bisects $\angle BAC$ and AC = BD. Then which of the following is/are true

(A) $\cos B + \cos C = \frac{\sqrt{5}}{2}$

(B) $\cos B - \cos C = \frac{1}{2}$

(C) $\frac{\sin A}{\sin C} = 1$

(D) $\frac{\sin A}{\sin C} = \frac{\sqrt{5}+1}{4}$

10. In kota city a person owns independently a mercedes car with probability $\frac{3}{10}$ and Audi with probability $\frac{4}{10}$. If he has mercedes only then he keeps a driver with probability $\frac{6}{10}$ where as if he owns Audi car only, then he keeps a driver with probability $\frac{7}{10}$ where as if he keeps both type of cars then his probability of keeping a driver is $\frac{9}{10}$. Then

(A) Probability that person keeps a driver is $\frac{412}{1000}$

(B) Probability that person keeps a driver is $\frac{71}{125}$

(C) Given that person keeps driver probability that he owns Audi car is $\frac{54}{103}$

(D) Given that person keeps driver, the probability that he own Audi car is $\frac{76}{103}$

Space for Rough Work

11. If the projection of the line $\frac{x}{2}=\frac{y-1}{2}=\frac{z-1}{1}$ on a plane P is $\frac{x}{1}=\frac{y-1}{1}=\frac{z-1}{-1}$. Then

(A) Equation of plane P is $x + y + 2z - 3 = 0$

(B) Equation of plane P is $x + y + 2z + 3 = 0$

(C) Distance of plane P from origin is $\sqrt{\frac{3}{2}}$

(D) Distance of plane P from point $(1, 1, -1)$ is $\frac{3}{\sqrt{6}}$

12. If Rolle's theorem is applicable to the function f defined by $f(x)=\begin{cases} ax^2+b & ; |x|<1 \\ 1 & ; |x|=1 \\ \frac{c}{|x|} & ; |x|>1 \end{cases}$ in the interval $[-3, 3]$ then which of the following alternative is/are correct.

(A) $a + b + c = 2$ (B) $|a| + |b| + |c| = 3$

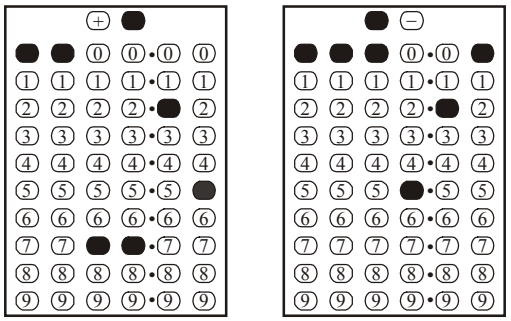
(C) $2a + 4b + 3c = 8$ (D) $4a^2 + 4b^2 + 4c^2 = 14$

Space for Rough Work

SECTION-II : (Maximum Marks: 24)

- This section contains **SIX** questions.
- The answer to each question is a **NUMERICAL VALUE**.
- For each question, enter the correct numerical value (in decimal notation, truncated/rounded-off to the **second decimal place**; e.g. 6.25, 7.00, –0.33, –.30, 30.27, –127.30, if answer is 11.36777..... then both 11.36 and 11.37 will be correct) by darken the corresponding bubbles in the ORS.

  For Example : If answer is –77.25, 5.2 then fill the bubbles as follows.



- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : +4 If ONLY the correct numerical value is entered as answer.
  Zero Marks : 0 In all other cases.

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1. For a polynomial g(x) with real coefficient, let m_g denote the number of distinct real roots of g(x). Suppose S is the set of polynomials with real coefficients defined by

$S = \{(x^2 - 1)^2 (a_0 + a_1x + a_2x^2 + a_3x^3) : a_0, a_1, a_2, a_3 \in R\}$.

For a polynomial f, let f' and f'' denote its first and second order derivatives, respectively. Then the minimum possible value of $(m\ f' + m\ f'')$, where $f \in S$, is _____

2. $f(x)$ is polynomial which satisfies $|f(x)| \leq |e^x - 1|\ \forall\ x \in \mathbb{R}$ and A = {x : x is all possible values of $f'(0)$}, then number of integer in set A is

3. Given two circle $x^2 + y^2 + 3\sqrt{2}(x + y) = 0$ and $x^2 + y^2 + 5\sqrt{2}(x + y) = 0$, the radius of third circle which is tangent to the two given circles and to their common diametre is

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Space for Rough Work

4. If N is the number of ways in which 5 distinct balls can be distributed among 3 people such that no person is left empty handed, then $\frac{N}{10}$ is equal to

5. Let F(x) be a non-negative continuous function defined on R such that $F(x) + F\left(x+\frac{1}{2}\right) = 1$. Then value of $\frac{1}{1000}\int_0^{1500} F(x)\,dx$

6. If (x, y) satisfy the equation $\tan^4 x + \tan^4 y + 2\cot^2 x \cot^2 y = 3 + \sin^2(x + y)$ sum of all the possible values of x where $x, y \in (0, 2\pi)$

Space for Rough Work

Space for Rough Work

QUESTION PAPER FORMAT AND MARKING SCHEME :

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

17. Each part has two sections as detailed in the following table.

Section	Que. Type	No. of Que.	Category-wise Marks for Each Question				Maximum Marks of the section
			Full Marks	Partial Marks	Zero Marks	Negative Marks	
I(i)	Single correct option	6	+3 If only the bubble corresponding to the correct option is darkened	—	0 If none of the bubbles is darkened	–1 In all other cases	18
I(ii)	One or more correct option(s)	6	+4 If only the bubble(s) corresponding to all the correct option(s) is(are) darkened	+1 For darkening a bubble corresponding to each correct option, provided NO incorrect option darkened	0 If none of the bubbles is darkened	–2 In all other cases	24
II	Numerical Value Type (Up to second decimal place)	6	+4 If only the bubble corresponding to correct answer is darkened	—	0 In all other cases	—	24

NAME OF THE CANDIDATE .....

FORM NO. .....

I have read all the instructions and shall abide by them.	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 Candidate	_____ Signature of the Invigilator