



Shri. A. R. Tambe Sir's

SHRADDHA
GROUP OF INSTITUTIONS

ONLINE TEST SERIES SAMPLE QUESTION PAPER

SHRADDHA SARVOTTAM : JEE-MAINS

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.

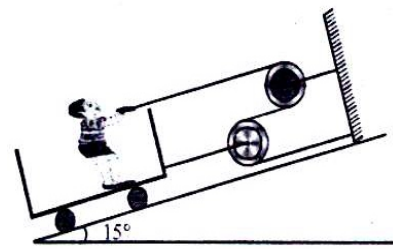
SUBJECT : PHYSICS

SECTION - A

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

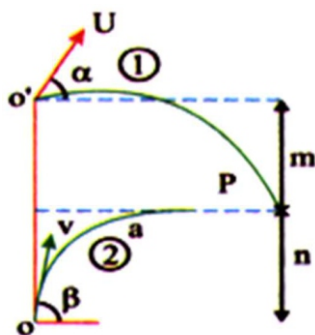
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.



- 1) A spherical body of mass m and radius r is allowed to fall in a medium of viscosity η . The time in which the velocity of the body increases from zero to 0.63 times the terminal velocity (v) is called time constant (τ). Dimensionally, τ can be represented by

1) $\frac{mr^2}{6\pi\eta}$ 2) $\sqrt{\frac{6\pi m r \eta}{g^2}}$
 3) $\frac{m}{6\pi\eta r v}$ 4) $\sqrt{\frac{r}{g}}$

- 2) Shots are fired simultaneously from the top and bottom of a vertical cliff at angles α and β and they strike an object simultaneously at the same point. If the horizontal distance of the object from the cliff is 'a', the height of the cliff is

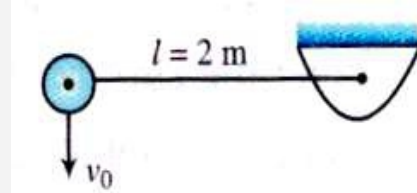


1) $\frac{a(\cot \alpha - \cot \beta)}{\cot \alpha \cot \beta}$ 2) $a(\sin \beta - \tan \alpha)$
 3) $\frac{a \tan \alpha}{\tan \beta}$ 4) $a(\cot \alpha - \cot \beta)$

- 3) A trolley is being pulled up an incline plane by a man sitting on it (as shown in figure). He applies a force of 250 N. If the combined mass of the man a trolley is 100 kg, the acceleration of the trolley will be [$\sin 15^\circ = 0.26$]

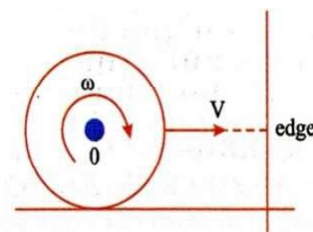
- 1) 2.4 m/s² 2) 9.4 m/s²
 3) 6.9 m/s² 4) 4.9 m/s²

- 4) A small sphere is given vertical velocity of magnitude $v_0 = 5 \text{ ms}^{-1}$ and it swings in a vertical plane about the end of a massless string. The angle θ with the vertical at which string will break, knowing that it can withstand a maximum tension equal to twice the weight of the sphere, is



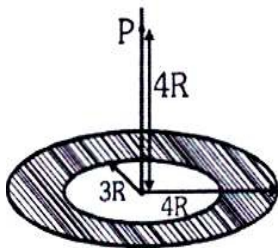
- 1) $\cos^{-1}\left(\frac{2}{3}\right)$ 2) $\cos^{-1}\left(\frac{1}{4}\right)$
 3) 60° 4) 30°

- 5) A uniform solid sphere of radius r is rolling on a smooth horizontal surface with velocity V and angular velocity ω ($V = \omega r$). The sphere collides with a sharp edge on the wall as shown. The coefficient of friction between the sphere and the edge $\mu = \frac{1}{5}$. Just after the collision the angular velocity of the sphere becomes equal to zero. The linear velocity of the sphere just after the collision is equal to

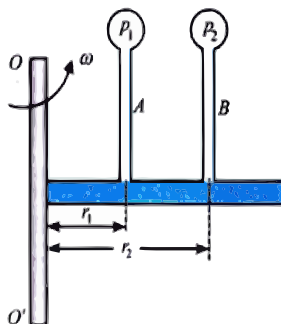


- 1) V 2) $\frac{V}{5}$ 3) $\frac{3V}{5}$ 4) $\frac{2V}{5}$

- 6) If the resultant of all the external forces acting on a system of particles is zero, then from an inertial frame, one can surely say that
- 1) linear momentum of the system does not change in time
 - 2) kinetic energy of the system does not change in time
 - 3) angular momentum of the system does not change in time
 - 4) potential energy of the system does not change in time
- 7) A thin uniform annular disc (see figure) of mass M has outer radius $4R$ and inner radius $3R$. The work required to take a unit mass from point P on its axis to infinity is



- 1) $\frac{2GM}{7R}(4\sqrt{2}-5)$
 - 2) $-\frac{2GM}{7R}(4\sqrt{2}-5)$
 - 3) $\frac{GM}{4R}$
 - 4) $\frac{2GM}{5R}(\sqrt{2}-1)$
- 8) A tube filled with water and closed at both ends uniformly rotates in a horizontal plane about the OO' axis. The manometers A and B fixed in the tube at distances r_1 and r_2 from rotational axis indicate pressures p_1 and p_2 , respectively. Determine the angular velocity ω of rotation of the tube.



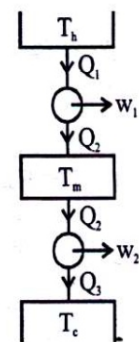
- 1) $\omega = \sqrt{\frac{2(p_2 - p_1)}{\rho(r_2^2 - r_1^2)}}$
- 2) $\omega = \sqrt{\frac{2(p_2 - p_1)}{\rho(r_2^2 + r_1^2)}}$
- 3) $\omega = \sqrt{\frac{2(p_2 - p_1)}{p_1 - p_2}}$
- 4) $\omega = \sqrt{\frac{2(p_2 - p_1)}{\rho r_1 r_2}}$

- 9) The density of water at the surface of the ocean is ρ . If the bulk modulus of water is B , then the density of ocean water at a depth where the pressure nP_0 is (P_0 is the atmospheric pressure)

- 1) $\frac{\rho B}{B - (n-1)P_0}$
- 2) $\frac{\rho B}{B + (n-1)P_0}$
- 3) $\frac{\rho B}{B - nP_0}$
- 4) $\frac{\rho B}{B + nP_0}$

- 10) Suppose that two heat engines are connected in series, such that the heat exhaust of the first engine is used as the heat input of the second engine as shown in figure. The efficiencies of the engines are η_1 and η_2 , respectively. The net efficiency of the combination is given by

- 1) $\eta_{net} = \eta_2 + (1 - \eta_1)\eta_2$
- 2) $\eta_{net} = \frac{\eta_1}{(1 - \eta_1)\eta_2}$
- 3) $\eta_{net} = \eta_1 + (1 - \eta_1)\eta_2$
- 4) $\eta_{net} = \frac{1 - \eta_1}{(1 - \eta_1)\eta_2}$



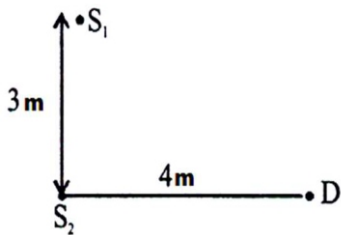
- 11) On an isothermal process, there are two points A and B at which pressures and volumes are $(2P_0, V_0)$ and $(P_0, 2V_0)$ respectively, If A and B are connected by a straight line, find the pressure at a point on this straight line at which temperature is maximum:

- 1) $\frac{4P_0}{3}$
- 2) $\frac{5}{4}P_0$
- 3) $\frac{3}{2}P_0$
- 4) $\frac{7}{5}P_0$

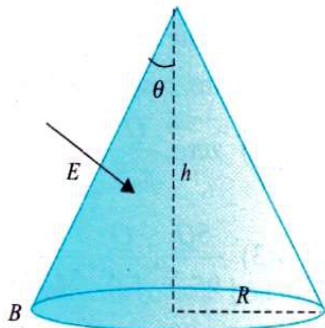
- 12) The time period of a bar pendulum when suspended at distances 30 cm and 50 cm from its centre of gravity comes out to be the same. If the mass of the body is 2 kg. Find out its moment of inertia about an axis passing through first point.

- 1) 0.24 kg-m^2
- 2) 0.72 kg-m^2
- 3) 0.48 kg-m^2
- 4) 0.32 kg-m^2

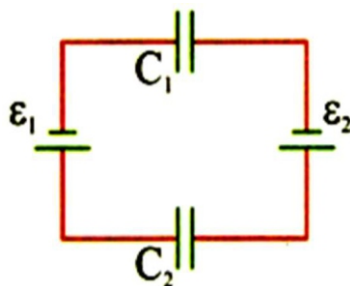
- 13) Two point sound source S_1 and S_2 are both have the same power and send out sound waves in the same phase. The wavelength of both the waves is $\frac{48}{5}$ m. The intensity due to S_2 alone at D is 25 W/m^2 . The resultant intensity at D is



- 1) 59 W/m^2 2) 73 W/m^2
3) 65 W/m^2 4) 83 W/m^2
- 14) A conic surface is placed in a uniform electric field E as shown in figure such that the field is perpendicular to the surface on the side AR. The base of the cone is of radius R , and the height of the cone is h . The angle of the cone is θ . Find the magnitude of the flux that enters the cone's curved surface from the left side. Do not count the outgoing flux ($\theta < 45^\circ$).



- 1) $ER [h \cos \theta + \pi(R/2) \sin \theta]$
2) $ER [h \sin \theta + \pi R/2 \cos \theta]$
3) $ER [h \cos \theta + \pi R \sin \theta]$
4) ER
- 15) Find the charge of each capacitor in the circuit shown in figure.



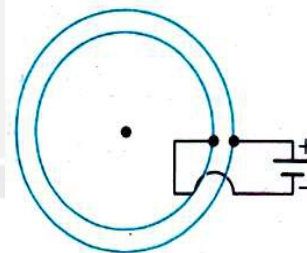
$$1) |q| = \frac{(\xi_2 + \xi_1)C_1C_2}{C_1 + C_2} \quad 2) |q| = \frac{(\xi_2 - \xi_1)C_1C_2}{C_1 + C_2}$$

$$3) |q| = \frac{(\xi_2 + \xi_1)C_1C_2}{C_1 - C_2} \quad 4) |q| = \frac{(\xi_2 - \xi_1)}{C_1 + C_2}$$

- 16) In the ideal double-slit experiment, when a glass-plate (refractive index 1.5) of thickness t is introduced in the path of one of the interfering beams (wavelength λ), the intensity at the position where the central maximum occurred previously remains unchanged. The minimum thickness of the glass-plate is:

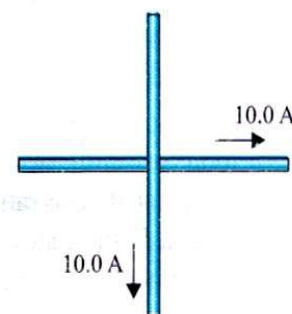
1) 2λ 2) $\frac{2\lambda}{3}$ 3) $\frac{\lambda}{3}$ 4) λ

- 17) A spherical shell, made of material of electrical conductivity $10^9/\pi \text{ } (\Omega\text{m})^{-1}$, has thickness $t = 2 \text{ mm}$ and radius $R = 10 \text{ cm}$. In an arrangement, its inside surface is kept at a lower potential than its outside surface. The resistance offered by the shell is equal to



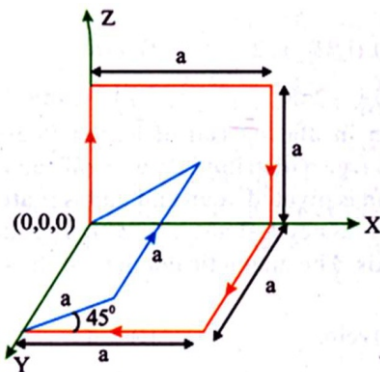
1) $5\pi \times 10^{-12} \Omega$ 2) $2.5 \times 10^{-11} \Omega$
3) $5 \times 10^{-12} \Omega$ 4) $5 \times 10^{-11} \Omega$

- 18) Two very long, straight wires carrying, currents as shown in figure. Find all locations where the net magnetic field is zero.



1) $y = \sqrt{2}x$ 2) $y = x$
3) $y = -x$ 4) $y = -(x/2)$

- 19) In the given loop length of each side is a . Current flowing through the loop is $I = 1$ Amp. Find its magnetic dipole moment.



- 1) $\frac{a^2}{\sqrt{2}}(\hat{j}) + \frac{a^2(1-\sqrt{2})}{\sqrt{2}}(\hat{i}) - a^2(\hat{k})$
 - 2) $\frac{a^2}{\sqrt{2}}(-\hat{i}) + \frac{a^2(1-\sqrt{2})}{\sqrt{2}}(\hat{k}) + a^2(-\hat{j})$
 - 3) $-a^2(\hat{i}) - \frac{a^2(1-\sqrt{2})}{\sqrt{2}}(\hat{j}) - \frac{a^2}{\sqrt{2}}(\hat{k})$
 - 4) $a^2\hat{i}$
- 20) The magnetic field in a region is given by $B = B_0\left(1 + \frac{x}{a}\right)\hat{k}$. A square loop of edge length d is placed with its edge along the X-axis and Y-axis. The loop is moved with a constant velocity $v = v_0\hat{i}$. The emf induced in the loop at $t = 0$ is

- 1) $\frac{v_0 B_0 d^2}{a}$
- 2) $\frac{v_0 B_0 d^2}{a^2}$
- 3) $v_0 B_0 d$
- 4) zero

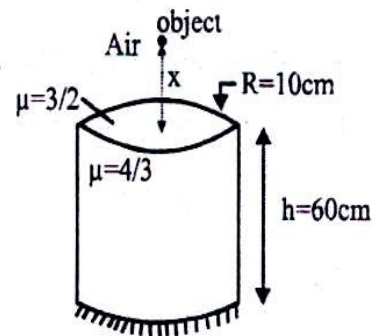
SECTION - B

(NUMERICAL VALUE ANSWER TYPE)

This section contains 05 questions. The answer to each question is a Numerical value. If the Answer in the decimals, Mark nearest Integer only question will be evaluated according to the following marking scheme:

Marking scheme: +4 for correct answer, -1 in all other cases.

- 21) To establish an instantaneous displacement current of 2A in the space between two parallel plates of $1\mu\text{F}$ capacitor, the potential difference across the capacitor plates will have to be changed at the rate of $n \times 10^6$. Find (n)
- 22) In the arrangement shown given that a biconvex lens of radius of curvature equal to 10 cm and concave mirror has focal length equal to 20 cm. Then the distance 'x' such that the final image formed by the system coincides with the object is $\frac{225}{x}$. Find (x)



- 23) After absorbing a slowly moving neutron of mass m_N (momentum ~ 0) a nucleus of mass M breaks into two nuclei of masses m_1 and $3m_1$ ($4m_1 = M + m_N$), respectively. If the de Broglie wavelength of the nucleus with mass m_1 is λ , then de-Broglie wavelength of the other nucleus will be $x\lambda$. Find (x)
- 24) The rest mass of the deuteron, ${}^2_1\text{H}$, is equivalent to an energy of 1876 MeV, the rest mass of a proton is equivalent to 939 MeV and that of a neutron to 940 MeV. A deuteron may disintegrate to a proton and a neutron if it captures a γ -ray photon of energy x Mev Find x :
- 25) On measuring diameter of a wire with help of screw gauge, main scale reading is 1 mm and 6th division of circular scale lying over reference line. On measuring zero error, it is found that zero of circular scale has advanced from reference line by 3 divisions on circular scale, then corrected diameter is $\frac{10.9}{x}$ mm. Find x

SUBJECT : CHEMISTRY

SECTION - A

(SINGLE CORRECT ANSWER TYPE)

This section contains 20 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

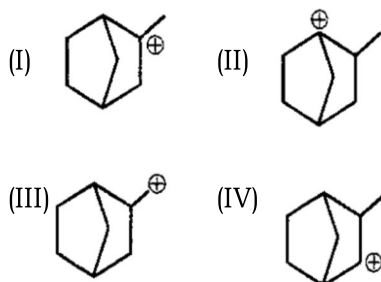
Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

- 26) What is the normal B.Pt of an aqueous solution whose freezing point is -2.45°C ?

($K_f = 1.86^{\circ}\text{C.kg/mol}$ $K_b = 0.512^{\circ}\text{C.kg/mol}$)

- 1) 100.7°C 2) 102.5°C
3) 109.0°C 4) 99.3°C

- 27) Find out correct stability order in the following carbocations-



- 1) $\text{IV} > \text{I} > \text{III} > \text{II}$
2) $\text{IV} > \text{III} > \text{I} > \text{II}$
3) $\text{I} > \text{IV} > \text{III} > \text{II}$
4) $\text{I} > \text{III} > \text{IV} > \text{II}$

28)

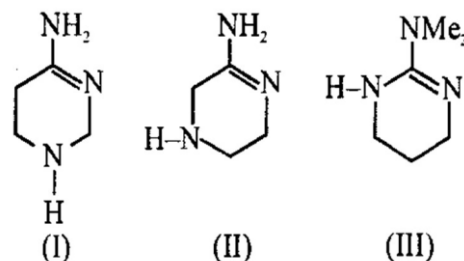
Type of isomerism	Pair of Examples
A) Ionisation	a) $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$
B) Linkage	b) $[\text{Cr}(\text{NH}_3)_6]$ $[\text{Co}(\text{CN})_6]$ & $[\text{Co}(\text{NH}_3)_6]$ $[\text{Cr}(\text{CN})_6]$
C) Coordination	c) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$ & $[\text{Co}(\text{NH}_3)_5(\text{ONO})]\text{Cl}_2$
D) Hydrate	d) $[\text{Co}(\text{SO}_4)(\text{NH}_3)_5]\text{Br}$ & $[\text{Co}(\text{Br})(\text{NH}_3)_5]\text{SO}_4$

The correct match is

	A	B	C	D
1)	a	b	c	d
2)	b	a	d	c

3)	d	c	b	a
4)	d	b	c	a

- 29) Correct decreasing order of basic strength



Of following compound-

- 1) $\text{III} > \text{II} > \text{I}$ 2) $\text{II} > \text{I} > \text{III}$
3) $\text{I} > \text{II} > \text{III}$ 4) $\text{III} > \text{I} > \text{II}$

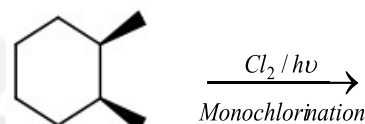
- 30) In a first order reaction, 50 minutes time is taken for the completion of 93.75% of a reaction. Half life of the reaction is

- 1) 25min 2) 12.5min
3) 20min 4) 10min

- 31) For an electron present in which of the following orbital for which $(n + l + m + s)$ value is maximum.

- 1) 3p 2) 5p
3) 4d 4) 5s

- 32) Select the correct statement/s



(I) Four 3° monochloro products will be obtained.


(II) Seven fractions are obtained on fractional distillation

(III) Eight 2° monochloro products will be obtained.

(IV) Only one 1° monochloro products will be obtained

- 1) I, II, IV 2) II, III, IV
3) Only IV 4) I, II, III

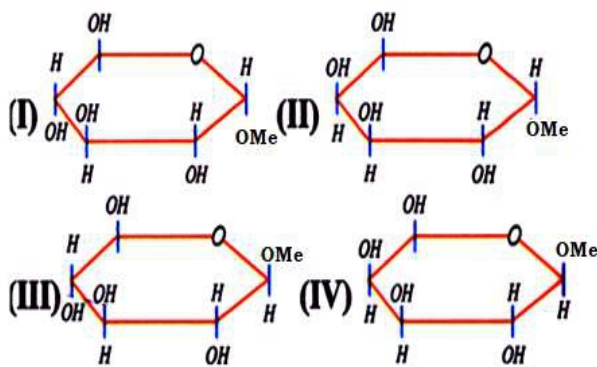
- 33) Among the following compounds, which one will react with acetone to give a product containing a carbon-nitrogen double bond?

- 1) $\text{C}_6\text{H}_5\text{NH}_2$ 2) $\text{C}_6\text{H}_5\text{NHC}_6\text{H}_5$
3) $(\text{CH}_3)_3\text{N}$ 4) 

34) Which of the following statements is not true?

- 1) F atom can hold additional electron more tightly than Cl atom
- 2) Cl atom can hold additional electron more tightly than F atom
- 3) The incoming electron encounters greater repulsion for F atom than for Cl atom
- 4) It is easier to remove an electron from F⁻ than Cl⁻

35)



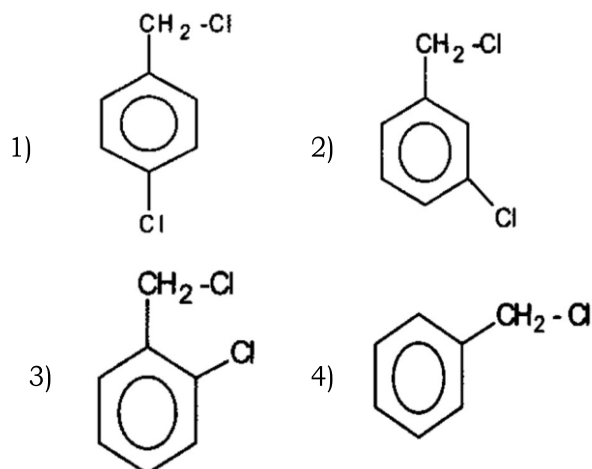
- 1) I & II are anomers, III and IV are epimers
- 2) I & III are epimers, II & IV are anomers
- 3) I & II are epimers, III & IV are anomers
- 4) I & III are anomers, I & II are epimers

36) Which of the following is correct electronic configuration of 3d orbital in excited state of central metal ion, when $[Ti(H_2O)_6]^{3+}$ absorbed yellow-green light.

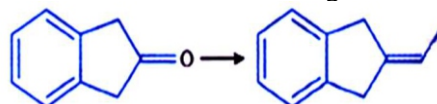
- 1) 3d

				1
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- 2) t_{2g}^1, e_g^0
- 3) t_{2g}^1, e_g^1
- 4) t_{2g}^0, e_g^1

37) An aromatic compound 'A', $C_7H_6Cl_2$, gives AgCl precipitate on heating with alcoholic $AgNO_3$ solution, and yields C_7H_7OCl on treatment with sodium hydroxide. A on oxidation gives a mono chloro benzoic acid which affords only one mono nitro derivative then, compound A is

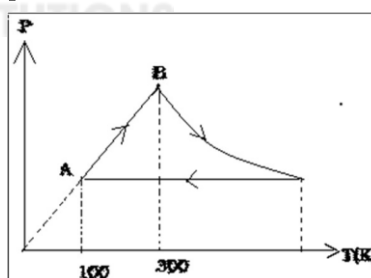


38) Which of the sets of reagents below should be used to effect the following transformation?



- 1) CH_3CH_2Br , $PPh_3/C_4H_9Li/THF/-78^\circ C$.
- 2) i) CH_3CH_2MgBr/Et_2O ; ii) H_2SO_4/Δ
- 3) i) $HC\equiv CNa/THF/-78^\circ C$;
ii) $H_2/Pd-C/BaSO_4/quinoline$
- 4) i) Br_2/CH_3CO_2H ; ii) Mg/Et_2O ;
iii) CH_3CHO ; iv) H_2SO_4/Δ

39) Calculate the net work done in the following cycle for 1 mole of an ideal gas, where in process BC, $P_T = \text{constant}$.



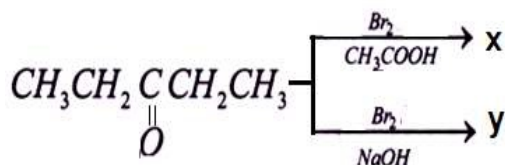
- 1) -1200R
- 2) +1200R
- 3) -800R
- 4) +800R

40) Which of the following statement is NOT CORRECT?

- 1) $La(OH)_3$ is less basic than $Lu(OH)_3$
- 2) In lanthanide series, ionic radius of Ln^{3+} ions decreases
- 3) La is actually an element of transition series rather than lanthanide series

4) Atomic radii of Zr and Hf are same because of lanthanide contraction.

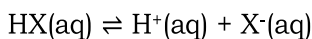
41) In the given reaction sequence



x, y respectively are

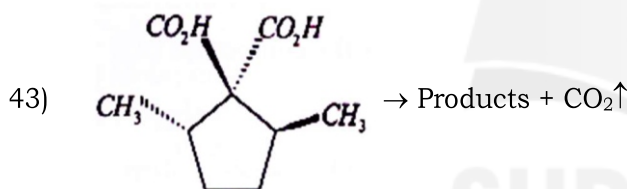
- 1) $\text{CH}_3\text{CH}_2\text{COCHBrCH}_3$ & $\text{CH}_3\text{CH}_2\text{COCBr}_2\text{CH}_3$
- 2) $\text{CH}_3\text{CH}_2\text{COCBr}_2\text{CH}_3$ & $\text{CH}_3\text{CH}_2\text{COCHBrCH}_3$
- 3) $\text{CH}_3\text{CH}_2\text{COCBr}_2\text{CH}_3$ & $\text{CH}_3\text{CH}_2\text{COCBrCH}_3$
- 4) $\text{CH}_3\text{CH}_2\text{COCHBrCH}_3$ & $\text{CH}_3\text{CH}_2\text{COCHBrCH}_3$

42) The freezing point of a 0.1M solution of weak acid (HX) is -0.20°C . What is the value of equilibrium constant for the reaction?



[Given: K_f for water = 1.8 K.kg/mol & Molality = Molarity]

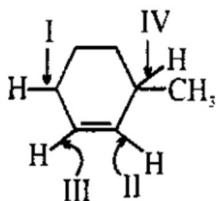
- 1) 1.46×10^{-4}
- 2) 1.35×10^{-3}
- 3) 1.21×10^{-2}
- 4) 1.35×10^{-4}



How many products will be formed when the above compound undergo de-carboxylation upon heating?

- 1) 0
- 2) 1
- 3) 2
- 4) 3

44) Which of the following C-H bonds participate in hyperconjugation?



- 1) I and II
- 2) I and IV
- 3) I and III
- 4) III and IV

45) Match the following

	Column - I (Orbital)	Column - II (Property)
P	s	A Have electron density at all three axes
Q	p_x	B YZ plane is nodal plane
R	d_{yx}	C dumbbell shape
S	$d_{x^2-y^2}$	D have azimuthal quantum no. $\ell = 2$

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

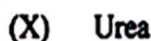
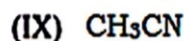
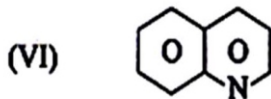
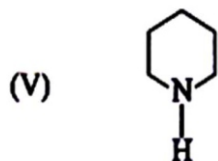
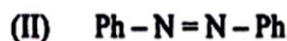
SECTION - B

(NUMERICAL VALUE ANSWER TYPE)

This section contains 05 questions. The answer to each question is a Numerical value. If the Answer in the decimals, Mark nearest Integer only question will be evaluated according to the following marking scheme:

Marking scheme: +4 for correct answer, -1 in all other cases.

- 46) In Carius method, 222 mg of magnesium pyrophosphate was produced from 0.1 g of an organic compound. The percentage of phosphorus in it is _____
- 47) The half-life period of a first order reaction is 1 hour. What is the time in hour taken for 87.5 % completion of the reaction?
- 48) The isoelectric point of Alanine if pka_1 and pka_2 is 2.3 and 9.7 respectively _____
- 49) The number of electrons required to reduce 1 mole of nitrate ion to hydrazine is _____
- 50) Amongst the following Kjeldahl's method can't be used for.



SUBJECT : MATHEMATICS

SECTION - A

(SINGLE CORRECT ANSWER TYPE)

This section contains 15 multiple choice questions. Each question has 4 options (1), (2), (3) and (4) for its answer, out of which ONLY ONE option can be correct.

Marking scheme: +4 for correct answer, 0 if not attempted and -1 if not correct.

51) Consider the equation

$$\sqrt{1 + \frac{3 \cos 2x}{\sqrt{\sin^4 x + 4 \cos^2 x} + \sqrt{\cos^4 x + 4 \sin^2 x}}}$$

$$= \sqrt{2} \sin^{-1}(\sin 2x), \quad x \in [-\pi, \pi]$$

1) Number of roots of this equation is 2

2) Number of roots of this equation is 3

3) One root lies in the interval $\left(\frac{\pi}{8}, \frac{\pi}{6}\right)$

4) If $x \in [0, n\pi]$, $n \in \mathbb{N}$, number of roots will be $n^2 + 8$

52) If $f: \mathbb{R} \rightarrow \mathbb{R}$ is a twice differentiable function such that $f''(x) > 0$ for all $x \in \mathbb{R}$, and

$$f\left(\frac{1}{2}\right) = \frac{1}{2}, f(1) = 1, \text{ then}$$

1) $0 < f'(1) \leq \frac{1}{2}$ 2) $f'(1) \leq 0$

3) $f'(1) > 1$ 4) $\frac{1}{2} < f'(1) \leq 1$

53) If a is a real constant and A, B and C are variable angles and

$$\sqrt{a^2 - 4 \tan A} + a \tan B + \sqrt{a^2 + 4 \tan C} = 6a, \text{ then}$$

the least value of $\tan^2 A + \tan^2 B + \tan^2 C$ is

1) 6 2) 10

3) 12 4) 3

54) Of all the mappings that can be defined from the set $A: \{1, 2, 3, 4\} \rightarrow B\{5, 6, 7, 8, 9\}$, a mapping is randomly selected. The chance that the selected mapping is strictly monotonic, is

1) $\frac{1}{125}$ 2) $\frac{2}{125}$

3) $\frac{5}{4096}$ 4) $\frac{5}{2048}$

55) The value of

$$6 + \log_{\frac{3}{2}} \left(\frac{1}{3\sqrt{2}} \sqrt{4 - \frac{1}{3\sqrt{2}}} \sqrt{4 - \frac{1}{3\sqrt{2}}} \sqrt{4 - \frac{1}{3\sqrt{2}}} \dots \right) \text{ is}$$

1) 3 2) 4

3) 2 4) 5

56) The value of the limit

$$\lim_{x \rightarrow \frac{\pi}{2}} \left(\frac{4\sqrt{2}(\sin 3x + \sin x)}{\left(2\sin 2x \sin \frac{3x}{2} + \cos \frac{5x}{2}\right) - \left(\sqrt{2} + \sqrt{2} \cos 2x + \cos \frac{3x}{2}\right)} \right)$$

is _____

1) 16 2) 32

3) 8 4) 0

57) Let P be $(5, 3)$ and a point R on $y = x$ on the x -axis be such that $PQ + QR + RP$ is minimum. Then the coordinates of Q are

1) $(17/4, 0)$ 2) $(17, 0)$

3) $(17/2, 0)$ 4) $(8, 0)$

58) If $A = \sin \frac{2\pi}{7} + \sin \frac{4\pi}{7} + \sin \frac{8\pi}{7}$ and

$$B = \cos \frac{2\pi}{7} + \cos \frac{4\pi}{7} + \cos \frac{8\pi}{7} \text{ then } \sqrt{A^2 + B^2}$$

is equal to

1) 1 2) $\sqrt{2}$

3) 2 4) $\sqrt{3}$

59) Let r be the range and $S^2 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \bar{x})^2$ be the SD of a set of observations x_1, x_2, \dots, x_n , then

- 1) $S \leq r \sqrt{\frac{n}{n-1}}$ 2) $S = r \sqrt{\frac{n}{n-1}}$
3) $S \geq r \sqrt{\frac{n}{n-1}}$ 4) None of these

60) Let $b_i > 1$ for $i = 1, 2, \dots, 101$. Suppose $\log_e b_1, \log_e b_2, \dots, \log_e b_{101}$ are in Arithmetic Progression (A.P.) with the common difference $\log_e 2$. Suppose

- a_1, a_2, \dots, a_{101} are in A.P. such that $a_1 = b_1$ and $a_{51} = b_{51}$. If $t = b_1 + b_2 + \dots + b_{51}$ and $s = a_1 + a_2 + \dots + a_{51}$ then
1) $s > t$ and $a_{101} > b_{101}$
2) $s > t$ and $a_{101} < b_{101}$
3) $s < t$ and $a_{101} > b_{101}$
4) $s < t$ and $a_{101} < b_{101}$

61) The mirror image of the curve $\arg\left(\frac{z-3}{z-i}\right) = \frac{\pi}{6}$ in the real axis is

- 1) $\arg\left(\frac{z+3}{z+i}\right) = \frac{\pi}{6}$ 2) $\arg\left(\frac{z-3}{z+i}\right) = \frac{\pi}{6}$
3) $\arg\left(\frac{z+i}{z+3}\right) = \frac{\pi}{6}$ 4) $\arg\left(\frac{z+i}{z-3}\right) = \frac{\pi}{6}$

62) A plane mirror is placed at the origin so that the direction ratios of its normal are $(1, -1, 1)$. A ray of light, coming along the positive direction of the x -axis strikes the mirror. Then the direction ratios of the reflected ray are

- 1) $\frac{1}{3}, \frac{2}{3}, \frac{2}{3}$ 2) $\frac{-1}{3}, \frac{2}{3}, \frac{2}{3}$
3) $\frac{-1}{3}, \frac{-2}{3}, \frac{-2}{3}$ 4) $\frac{-1}{3}, \frac{-2}{3}, \frac{2}{3}$

63) The value $\sum_{r=0}^{20} r(20-r) \binom{20}{r}^2$ is equal to

- 1) $400^{39} C_{20}$ 2) $400^{40} C_{19}$

- 3) $400^{39} C_{19}$ 4) $400^{38} C_{20}$

64) In a polygon, no three diagonals are concurrent. If the total number of points of intersection of diagonals interior to the polygon is 70, then the number of diagonals of the polygon is

- 1) 20 2) 28
3) 8 4) 30

65) A series of concentric ellipses E_1, E_2, \dots, E_n are drawn such that E_n touches the extremities of the major axis of E_{n-1} and the foci of E_n coincide with the extremities of minor axis of E_{n-1} . If the eccentricity of the ellipses is independent of n , then the value of the eccentricity, is

- 1) $\frac{\sqrt{5}}{3}$ 2) $\frac{\sqrt{5}-1}{2}$
3) $\frac{\sqrt{5}+1}{2}$ 4) $\frac{1}{\sqrt{5}}$

66) If $y = y(x)$ satisfies the differential equation

$$8\sqrt{x}(\sqrt{9+\sqrt{x}})dy = \left(\sqrt{4+\sqrt{9+\sqrt{x}}}\right)^{-1} dx, x > 0$$

and $y(0) = \sqrt{7}$, then $y(256) =$

- 1) 80 2) 3
3) 16 4) 9

67) If the value of the integral $\int_1^2 e^{x^2} dx$ is α , then the

value of $\int_e^{e^4} \sqrt{\ln x} dx$ is -

- 1) $e^4 - e - \alpha$ 2) $2e^4 - e - \alpha$
3) $2(e^4 - e) - \alpha$ 4) $2e^4 - 1 - \alpha$

68) The coordinates of two points P and Q are (x_1, y_1) and (x_2, y_2) and O is the origin. If the circles are described on OP and OQ as diameters, then the length of their common chord is

- 1) $\frac{|x_1 y_2 + x_2 y_1|}{PQ}$ 2) $\frac{|x_1 y_2 - x_2 y_1|}{PQ}$
3) $\frac{|x_1 x_2 + y_1 y_2|}{PQ}$ 4) $\frac{|x_1 x_2 - y_1 y_2|}{PQ}$

- 69) Let \mathbb{R} be the set of real numbers and $f: \mathbb{R} \rightarrow \mathbb{R}$, be a differentiable function such that $|f(x) - f(y)| \leq |x - y|^3 \forall x, y \in \mathbb{R}$. If $f(10) = 100$, then the value of $f(20)$ is equal to
 1) 0 2) 10 3) 20 4) 100
- 70) Let $p(x)$ be a quadratic polynomial such that $p(0) = 1$. If $p(x)$ leaves remainder 4 when divided by $x - 1$ and it leaves remainder 6 when divided by $x + 1$; then:
 1) $p(2)$ 2) $p(-2) = 19$
 3) $p(-2) = 11$ 4) $p(2) = 11$

75)
$$\int \frac{(x^2 + 1)dx}{x\sqrt{x^2 + 2x - 1}\sqrt{1 - x^2 - x}} =$$

$$P \sin^{-1} \sqrt{x - \frac{1}{x}} + Q + C, \text{ then find } P^Q$$

SECTION - B

(NUMERICAL VALUE ANSWER TYPE)

This section contains 05 questions. The answer to each question is a Numerical value. If the Answer in the decimals, Mark nearest Integer only question will be evaluated according to the following marking scheme:

Marking scheme: +4 for correct answer, -1 in all other cases.

- 71) The $\frac{x+4}{3} = \frac{y+6}{5} = \frac{z-1}{-2}$ and $3x - 2y + z + 5 = 0 = 2x + 3y + 4z - k$ are coplanar for k is equal to
- 72) If $\vec{a}, \vec{b}, \vec{c}$ are non-coplanar, $[\vec{b} \ \vec{c} \ \vec{d}] = 24$ and $(\vec{a} \times \vec{b}) \times (\vec{c} \times \vec{d}) + (\vec{a} \times \vec{c}) \times (\vec{d} \times \vec{b}) + (\vec{a} \times \vec{d}) \times (\vec{b} \times \vec{c}) + k\vec{a} = \vec{0}$, then $\frac{k}{8} = \underline{\hspace{2cm}}$.
- 73) If e_1, e_2, e_3 are the eccentricities of a parabola (P) ellipse (E) and hyperbola (H) respectively and $e_1^2 + e_2^2 + e_3^2 = \frac{46}{9}, e_1^2 - e_2^2 + e_3^2 = \frac{44}{9}$ then the eccentricity of conjugate hyperbola of H is
- 74) Let
$$f(x) = \begin{cases} -x^3 + \frac{(b^3 - b^2 + b - 1)}{(b^2 + 3b + 2)}, & 0 \leq x < 1 \\ 2x - 3, & 1 \leq x \leq 3 \end{cases}$$

 The smallest positive integral value of b for which $f(x)$ has its smallest value at $x = 1$ is $\underline{\hspace{2cm}}$.