



Shri. A. R. Tambe Sir's
SHRADDHA
GROUP OF INSTITUTIONS

ONLINE TEST SERIES

SAMPLE QUESTION PAPER

SHRADDHA SAFALATA : JEE-ADVANCED - PAPER 1

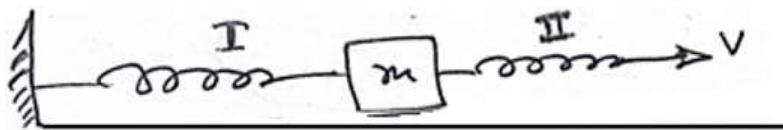
IMPORTANT INSTRUCTIONS

1. On the Answer Sheet, fill in the particulars on Side-1 and Side-2 carefully with blue/black ball point pen only.
2. The test is of 3 hours duration and this Test Booklet contains 75 questions. Each question carries 4 marks. For each correct response, the candidate will get 4 marks. For each incorrect response, one mark will be deducted from the total scores. The maximum marks are 300.
3. In this Test Paper, Each Subject will have two sections. Section A will be of Multiple-Choice Questions (MCQs) and Section B will contain Questions whose answers are to be filled in as a numerical value. There will be negative marking for incorrect answer in Section A and Section B. For each question in Section B, a candidate has to enter the correct integer value of the answer using the mouse and the on- screen virtual numeric keypad in the place designated to enter the answer. For Section B, the answer should be rounded off to the nearest integer.
4. In case of more than one option correct in any question, the best correct option will be considered as answer.
5. Use Blue/Black Ball Point Pen only for writing particulars on this page/markings responses.
6. Rough work is to be done on the space provided for this purpose in the Test Booklet only.
7. On completion of the test, the candidate must hand over the Answer Sheet to the Invigilator before leaving the Room/Hall. The candidates are allowed to take away this Test Booklet with them.
8. The candidates should ensure that the Answer Sheet is not folded. Do not make any stray marks on the Answer Sheet. Do not write your Form No. anywhere else except in the specified space in the Test Booklet/Answer Sheet.
9. Use of white fluid for correction is not permissible on the Answer Sheet.

SUBJECT : PHYSICS**SECTION 1 (Maximum Marks: 12)**

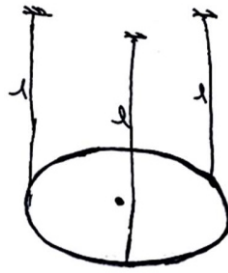
- This section contains **THREE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:
Full Marks : +4 **ONLY** if (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;
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, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to correct answers, then
choosing **ONLY** (A), (B) and (D) will get +4 marks;
choosing **ONLY** (A) and (B) will get +2 marks;
choosing **ONLY** (A) and (D) will get +2 marks;
choosing **ONLY** (B) and (D) will get +2 marks;
choosing **ONLY** (A) will get +1 mark;
choosing **ONLY** (B) will get +1 mark;
choosing **ONLY** (D) will get +1 mark;
choosing no option (i.e. the question is unanswered) will get 0 marks; and
choosing any other combination of options will get -2 marks.

- 1) A block of a mass m lies at rest on a smooth horizontal table, two identical springs with the same spring constant K are attached to it. The left end of the spring I is attached to a wall. The right side of the spring II is pulled at $t = 0$ at a constant velocity V .

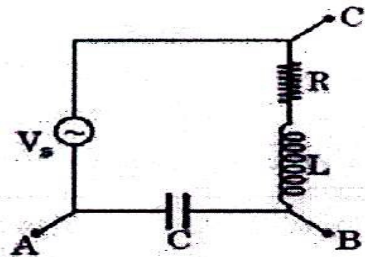


- The mass will have the velocity V for the first time after $\pi\sqrt{\frac{m}{2K}}$ time.
- The mass will have the velocity V for the first time after $\pi\sqrt{\frac{m}{K}}$ time.
- The mass will be at a distance $X = \frac{\pi}{2}\sqrt{\frac{m}{2K}}V$ from the initial at moment when it acquires speed V for first time.
- The mass will be at a distance $X = \frac{\pi}{2}\sqrt{\frac{2m}{K}}V$ from the initial at moment when it acquires speed V for first time.

- 2) A massive ring of mass m is suspended on three identical thin vertical threads of length L .



- 1) The period of small torsional oscillation of the ring about its axis is $T = 2\pi\sqrt{\frac{l}{g}}$
 - 2) The period of small torsional oscillation of the ring about its axis is $T = 2\pi\sqrt{\frac{l}{2g}}$
 - 3) The time period becomes $\sqrt{2}$ times if a small body of the same mass as that of the ring is placed at the ring center by light spokes.
 - 4) The time period becomes $\frac{1}{\sqrt{2}}$ times if a small body of the same mass as that of the ring is placed at the ring centre by light spokes.
- 3) Consider a series LRC circuit with an ac voltage V_s of varying frequency ω , as shown in the figure. A circuit which allows low frequency voltages, but blocks high frequency voltages is called low pass filter (LPF) and circuit which allows high frequency voltages but blocks low frequency voltages is called High-pass filter (HPF). When the output voltage (V_0) is measured :-

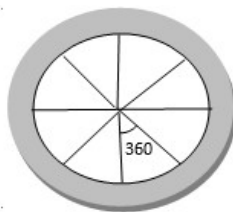


- 1) across A and B, the circuit behaves like a LPF because $\lim_{\omega \rightarrow 0} \frac{V_0}{V_s} = 1.0$ and $\lim_{\omega \rightarrow \infty} \frac{V_0}{V_s} = 0$
- 2) across B and C, the circuit behaves like a HPF because $\lim_{\omega \rightarrow \infty} \frac{V_0}{V_s} = 0$ and $\lim_{\omega \rightarrow 0} \frac{V_0}{V_s} = 1.0$
- 3) across B and C, the circuit behaves like a HPF because $\lim_{\omega \rightarrow 0} \frac{V_0}{V_s} = 0$ and $\lim_{\omega \rightarrow \infty} \frac{V_0}{V_s} = 1.0$
- 4) across B and C, the circuit behaves like a LPF because $\lim_{\omega \rightarrow 0} \frac{V_0}{V_s} = 0$ and $\lim_{\omega \rightarrow \infty} \frac{V_0}{V_s} = 1.0$

SECTION 2 (Maximum Marks: 12)

- This section contains **FOUR (04)** 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.

- 4) A video camera that takes 15 frames per second is filming the rotation of a bicycle wheel. If the bicycle wheel is rotating at 2 rotations per second and has 10 spokes, at what speed would it seem to rotating in the movies.

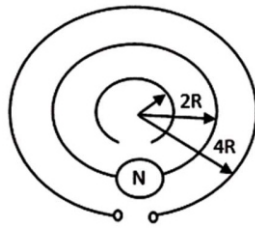


- 1) 0.25 rotations per sec in the same direction as the actual rotation.
 - 2) 0.25 rotations per sec in the opposite direction as the actual rotation.
 - 3) 0.5 rotations per sec in the same direction as the actual rotation.
 - 4) 0.5 rotations per sec in the opposite direction as the actual rotation.
- 5) A Carnot cycle operates using a heat reservoir at a temperature T_H and a cold reservoir at temperature T_C . How will the operation efficiency change if we decrease T_H and T_C by the same amount?
- 1) It increases
 - 2) It decreases
 - 3) It doesn't change
 - 4) It depends on how much we change T_H and T_C
- 6) The main scale of a vernier callipers reads in milli meter and its vernier scale is divided into 10 divisions which coincide with a division of the main scale. When the two jaws of the instrument touch each other the seventh division of the vernier scale coincides with a main scale division and the zero of the vernier lies to the right of the zero of the main scale. Further more, when a cylinder is tightly placed along its length between the two jaws, the zero of the vernier scale lies slightly to the left of 3.2 cm, and the fourth vernier division coincides with a main scale division. The measured value of the length of the cylinder is
- 1) 3.14 cm
 - 2) 3.24 cm
 - 3) 3.07 cm
 - 4) 3.17 cm
- 7) Suppose potential energy between electron and proton at separation r is given by $U = k \ln r$, where k is constant. For such hypothetical hydrogen atom, find the ratio of energy difference between energy levels ($n = 1$ and $n = 2$) and ($n = 2$ and $n = 4$) is
- 1) 1
 - 2) 4
 - 3) 5
 - 4) 6

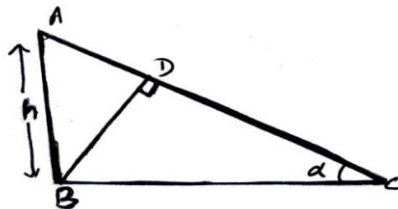
SECTION 3 (Maximum Marks: 24)

- 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.

- 8) Three open conductor rings made of thin wire are placed concentrically. Their radii are R , $2R$ and $4R$. A time varying current is allowed to flow in the middle ring, as a result an emf of V_0 is induced in the smallest ring. The emf induced in the largest ring is how much times V_0 .



- 9) Consider a frictionless inclined plane of height h and angle α . One end of an elastic string is connected to point B, the other end is passed through an orifice at point D in the plane and connected to a body of mass m initially stationary at point A. This body comes to rest at point C at the bottom of the inclined plane. The line drawn from point B to point D is perpendicular to side AC.



Knowing that the length of the string in unstretched state is equal to the length of segment BD, find the elastic constant in N/m.

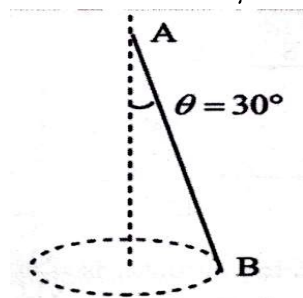
Data: $m = 2\text{kg}$; $\alpha = 30^\circ$; $h = 2\text{m}$; $g = 10\text{m/s}^2$.

- 10) The self inductance of coils shown in the fig (a) and fig (b) are $L_1 = 3\mu\text{H}$ and $L_2 = 2\mu\text{H}$ respectively. The self inductance of the coil shown in fig (c) in μH is _____.



- 11) A hydrogen like atom of atomic number Z is in excited state of quantum number $2n$. It can emit a maximum energy photon of 204 eV . If it makes a transition to the quantum state n , a photon of energy 40.8 eV is emitted. Calculate the atomic number Z . Ground state energy of hydrogen atom is -13.6 eV .
- 12) A non conducting uniform rod AB of mass charge Q uniformly spread over its length is rotated uniformly in a conical pendulum motion forming a constant angle $\theta = 30^\circ$ with

its axis of rotation. The magnetic moment of the rod μ . The angular momentum of the rod about A has a magnitude L . Find the value of $\frac{QL}{m\mu}$ in SI units?



- 13) A point (sound generating) source of power 6.5 milli watts, is placed at the centre of the hollow cylinder of length 24cm and it's radius of cross-section 5cm. Then the power passing through the lateral surface of the cylinder in milli watts is

SECTION 4 (Maximum Marks: 12)

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists: **List-I** and **List-II**.
- List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- 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 **ONLY** if the option corresponding to the correct combination 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.

- 14) A particle of mass m , charge q (positive) is released from the origin O with velocity $\vec{v} = v_0 \hat{i}$ in a uniform magnetic field $\vec{B} = \frac{B_0}{2} \hat{i} + \frac{\sqrt{3}B_0}{2} \hat{j}$. Assuming that the field extends all over the space. At $t = \frac{2pm}{B_0q}$ Match the following

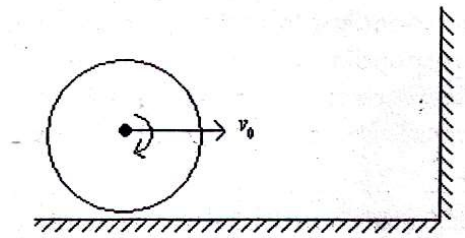
List-I	List-II
A) X-co-ordinate of the particle	P) $\frac{\sqrt{3}pmv_0}{2B_0q}$
B) Y-co-ordinate of the particle	Q) $\frac{pmv_0}{B_0q}$
C) Z-co-ordinate of the particle	R) $\frac{pmv_0}{2B_0q}$
D) Distance of the particle from origin	S) Zero

- 1) **A** **B** **C** **D**
 R P S Q

- 2) R P Q S
3) R S P Q
4) Q P S R

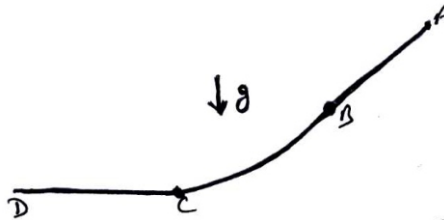
15) Consider the following diagram in which a sphere rolls towards a smooth vertical wall with uniform speed v_0 . The ground is rough and sufficiently long. List-I consists of the co-efficient of restitution 'e' and List- II consists of final speed of the sphere after collision with wall when rolling becomes pure. Match them

	List - I		List - II
(I)	$e = 1$	(P)	$\frac{4}{21}v_0$
(II)	$e = \frac{3}{4}$	(Q)	$\frac{1}{14}v_0$
(III)	$e = \frac{2}{3}$	(R)	$\frac{3}{7}v_0$
(IV)	$e = \frac{1}{2}$	(S)	$\frac{1}{4}v_0$



- | | I | II | III | IV |
|----|----------|-----------|------------|-----------|
| 1) | R | S | P | Q |
| 2) | P | S | R | Q |
| 3) | Q | P | R | Q |
| 4) | S | P | Q | R |

16) An ant is sliding on a smooth straw starting from a point A without an initial velocity; the sloping straight segment AB is smoothly joined to an arc BC with a curvature radius R, and the arc is smoothly joined to a horizontal straight segment CD. If it gives that $AB : BC : CD = 1 : 2 : 3$ and the total length of the path is made smaller than R.



Let t_1 , t_2 and t_3 be the time take to slide AB, BC and CD portion respectively. Match the follows.

List I	List II
A) t_1	(p) $\frac{3}{2}\sqrt{\frac{R}{2g}}$
B) t_2	(q) $\frac{\pi}{2}\sqrt{\frac{R}{g}}$
C) t_3	(r) $2L\sqrt{\frac{2g}{R}}$
D) V_B	(s) $\sqrt{\frac{R}{8}}$
E) V_C	(t) $2L\sqrt{\frac{g}{R}}$

- | | A | B | C | D | E |
|----|----------|----------|----------|----------|----------|
| 1) | s | q | p | t | r |
| 2) | p | r | q | s | t |

- 3) t s r q p
4) q p s r t

- 17) An ideal monoatomic gas undergoes different types of process which are described in Column – I, match the corresponding effects in column – II. The letters has usual meaning.

List – I	List – II
A) $PV^{-2} = \text{constant}$	P) If volume increases then temperature will also increase
B) $PV^2 = \text{constant}$	Q) If volume increases then temperature decreases
C) $C = C_v + 2R$	R) for expands, heat will have to be supplied to the gas
D) $C = C_v - 2R$	T) If pressure increases the work done by gas is negative

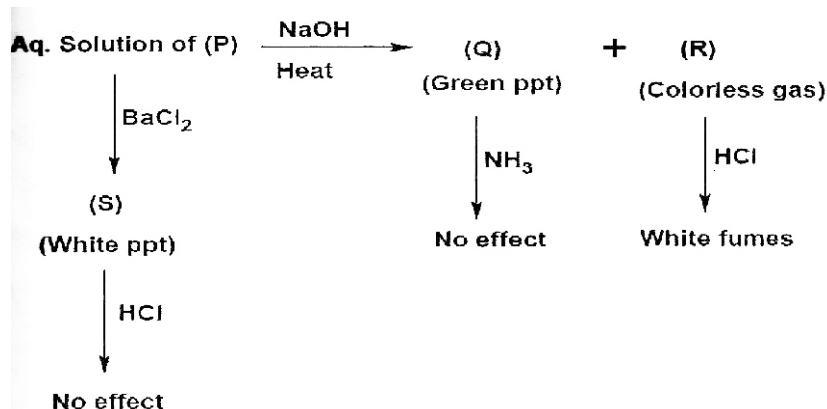
- | | A | B | C | D |
|----|-----|-----|------|----|
| 1) | PS | QT | RST | QT |
| 2) | QT | PRS | PQRS | QT |
| 3) | PRS | QT | PRST | QT |
| 4) | PRS | PS | RST | PS |

SUBJECT : CHEMISTRY

SECTION I (Maximum Marks: 12)

- This section contains **THREE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
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Partial Marks : +2 If three or more options are correct but **ONLY** two options are chosen, 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, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to correct answers, then
choosing **ONLY** (A), (B) and (D) will get +4 marks;
choosing **ONLY** (A) and (B) will get +2 marks;
choosing **ONLY** (A) and (D) will get +2 marks;
choosing **ONLY** (B) and (D) will get +2 marks;
choosing **ONLY** (A) will get +1 mark;
choosing **ONLY** (B) will get +1 mark;
choosing **ONLY** (D) will get +1 mark;
choosing no option (i.e. the question is unanswered) will get 0 marks; and
choosing any other combination of options will get - 2 marks

- 18) 2.0036 litre aqueous solution containing sufficient sodium salt of 2,3-dimethyl butan-1,4-dioic acid is electrolysed in an electrolytic cell using 9.65 mA current for 2×10^6 sec using inert Pt-electrodes with 100% current efficiency. Select the correct option(s): (Assume the density of water 1 g/ml, K_w of water at 25°C is 1×10^{-14} and consider that OH^- ions occupy negligible volume)
- 1) Mass of hydrocarbon formed at anode is 5.6 gm.
 - 2) pH of solution after electrolysis is 13 at 25°C
 - 3) Gas evolved at cathode occupies 2.24 litre volume at STP.
 - 4) Gas(es) evolved at cathode and anode occupies 8.96 litre volume at STP
- 19) Which of the following statements is/are correct?
- 1) An aqueous solution of Co(II) thiocyanate (10% freshly prepared) and mercuric nitrate solution taken in equal volumes on stirring the wall of the vessel with a glass rod produce deep – blue precipitate.
 - 2) White precipitate of $\text{Al}(\text{OH})_3$ is soluble in sodium hydroxide as well in ammonia solution
 - 3) Green precipitate of $\text{Cr}(\text{OH})_3$ readily dissolves in excess of sodium hydroxide forming a green solution
 - 4) Chromium (III) salts give green coloured borax bead in both oxidizing and reducing flame.
- 20) Consider the following sequence of reaction(s):



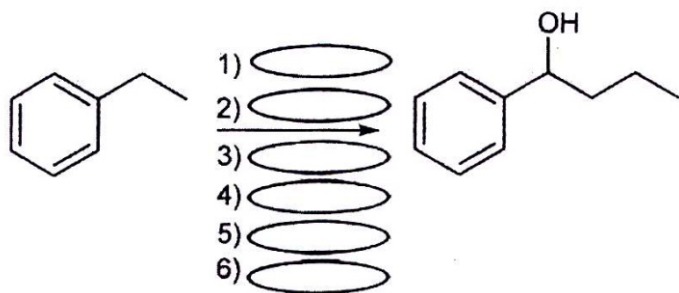
Which of the following statement(s) is (are) CORRECT?

- 1) (P) gives brown precipitate with alkaline $\text{K}_2[\text{HgI}_4]$
- 2) (Q) turns brown upon exposure to air
- 3) (P) gives blue precipitate with $\text{K}_4[\text{Fe}(\text{CN})_6]$ in absence of air
- 4) (P) gives red coloured solution with NH_4SCN

SECTION II (Maximum Marks: 12)

- This section contains **FOUR (04)** 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:
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Negative Marks : – 1 In all other cases.

21)



Propose the efficient synthesis for the above transformation in such a way that it uses exactly 6 reagents from the following pool.

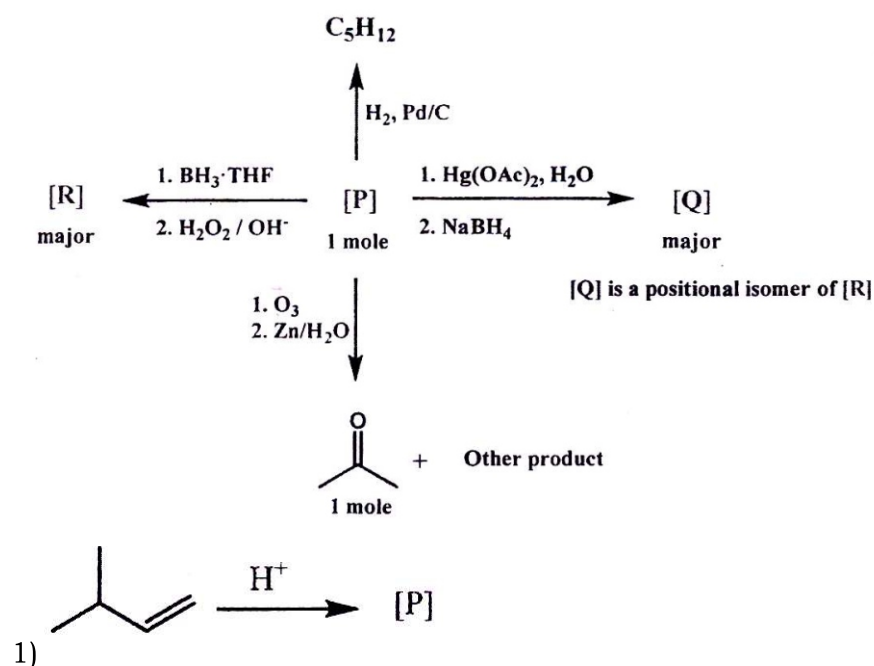
* NBS	* t- BuOK	* Conc. Sulphuric acid
* NaOEt	* n-PrMgBr	* H ₃ O ⁺
* DMS(Me ₂ S)	* BH ₃ .THF	* O ₃
* EtMgBr	* H ₂ O ₂ , NaOH	

How many of the following statements are correct. (Reagents 1, 2, 3, 4, 5 & 6 are the reagents used in the synthesis)

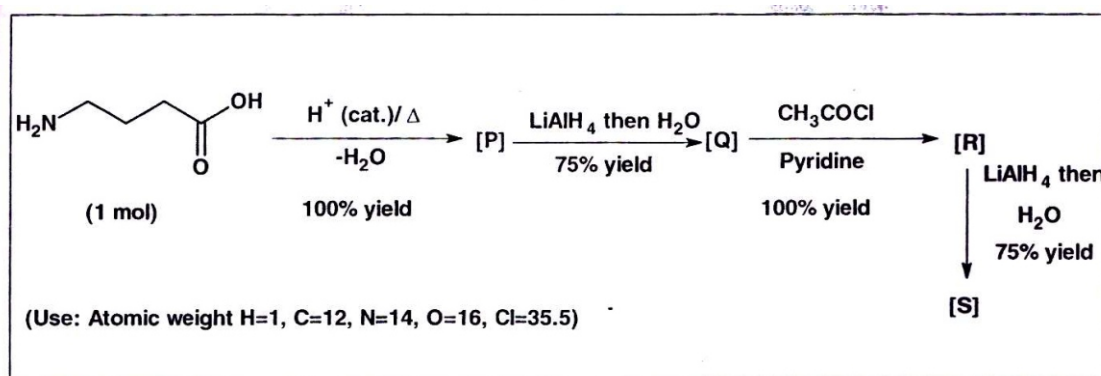
- i) 2nd reagent causes elimination. ii) EtMgBr is not used.
 iii) 5th reagent causes nucleophilic addition.
 iv) H₃O⁺ is the 4th reagent.
 v) Synthesis begins with Free radical substitution
 vi) Synthesis involves reductive ozonolysis but not oxidative ozonolysis.
 vii) BH₃—THF is used as 3rd reagent.

1) 4 2) 5 3) 6 4) 7

22) Choose the correct options regarding given scheme? (in each stage consider major organic product)



- 2) [P] can exhibit geometrical isomerism
 3) [Q] can be oxidized with PCC
 4) other product in reaction scheme is 2 moles of formaldehyde
- 23) The solubility product of $\text{Ca}(\text{OH})_2$ at 250°C is 4.42×10^{-5} . A 500 mL of saturated solution of $\text{Ca}(\text{OH})_2$ is mixed with equal volume of 0.4 M NaOH. How much $\text{Ca}(\text{OH})_2$ in milligrams is precipitated?
 1) 758.2 mg 2) 725.2 mg 3) 785.2 mg 4) 658.2 mg
- 24) The weight of major organic product [S] formed in the following reaction sequence is:

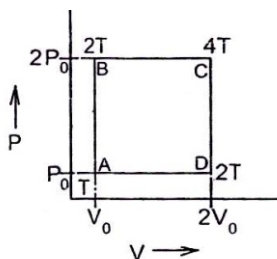


- 1) 55.69 g 2) 64.69 g 3) 74.25 g 4) 99.0g

SECTION III (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 on screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:
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- 25) The efficiency (in %) of the following cyclic process $A \rightarrow B \rightarrow C \rightarrow D \rightarrow A$ for 1-mole mono-atomic gas is $(x + 5.38)$ what is x ?

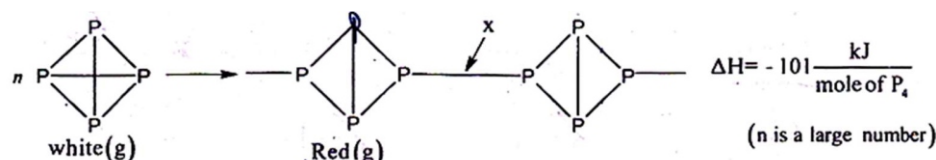


- 26) 0.20 mole of CO was taken in a 2.50 L flask maintained at 750 K along with a catalyst so that the following reaction could take place:

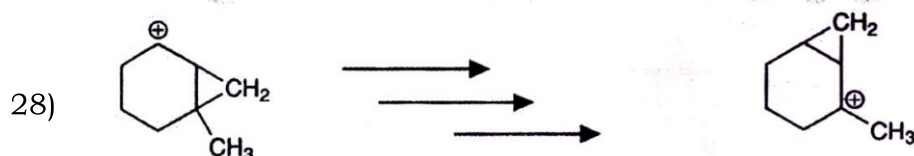


Hydrogen was introduced until the total pressure in the flask at equilibrium was 12.30 atm and 0.10 mole of CH_3OH was formed. The equilibrium constant of the reaction is around $1.83 \times 10^{-Y} \text{ atm}^{-2}$. Determine Y ($R = 0.082 \text{ lit atm/mol/K}$)

- 27) White phosphorous P_4 (s) is polymerised in to red phosphorous as:



The enthalpy of sublimation of $P_{4(s)} \rightarrow P_{4(g)}$ is 59 kJ/mol and enthalpy of atomization of $P_{4(s)}$ is 1265 kJ/mole. The P – P bond enthalpy in red phosphorus joining two tetrahedral $\left(\frac{\text{kJ}}{\text{mol}}\right)$ is



Above carbocation rearrangement is a multistep process which proceeds without '5' membered ring.

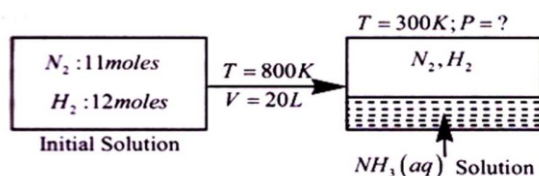
Number of hydride shift steps is 'A'

Number of methyl shift steps is 'B'

Total number of steps of rearrangement is 'C'

Find the value of $A \times B \times C$

- 29) 11 moles N_2 and 12 moles of H_2 mixture reacted in 20 litre vessel at 800K. After equilibrium was reached, 6 mole of H_2 was present. 3.58litre of liquid water is injected in equilibrium mixture and resultant gaseous mixture suddenly cooled to 300K. What the final pressure of gaseous mixture is $(x + 3.47)$ atm. What is x ? Neglect vapour pressure of liquid solution Assuming (i) all NH_3 dissolved in water (ii) no change in volume of liquid (iii) no reaction of N_2 and H_2 at 300K



- 30) 10 ml of mixture of CO , CH_4 and N_2 exploded with excess of oxygen gave a contraction of 6.5 mL. There was a further contraction of 7 ml, when the residual gas treated with KOH . What is the volume (ml) of CO in the original composition?

SECTION 4 (Maximum Marks: 12)

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists: **List-I** and **List-II**.
- List-I has Four entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- 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 **ONLY** if the option corresponding to the correct combination 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

- 31) Conductivity of 0.01 M HA solution is $3.8 \times 10^{-5} \text{ ohm}^{-1}\text{cm}^{-1}$, conductivity of mixture of 100 ml of 0.01 M HA and 1 m mol NaOH is $80 \times 10^{-5} \text{ ohm}^{-1} \text{ cm}^{-1}$

$$\lambda_{H^+}^{\circ} = 350 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$$

$$\lambda_{A^-}^{\circ} = 30 \text{ ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$$

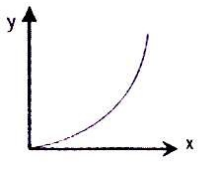
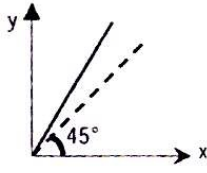
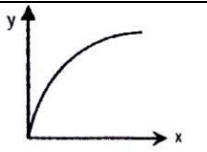
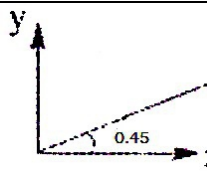
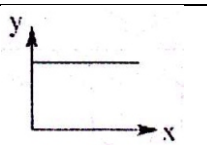
Assume no change in volume on addition of NaOH

	List - I		List - II
I	λ_m (HA) in $\text{ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$	P	80
II	λ_m (NaA) in $\text{ohm}^{-1} \text{ cm}^2 \text{ mol}^{-1}$	Q	4
III	pH of 0.01 M HA	R	5
IV	pH of mixture after addition of NaOH	S	3.8
		T	9

	I	II	III	IV
1)	S	P	R	T
2)	P	S	Q	T
3)	S	P	Q	T
4)	P	S	Q	R

- 32) Match the correct properties of compounds of list (I) with list (II) [Take Pressure in bar]

Volume in Litre: $R = 0.08 \text{ Latm/mol/K}$

	List - I		List - II
I	PV vs T^2 [n & V constant] [PV is taken on Y axis]	P	
II	PV vs T (n = 0.1 mol)	Q	
III	$\frac{P}{V}$ vs $\frac{1}{V^2}$ [n = 1 mol, T = 298 K]	R	
IV	V vs \sqrt{T} [n and P constant]	S	
		T	

	I	II	III	IV
1)	R	S	Q	P
2)	P	S	Q	R
3)	S	Q	R	T
4)	P	S	R	Q

- 33) Match the property of an ideal gas sample in Column – A with that of Column- B
 Given that: λ is mean free path

Z_1 is number of collision made by a single molecule with other molecules per unit time.

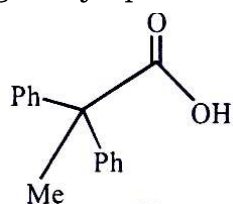
Z_{11} is number of Bimolecular collisions per unit time

	List – I		List – II
P	Average speed of a gas molecule	A	T (constant P)
Q	λ	B	P (constant T)
R	Z_1	C	\sqrt{T} (constant P)
S	Z_{11}	D	$T^{-3/2}$ (constant P)
		E	$T^{-1/2}$ (constant P)

	P	Q	R	S
1)	C	A	B, E	D
2)	B	A	C	D
3)	C	A	D	E
4)	A	C	E	B

- 34) The desired product X can be prepared by reacting the major product of the reactions in LIST-I with one or more appropriate reagents in LIST-II.

(given, order of migratory aptitude: aryl > alkyl > hydrogen)



(X) is

	List – I		List – II
P	 $+ \text{H}_2\text{SO}_4$	A	$1_2, \text{NaOH}$
Q	 $+ \text{HNO}_2$	B	$[\text{Ag}(\text{NH}_3)_2]\text{OH}$

R	$+ H_2SO_4$	C	Fehling solution
S	$+ AgNO_3$	D	HCHO, NaOH
		E	NaOBr

	P	Q	R	S
1)	A	B, C	A, D	B, D
2)	A, E	C, D	D, E	C
3)	A, E	C, D	E	B, D
4)	A, E	B, C	A, E	B, C

SUBJECT : MATHEMATICS

SECTION 1 (Maximum Marks: 12)

- This section contains **THREE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **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 **ONLY** if (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;
 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, in a question, if (A), (B) and (D) are the **ONLY** three options corresponding to correct answers, then
 choosing **ONLY** (A), (B) and (D) will get +4 marks;
 choosing **ONLY** (A) and (B) will get +2 marks;
 choosing **ONLY** (A) and (D) will get +2 marks;
 choosing **ONLY** (B) and (D) will get +2 marks;
 choosing **ONLY** (A) will get +1 mark;
 choosing **ONLY** (B) will get +1 mark;
 choosing **ONLY** (D) will get +1 mark;
 choosing no option (i.e. the question is unanswered) will get 0 marks; and
 choosing any other combination of options will get -2 marks.

- 35) A bug starts from the origin O (0,0) in the co-ordinate plane jumping from one point to another at the rate of one jump per second. IT moves according to the rule that from (m,n) it jumps to either (m, n + 1) or (m + 1, n), ($m, n \in W$), either been equally likely. Five second from the start bug reaches (α, β) then
- 1) The number of different values that $|\alpha - \beta|$ can take is 3
 - 2) Probability that bug reaches (α, β) if $|\alpha - \beta| = 1$, is $\frac{5}{8}$
 - 3) Probability that bug reaches (α, β) if $|\alpha - \beta| > 1$ is $\frac{1}{8}$
 - 4) Probability that bug reaches (α, β) if $|\alpha - \beta| > 1$ is $\frac{1}{3}$
- 36) L_1 is tangent drawn to the curve $x^2 - 4y^2 = 16$ at $A\left(5, \frac{3}{2}\right)$. L_2 is another tangent parallel to L_1 which meets the curve at B. L_3 and L_4 are normal to the curve at A and B. Lines L_1, L_2, L_3, L_4 form a rectangle, then
- 1) equation of tangent at B is $6y = 5x - 16$
 - 2) equation of normal at B is $12x + 10y + 75 = 0$
 - 3) radius of largest circle inscribed in the rectangle is $\frac{16}{\sqrt{61}}$
 - 4) Radius of the circle circumscribing the rectangle is $\sqrt{109}$
- 37) A line through the centroid G of an equilateral triangle ABC cuts the sides of the triangle AC at P, AB at N and extended side BC at M. Let the side of the triangle be l then
- 1) If X is foot of perpendicular on AC from G the $GX = \frac{l}{2\sqrt{3}}$
 - 2) If X is foot of perpendicular on AC from G the $GX = \frac{l}{\sqrt{3}}$
 - 3) IF $BM < CM$ then $BN < AN$
 - 4) Sum of perpendicular distances of A, C from the line is equal to perpendicular distance of B from the line.

SECTION 2 (Maximum Marks: 12)

- This section contains **FOUR (04)** 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.

- 38) Let A, B, C, D be the vertices of a regular tetrahedron each of whose edges measures 1 meter. A bug, starting from vertex A, observes the following rules, at each vertex it chooses one of the three edges meeting at that vertex, each edge being equally likely to be chosen, and crawls along that edge to the vertex at its opposite end. Let $p = \frac{n}{729}$ be

SECTION 4 (Maximum Marks: 12)

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists: **List-I** and **List-II**.
- **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **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 **ONLY** if the option corresponding to the correct combination 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.

48) Let $A = \begin{bmatrix} 2 & 1 \\ 1 & 0 \end{bmatrix}^n = \begin{bmatrix} a_{11}(n) & a_{12}(n) \\ a_{21}(n) & a_{22}(n) \end{bmatrix}$. If $\lim_{n \rightarrow \infty} \frac{a_{12}(n)}{a_{22}(n)} = \ell$ where $\ell^2 = \sqrt{a} + \sqrt{b}$ ($a, b \in \mathbb{N}$ & $a > b$)

List - I	List - II
I) a	P) Prime number
II) b	Q) Perfect square
III) a + b	R) Perfect cube
IV) $a^2 + b^2$	S) Multiple of 5
	T) Multiple of 10

The correct option is

	I	II	III	IV		I	II	III	IV
1)	Q	R	T	S	2)	Q	R	P	S
3)	P	S	R	T	4)	P	R	T	S

49)

List - I	List - II
P) If $\sqrt{x^2 + y^2} + \sqrt{(x+3)^2 + (y+4)^2} = 9 - a^2$ represent an ellipse then number of integral value of a is	1) 7
Q) If $a, b, c > 0$ & $a^2 = bc$ and $a + b + c = abc$ then the least possible value of a^2 is	2) 5
R) The minimum value of $n \in \mathbb{N}$ so that the sum of coefficient of terms in the expansion of $(a + b + c - d)^n$ is more than the number of terms is	3) 3
S) If $\lim_{x \rightarrow \infty} (8x^3 + ax^2)^{\frac{1}{3}} - bx$ exists & is equal to 1, then value of $a - 3b$ is equals to	4) 6
	5) 2

	P	Q	R	S		P	Q	R	S
1)	3	4	1	1	2)	2	1	4	1
3)	2	1	4	4	4)	3	3	1	4

50) Match each entry in List – I to the correct entries in List – II

List – I	List – II
P) Distance between the points on the curve $4x^2 + 9y^2 = 1$, where tangent is parallel to the line $8x = 9y$, is	1) $\frac{16}{5}$
Q) Sum of distances of the foci of the curve $25(x + 1)^2 + 9(y + 2)^2 = 225$ from $(-1, 0)$ is	2) 3
R) Sum of distances from the x – axis of the points on the ellipse $\frac{x^2}{9} + \frac{y^2}{4} = 1$ where the normal is parallel to the line $2x + y = 1$ is	3) $\frac{2}{\sqrt{5}}$
S) Tangents are drawn from points on the line $x - y + 2 = 0$ to the ellipse $x^2 + 2y^2 = 2$, then all the chords of contact pass through the point whose distance from $\left(2, \frac{1}{2}\right)$ is	4) 8
	5) 1

	P	Q	R	S		P	Q	R	S
1)	3	2	1	4	2)	3	2	5	4
3)	3	4	1	2	4)	3	1	2	4

51) Matching the following statement

List – I	List – II
P) If $\frac{dy}{dx} \left(\frac{1 + \cos x}{y} \right) = -\sin x$ and $f\left(\frac{\pi}{2}\right) = -1$ then $f(0)$ is	1) 5
Q) The number of points of non-derivability of the function $f(x) = \left[\frac{2x}{\pi} \right] \operatorname{sgn} \left(\frac{1}{\{x\}} \right)$ in $(-2, 2)$ is (where $[P]$, $\{P\}$ & $\operatorname{sgn}(P)$ denotes greater integer $\leq P$, fractional part of P & signum function of P respectively)	2) -2
R) The area bounded by $e^{\ln x+1 } \geq y , x \leq 1$ is	3) 4
S) Number of real values of x which satisfy the equation $\frac{(\sec^{-1} x)^3 + (\operatorname{cosec}^{-1} x)^3}{(\tan^{-1} x + \cot^{-1} x)^3} = 7$ is	4) 1
	5) 7

	P	Q	R	S		P	Q	R	S
1)	1	2	3	4	2)	2	1	3	4
3)	2	3	1	4	4)	2	1	4	3