

PAPER – 1

TEST CODE - 2004

CLASS – XII

BOOKLET - A

Date :- 27-06-2010

Duration : 3 Hours

Max. Marks : 237

INSTRUCTIONS

Each of the three parts of the paper contains Section A and Section C. Section A of each part contains 18 questions and section C contains 2 questions. Total number of pages are **28**. Please ensure that the Questions paper you have received contains ALL THE QUESTIONS in each part and each section and PAGES.

SECTION - A

- Q.1 to Q.8** has four choices (A), (B), (C), (D) out of which **only one is correct** & carry **4 marks** each. 1 mark will be deducted for each wrong answer.
- Q. 9 to Q.10** are Reasoning type questions, contains statement-1 (Assertion) & statement-2 (Reason) Each Question has 4 choices (A), (B), (C), (D) out of which **only one is correct** & carry **4 marks** each. 1 mark will be deducted for each wrong answer.
- Q.11 to Q.15** has four choices (A), (B), (C), (D) out of which **one or more than one is/are correct** & carry **4 marks** each. **1 mark** will be deducted for each wrong answer.
- Q.16 to Q. 18** are based upon a **paragraph**. Each Questions has 4 choices (A), (B), (C), (D) out of which **one or more than one is/are correct** & carry **3 marks** each. 1 mark will be deducted for each wrong answer.

SECTION - C

- Q.1 to Q.2** are **Integer answer type questions** (whose answer are upto 4 digits) & carry **5 marks** each. 1 mark will be deducted for each wrong answer.

NOTE : GENERAL INSTRUCTION FOR FILLING THE OMR ARE GIVEN BELOW.

- Use only **HB pencil** or **blue/black pen (avoid gel pen)** for darkening the bubble.
- Indicate the correct answer for each question by filling appropriate bubble in your OMR answer sheet.
- The Answer sheet will be checked through computer hence, the answer of the question must be marked by shading the circles against the question by dark **HB pencil or blue/black pen**.
- While filling the bubbles please be careful about **SECTIONS** [i.e. Section-A include single correct answers, reasoning type, multiple correct answers, paragraph type), Section-B (include matrix match type), Section-C (include integer answers type)].

SECTION-A	SECTION-B	SECTION-C																																				
<p>For example if only 'A' choice is correct then, the correct method for filling the bubble is</p> <p style="text-align: center;">A B C D E ● ○ ○ ○ ○</p> <p>For example if only 'A & C' choices are correct then, the correct method for filling the bubble is</p> <p style="text-align: center;">A B C D E ● ○ ● ○ ○</p> <p>the wrong method for filling the bubble are</p> <p style="text-align: center;">⊗ ⊗ ⊗ ⊗ ○</p> <p>The answer of the questions in wrong or any other manner will be treated as wrong.</p>	<p>For example If Correct match for (A) is P; for (B) is R, S; for (C) is Q, T; for (D) is P, Q, S then the correct method for filling the bubble is</p> <table style="margin-left: auto; margin-right: auto;"> <tr><td></td><td>P</td><td>Q</td><td>R</td><td>S</td><td>T</td></tr> <tr><td>A</td><td>●</td><td>○</td><td>○</td><td>○</td><td>○</td></tr> <tr><td>B</td><td>○</td><td>○</td><td>●</td><td>●</td><td>○</td></tr> <tr><td>C</td><td>○</td><td>●</td><td>○</td><td>○</td><td>○</td></tr> <tr><td>D</td><td>●</td><td>●</td><td>○</td><td>●</td><td>○</td></tr> </table>		P	Q	R	S	T	A	●	○	○	○	○	B	○	○	●	●	○	C	○	●	○	○	○	D	●	●	○	●	○	<p>Ensure that all columns are filled. Answers, having blank column will be treated as incorrect. Insert leading zero(s) if required :</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td>'6' should be filled as 0006</td> <td>'86' should be filled as 0086</td> <td>'1857' should be filled as 1857</td> </tr> <tr> <td style="text-align: center;"> ●●●○ ①①①① ②②②② ③③③③ ④④④④ ⑤⑤⑤⑤ ⑥⑥⑥● ⑦⑦⑦⑦ ⑧⑧⑧⑧ ⑨⑨⑨⑨ </td> <td style="text-align: center;"> ●●●○ ①①①① ②②②② ③③③③ ④④④④ ⑤⑤⑤⑤ ⑥⑥●● ⑦⑦⑦⑦ ⑧●⑧⑧ ⑨⑨⑨⑨ </td> <td style="text-align: center;"> ○①①① ●①①① ②②②② ③③③③ ④④④④ ⑤⑤⑤⑤ ⑥⑥●● ⑦⑦⑦● ⑧●⑧⑧ ⑨⑨⑨⑨ </td> </tr> </table>	'6' should be filled as 0006	'86' should be filled as 0086	'1857' should be filled as 1857	●●●○ ①①①① ②②②② ③③③③ ④④④④ ⑤⑤⑤⑤ ⑥⑥⑥● ⑦⑦⑦⑦ ⑧⑧⑧⑧ ⑨⑨⑨⑨	●●●○ ①①①① ②②②② ③③③③ ④④④④ ⑤⑤⑤⑤ ⑥⑥●● ⑦⑦⑦⑦ ⑧●⑧⑧ ⑨⑨⑨⑨	○①①① ●①①① ②②②② ③③③③ ④④④④ ⑤⑤⑤⑤ ⑥⑥●● ⑦⑦⑦● ⑧●⑧⑧ ⑨⑨⑨⑨
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PART - I [MATHEMATICS]

SECTION - (A)

[STRAIGHT OBJECTIVE TYPE]

Q.1 to Q.8 has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct

1. If $f(x) = |x^2 - 3x + 2| + |\sin x|$ then number of points where $f(x)$ is not differentiable in $[-\pi, \pi]$ is/are
(A) 1 (B) 3 (C) 4 (D) 5
2. The limit $\lim_{\theta \rightarrow 0} \left(\left[\frac{n \sin \theta}{\theta} \right] + \left[\frac{n \tan \theta}{\theta} \right] \right)$ is equal to
(where $[*] \rightarrow$ denotes greatest integer function and $n \in \mathbb{I}$)
(A) $2n$ (B) $2n + 1$ (C) $2n - 1$ (D) does not exist

(SPACE FOR ROUGHWORK)



3. If the equation $x^2 + 2|x + 4| = 0$ has integral roots then minimum value of a is
(A) 0 (B) -1 (C) -5/2 (D) +1
4. Which of the following is biggest
(A) $\sin 1 + \cos 1$ (B) $\sqrt{\sin 1} + \sqrt{\cos 1}$ (C) $\sqrt{1 + \sin 2}$ (D) 1
5. No. of values of x satisfying the equation $\log_{\sin 1} \sin x = \log_x x$ in $[0, 2\pi]$
(A) 0 (B) 1 (C) 2 (D) 4

(SPACE FOR ROUGHWORK)



6. The value of $\tan \left[\frac{\cos^{-1}(\sin(\cos^{-1} x)) + \sin^{-1}(\cos(\sin^{-1} x))}{2} \right]$ is
(A) 1 (B) 0 (C) -1 (D) Does not exist
7. If $\log\left(\frac{5c}{a}\right)$, $\log\left(\frac{3b}{5c}\right)$ & $\log\left(\frac{a}{3b}\right)$ are in A.P. and a, b, c are in G.P. then a, b, c are the lengths of sides of
(A) an isosceles Δ (B) an equilateral Δ (C) a scalene Δ (D) None of these
8. Let $f : \mathbb{R} \rightarrow \mathbb{R}$ and $g : \mathbb{R} \rightarrow \mathbb{R}$ are both one - one and onto functions such that they are mirror images of each other about the line $y = 0$, then $h(x) = f(x) + g(x)$ is
(A) one-one and onto (B) one-one but not onto (C) not one-one but onto (D) None of these

(SPACE FOR ROUGHWORK)



[REASONING TYPE]

Q.9 to Q.10 is Reasoning type question, contains Statement-1 (Assertion) and Statement-2 (Reason) Each questions has **four** choices (A), (B), (C), (D) out of which **ONLY ONE** is correct

9. **Statement-1** : The function $f(x)$ defined by $x + |f(x)| = 2f(x)$ is not differentiable at $x = 0$.
Statement-2 : $f(x)$ is not continuous at $x = 0$.
 (A) Statement (1) is true and statement (2) is true and statement (2) is correct explanation for (1)
 (B) Statement (1) is true and statement (2) is true and statement (2) is NOT correct explanation for (1)
 (C) Statement (1) is true but (2) is false
 (D) Statement (1) is false but (2) is true
10. **Statement-1** : $\frac{d}{dx} \{\tan^{-1}(\sec x + \tan x)\} = \frac{d}{dx} \{\cot^{-1}(\operatorname{cosec} x + \cot x)\}$, $x \in \left(0, \frac{\pi}{4}\right)$.
Statement-2 : $\sec^2 x - \tan^2 x = 1 = \operatorname{cosec}^2 x - \cot^2 x$.
 (A) Statement (1) is true, statement (2) is true and statement (2) is correct explanation for Statement (1)
 (B) Statement (1) is true, statement (2) is true and statement (2) is NOT the correct explanation for Statement (1)
 (C) Statement (1) is true but statement (2) is false
 (D) Statement (1) is false but statement (2) is true

(SPACE FOR ROUGH WORK)



[MULTIPLE OBJECTIVE TYPE]

Q.11 to Q.15 has four choices (A), (B), (C), (D) out of which **ONE OR MORE THAN ONE** is correct

11. The function defined as $f(x) = \lim_{n \rightarrow \infty} \begin{cases} \cos^{2n} x, & x < 0 \\ \sqrt[n]{1+x^n}, & 0 \leq x \leq 1 \\ \frac{1}{1+x^n}, & x > 1 \end{cases}$

then which of the following does not hold good

- (A) continuous at $x = 0$ but not at $x = 1$ (B) continuous at $x = 1$ but not at $x = 0$
 (C) continuous at both $x = 1$ & $x = 0$ (D) discontinuous both at $x = 1$ & $x = 0$

12. Let A_n & G_n be respectively arithmetic & geometric mean of 'n' positive integer $n + 1, n + 2, \dots, n + n$. then which of the following hold good

- (A) $\lim_{n \rightarrow \infty} \frac{A_n}{n} = \frac{2}{3}$ (B) $\lim_{n \rightarrow \infty} \frac{A_n}{n} = \frac{3}{2}$ (C) $\lim_{n \rightarrow \infty} \frac{G_n}{n} = e^{1/2}$ (D) $\lim_{n \rightarrow \infty} \frac{G_n}{n} = e^{1/4}$

(SPACE FOR ROUGH WORK)



13. If $f(\theta) = \begin{cases} \lim_{x \rightarrow 2} \frac{(\sin \theta)^x + (\cos \theta)^x - 1}{\{ |x-2| \}} , & \theta \neq \frac{\pi}{4} \\ -\frac{1}{2} \ln 2 , & \theta = \frac{\pi}{4} \end{cases}$ has

(where $\{*\} \rightarrow$ denotes fractional part function)

- (A) finite type non-removable discontinuity at $\theta = \frac{\pi}{4}$ (B) removable type discontinuity at $\theta = \frac{\pi}{4}$
 (C) jump of discontinuity is $\ln 2$ (D) function is continuous at $\theta = \frac{\pi}{4}$

14. For the quadratic polynomial $f(x) = 4x^2 - 8kx + k$, the statements which hold good is/are

- (A) there is only one integral k for which $f(x)$ is non-negative, $\forall x \in \mathbb{R}$
 (B) for $k < 0$ the number zero lies between the zeros of the polynomial.
 (C) $f(x) = 0$ has two distinct solutions in $(0, 1)$ for $k \in (1/4, 4/7)$
 (D) Minimum value of y , $\forall k \in \mathbb{R}$ is $k(1 + 12k)$

15. Let $f(x) = \lim_{n \rightarrow \infty} \frac{1-x^n}{1+x^n}$ then

- (A) $f(x)$ is a constant in $0 < x < 1$ (B) $f(x)$ is continuous at $x = 1$
 (C) $f(x)$ is not differentiable at $x = 1$ (D) None of these

(SPACE FOR ROUGH WORK)



[COMPREHENSION TYPE]

Q.16 to Q.18 are based upon a paragraph. Each questions has four choice (A), (B), (C), (D) out of which **ONE OR MORE THAN ONE** is correct

If a polynomial function $f(x)$ of degree n satisfies $f(x) = f'(x) \cdot f''(x) ; \forall x \in \mathbb{R}$

16. $f(x)$ may be an
 (A) onto function (B) into function (C) even function (D) odd function
17. If $f(x)$ has exactly two distinct real zeroes then the no. of points for which $y = |f(x)|$ is non-differentiable is/are
 (A) 0 (B) 1 (C) 3 (D) more than 3

18. If $f(x)$ is defined as $f(x) = \sum_{i=1}^n (-1)^{i-1} a_i x^i - 6$, where $a_i = 7 - 2i$ & $n \in \mathbb{N}$ and $h(x) = \begin{cases} \frac{f(x)}{x-2} , & x \neq 2 \\ 3 , & x = 2 \end{cases}$

- then which of the following does not hold good
 (A) $h(x)$ is continuous at $x = 2$
 (B) $h(x)$ is differentiable at $x = 2$
 (C) $h(x)$ has finite type non-removable discontinuity at $x = 2$
 (D) $h(x)$ has infinite type non-removable discontinuity at $x = 2$

(SPACE FOR ROUGH WORK)



SECTION - C
[INTEGER ANSWER TYPE]

Q.1 to Q.2 are INTEGER ANSWER TYPE Questions. (The answer of each of the questions are upto 4 digits)

1. Let f and g be differentiable functions satisfying $g'(a^2 + b^2) = 2$, $g(a^2 + b^2) = c$ and $f \circ g = I$ (Identity function) then $f'(c) = \frac{1}{N}$, The value of 'N' is equal to (where $N \in \text{natural number}$)
2. If $y = (\sin^{-1} x)^2 + (\cos^{-1} x)^2$ satisfies a differential equation $(1 - x^2)y_3 - pxy_2 - qy_1 = 0$ then $p + q$ is equal to (where $p, q \in \mathbb{N}$)

(SPACE FOR ROUGH WORK)



PART - II [PHYSICS]

SECTION - (A)

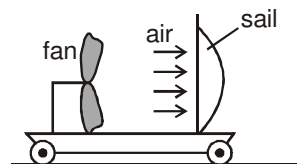
[STRAIGHT OBJECTIVE TYPE]

Q.1 to Q.8 has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct

1. A fan and a sail are mounted vertically on cart that is initially at rest on a horizontal table as shown in the diagram below.

When the fan is turned on an air stream is blown towards the right and is incident on the sail. The cart is free to move with negligible resistance forces. After the fan has been turned on then cart will.

- (A) move to the right and then to the left
(B) remain at rest
(C) move towards the right
(D) move towards the left



2. A rope of length L and mass M is being pulled on a rough horizontal floor by a constant horizontal force $F = Mg$. The force is acting at one end of the rope in the same direction as the length of the rope. The coefficient of kinetic friction between rope and floor is $1/2$. Then, the tension at the mid-point of the rope is :

- (A) $\frac{Mg}{4}$ (B) $\frac{2Mg}{5}$ (C) $\frac{Mg}{2}$ (D) none of these

3. An astronaut aboard the space shuttle, which is in orbit about the earth, is said to be weightless because :

- (A) there is no force of gravity on her
(B) a radially outwards force acts on her which cancels the force of gravity
(C) she is freely falling in the earth's gravitational field
(D) she is at such a position between the earth and the moon that their forces of gravity cancel each other.

(SPACE FOR ROUGH WORK)

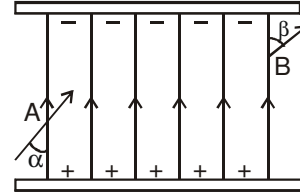


4. A particle of mass m is attached to one end of string of length ℓ while the other end is fixed to a point height h above the smooth horizontal table. The particle is made to revolve in a circle on the table so as to make n revolutions per second. The maximum value of n if the particle is to be in contact with the table will be :

(A) $\frac{1}{2\pi} \sqrt{\frac{g}{h}}$ (B) $\frac{1}{2\pi} \sqrt{\frac{g}{\ell}}$ (C) $\frac{1}{2\pi} \sqrt{\frac{g}{2h}}$ (D) None of these

5. A charged particle enters at point A and comes out from B. Its velocity makes angle α & β with electric field at these two points. Ratio of kinetic energy of charged particle (K_A/K_B) at these two point will be :

(A) $\frac{\sin^2 \alpha}{\sin^2 \beta}$ (B) $\frac{\sin^2 \beta}{\sin^2 \alpha}$
 (C) $\frac{\cos^2 \alpha}{\cos^2 \beta}$ (D) none of these

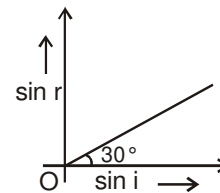


6. In a Young's double slit experiment light of wavelength 500 nm is used and the screen is at a distance of 2 m from the slits, plane. An observer close to the slits observes the fringes. His limit of resolution is 0.1° . The maximum slit separation, required for the person to resolve between different fringes is :
- (A) 1.72 mm (B) 1.00 mm (C) 0.86 mm (D) none of these

(SPACE FOR ROUGHWORK)



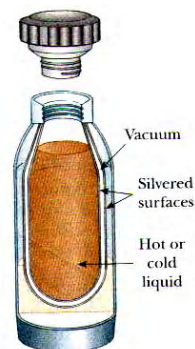
7. A ray of monochromatic light is incident on the plane surface of separation between two media 1 and 2 with angle of incidence 'i' in the medium 1 and angle of refraction 'r' in the medium 2. The graph shows the relation between sin r and sin i, then which of the following statements are correct :
- (A) the speed of light in the medium 2 is $\sqrt{3}$ times than in medium 1
 - (B) the speed of light in the medium 2 is $\frac{1}{\sqrt{3}}$ times than in medium 1
 - (C) the total internal reflection can take place when the incidence is in medium 1
 - (D) the total internal reflection can not take place when the incidence is in medium 2



8. The dewar flask is a container designed to minimize energy transfers by conduction, convection, and radiation. Such a container is used to store cold or hot liquid for long periods of time.

The standard construction (figure shown) consists of a double-walled Pyrex glass vessel with silvered walls. The space between the walls is evacuated. The silvered suraces minimize energy transfer by radiation because silver is a very good reflector and has very low emissivity. A further reduction in energy loss is obtained by reducing the size of the neck. Here the space between the walls is evacuated :

- (A) To minimize the heat tranfer by convection
- (B) To minimize the heat tranfer by convection & radiation
- (C) To minimize the heat tranfer by convection & conduction
- (D) To minimize the heat tranfer by conduction



(SPACE FOR ROUGH WORK)



[REASONING TYPE]

Q.9 to Q.10 is Reasoning type question, contains Statement-1 (Assertion) and Statement-2 (Reason) Each questions has **four** choices (A), (B), (C), (D) out of which **ONLY ONE** is correct

9. **STATEMENT-1** : Normal contact force offered by a horizontal surface on a block placed on it doesn't form an action-reaction pair with the weight of the block.
STATEMENT-2 : Contact force is electromagnetic in nature & weight is gravitational.
(A) Statement - I is true, statement - II is true and statement - II is correct explanation for statement - I
(B) Statement - I is true, statement - II is true and statement - II is NOT correct explanation for statement - I
(C) Statement - I is true, statement - II is false.
(D) Statement - I is false, statement - II is false.
10. **Statement - I** : A uniformly charged disc has a pin hole at its centre. The electric field at the centre of the disc is zero.
Statement - II : Disc can be supposed to be made up of many concentric uniformly charged rings each of which produce zero electric field at the centre.
(A) Statement - I is true, statement - II is true and statement - II is correct explanation for statement - I
(B) Statement - I is true, statement - II is true and statement - II is NOT correct explanation for statement - I
(C) Statement - I is true, statement - II is false.
(D) Statement - I is false, statement - II is false.

(SPACE FOR ROUGH WORK)

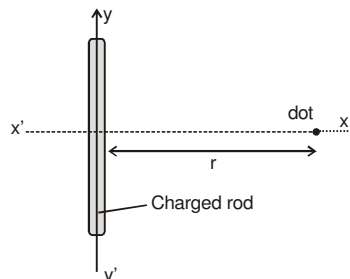


[MULTIPLE OBJECTIVE TYPE]

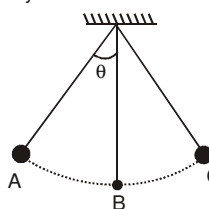
Q.11 to Q.15 has four choices (A), (B), (C), (D) out of which **ONE OR MORE THAN ONE** is correct

11. At two particular closest instant of time t_1 and t_2 the displacement of a particle in SHM are equal. Then it can be concluded that at the instants t_1 and t_2 the :
- (A) instantaneous velocities are equal (B) instantaneous acceleration are equal
 (C) phases of the motion are unequal (D) kinetic and potential energies are equal

12. A uniformly charged rod is kept on y-axis with centre at origin, as shown. Which of the following actions will increase the electric field strength at the position of the dot ?
- (A) make the rod longer without changing the charge
 (B) make the rod shorter without changing the charge
 (C) make the rod shorter without changing the linear charge density
 (D) rotate the rod about yy'



13. On the figure shown, a stone tied to a light string is oscillating between extreme points A and C in a vertical plane. Accelerations of stone are \vec{a}_A, \vec{a}_B and \vec{a}_C at the respective points then (Given : $\sin \theta = 4/5$)



- (A) $|\vec{a}_A| = |\vec{a}_B|$ (B) $\frac{8\vec{a}_B}{5} = \vec{a}_A + \vec{a}_C$ (C) $\vec{a}_A = \vec{a}_C$ (D) $(\vec{a}_A - \vec{a}_C) \cdot \vec{a}_B = 0$

(SPACE FOR ROUGH WORK)



14. Consider the image formation of a real or virtual object by a lens or mirror.
- (A) The line through a point object and its image passes through the centre of curvature of mirror.
- (B) The line through a point object and its image passes through the optical centre of lens if media on both sides of lens are same.
- (C) The line through a point object and its image passes through the optical centre of lens, even if the different media on two sides of the lens.
- (D) The line through a point object and its image passes through the pole of the mirror.

15. An insulating rod of uniform linear charge density λ and uniform linear mass density μ lies on a smooth table whose surface is xy -plane. A uniform electric field E is switched on.

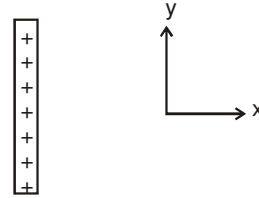
(A) If electric field is along x -axis, the speed of the rod when it has

travelled a distance d is $\sqrt{\frac{2\lambda Ed}{\mu}}$

(B) If electric field E is at an angle θ ($< 90^\circ$) with x -axis, the speed of the

rod when it has travelled a distance d is $\sqrt{\frac{2\lambda Ed \cos \theta}{\mu}}$

- (C) Torque on the rod due to the field about centre of mass in case B is into the plane of paper.
- (D) Torque on the rod due to the field about centre of mass in case B is zero.



(SPACE FOR ROUGH WORK)



[COMPREHENSION TYPE]

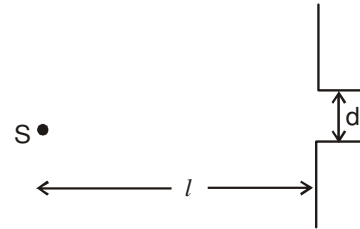
Q.16 to Q.18 are based upon a paragraph. Each questions has four choice (A), (B), (C), (D) out of which **ONE OR MORE THAN ONE** is correct

Paragraph for questions no. 16 to 18

An isotropic point source of light emits light uniformly in all direction in a spherical distribution. The visible energy emitted by the source per second is called luminous flux (ϕ). The amount of luminous flux crossing through

a small area 'ds' kept at a distance r from the source is $d\phi = \left(\frac{\phi}{4\pi r^2}\right) ds$.

Consider the following situation. A point source emitting a luminous flux ϕ is kept at a distance l from a screen. There is a hole of small diameter d in the screen directly in front of the source. (see figure)



16. Choose the correct option :

- (A) The amount of luminous flux that passes through the area is is propotional to r^{-1}
- (B) The amount of luminous flux that passes through the area is is propotional to r^{-2}
- (C) The amount of luminous flux that passes through the hole is $\frac{\phi d^2}{16l^2}$
- (D) The amount of luminous flux that passes through the hole is $\frac{\phi d^2}{l^2}$

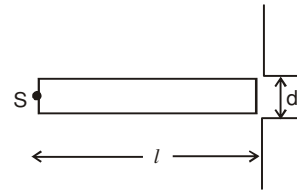
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A transparent cylinder made of glass (refractive index n) having a length l and diameter d is kept between the source and the hole.

All the flux emerging towards right enters into the cylinder.

The extreme rays from the source S , whose angle of incidence on the left face of cylinder is $\pi/2$ is refracted at an angle α into the cylinder.



17. According to snell's law, $\sin \alpha = \dots\dots\dots$

(A) $\frac{1}{n}$ (B) $\frac{1}{\sqrt{1-n^2}}$ (C) $\frac{n}{\sqrt{n^2-1}}$ (D) $\frac{\sqrt{n^2-1}}{n}$

The above refracted ray will be incident on lateral surface at an angle $\pi/2 - \alpha$. The value of refractive index n , for which the above ray suffers total internal reflection is n_0 .

18. The value of n_0 satisfy

(A) $n_0 > \sqrt{2}$ (B) $n_0 < \sqrt{2}$ (C) $n_0 > \frac{1}{\sqrt{2}}$ (D) $n_0 < \frac{1}{\sqrt{2}}$

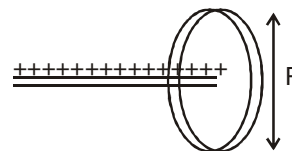
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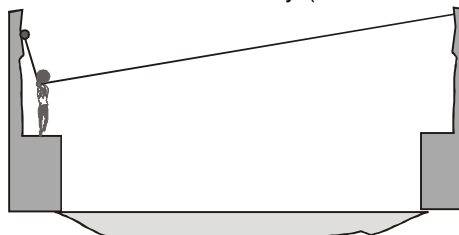
SECTION - C
[INTEGER ANSWER TYPE]

Q.1 to Q.2 are **INTEGER ANSWER TYPE** Questions. (The answer of each of the questions are upto 4 digits)

1. A ring of insulating material is situated at one corner of semi-infinite long line charge. If λ is charge per unit length for ring as well as line charge and R is radius of ring. Plane of ring is perpendicular to line charge. If the tension in the ring is T. Then find out $\frac{T}{K}$ [$\lambda = 10 \text{ C/m}$, $K = 9 \times 10^9 \text{ Nm}^2/\text{C}^2$]



2. A soldier has to cross a 80 m wide river on a ropeway grabbing on a pulley. The length of the rope is 100 m, its ends are fixed at the same height on both banks of the river and the rope is tight as shown. The soldier starts from a platform under one of the fixed points with zero initial velocity. (friction is absent everywhere.)



If the highest speed of the soldier during the crossing is v (in m/s). What is v^2 ?

(SPACE FOR ROUGHWORK)



PART - III [CHEMISTRY]

SECTION - (A)

[STRAIGHT OBJECTIVE TYPE]

Q.1 to Q.8 has four choices (A), (B), (C), (D) out of which **ONLY ONE** is correct

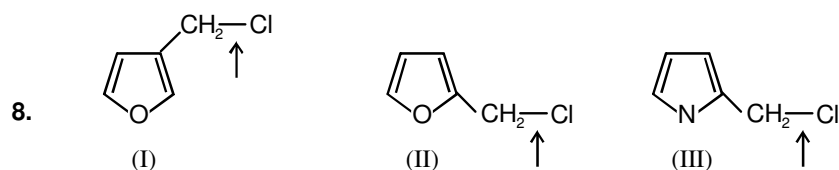
- At constant pressure and temperature, if the total entropy change for the system and surroundings during some process is positive then the free energy change for the process.
(A) positive (B) negative (C) Zero (D) Can't say
- Consider the reaction:

$$2\text{NO}(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons 2\text{NO}_2(\text{g})$$
 When nitrogen monoxide is reacted in the presence of oxygen, nitrogen dioxide is produced. At room temperature, the $\Delta H^\circ_{\text{RXN}}$ is about -115 kJ/mol and $\Delta S^\circ_{\text{RXN}}$ is about -150 J/K mol . Given this data how would you interpret this thermodynamic process with regard to enthalpy and entropy? Select the correct answer.
 (A) The reaction is exothermic (heat is released) and it is becoming more disordered.
 (B) The reaction is exothermic (heat is released) and it is becoming more ordered.
 (C) The reaction is endothermic (heat is absorbed) and it is becoming more ordered.
 (D) The reaction is endothermic (heat is released) and it is becoming more ordered.
- The potential energy of the electron present in the ground state of Li^{2+} ion is represented by :
 (A) $\frac{+3e^2}{4\pi\epsilon_0 r}$ (B) $\frac{-3e}{4\pi\epsilon_0 r}$ (C) $\frac{-3e^2}{4\pi\epsilon_0 r^2}$ (D) $\frac{-3e^2}{4\pi\epsilon_0 r}$

(SPACE FOR ROUGHWORK)



4. 6 gm of water is added to 118% oleum. What is the percentage labelling of new oleum formed.
 (A) 115.73% (B) 118% (C) 106% (D) 111.32%
5. Number of visible lines when an electron returns from 4th excited state to ground state in hydrogen spectrum
 (A) 6 (B) 10 (C) 3 (D) 4
6. Increase in the frequency of the incident radiations increases the
 (A) rate of emission of photo electrons (B) work function
 (C) Kinetic energy of photoelectrons (D) Threshold frequency
7. Equal masses of O₂ and N₂ are reacted according to the equation
 $O_2 + N_2 \rightarrow 2NO$
 Which statement is true?
 (A) O₂ is the limiting reagent and N₂ is present in excess.
 (B) N₂ is the limiting reagent and O₂ is present in excess.
 (C) All of O₂ and N₂ react and neither is in excess.
 (D) Nothing can be said about the limiting reagent.



Which of the following order is correct for the energy required for heterolytic cleavage of indicated C – Cl bonds producing carbocations?

- (A) I > II > III (B) III > II > I (C) II > III > I (D) I > III > II

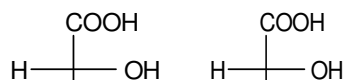
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[REASONING TYPE]

Q.9 to Q.10 is Reasoning type question, contains Statement-1 (Assertion) and Statement-2 (Reason) Each questions has **four** choices (A), (B), (C), (D) out of which **ONLY ONE** is correct

9. **Statement -1** : The thermodynamic function which determines the spontaneity of a process is the free energy. For a process to be spontaneous, the change in free energy must be negative.
Statement -2 : The change in free energy is related to the change in entropy. The change in entropy for a process must be always positive if it is spontaneous.
 (A) Statement (1) is True, statement (2) is True and statement (2) is correct explanation for Statement (1)
 (B) Statement (1) is True, statement (2) is True and statement (2) is NOT the correct explanation for Statement (1)
 (C) Statement (1) is true, statement (2) is false
 (D) Statement (1) is false, statement (2) is true
10. **Statement -1** : The necessary condition for compounds A & B to be distereoisomer, they must have atleast two chiral centre.



Statement -2 : $\begin{array}{c} \text{COOH} \\ | \\ \text{H} - \text{C} - \text{OH} \\ | \\ \text{COOH} \end{array}$ & $\begin{array}{c} \text{COOH} \\ | \\ \text{HO} - \text{C} - \text{H} \\ | \\ \text{COOH} \end{array}$ are distereoisomers.

- (A) Statement (1) is True, statement (2) is True and statement (2) is correct explanation for Statement (1)
 (B) Statement (1) is True, statement (2) is True and statement (2) is NOT the correct explanation for Statement (1)
 (C) Statement (1) is true, statement (2) is false
 (D) Statement (1) is false, statement (2) is true

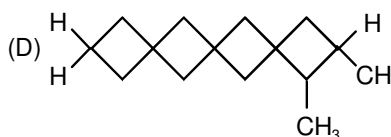
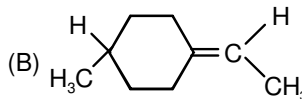
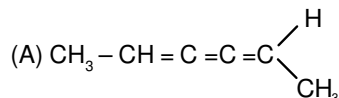
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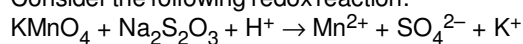
[MULTIPLE OBJECTIVE TYPE]

Q.11 to Q.15 has four choices (A), (B), (C), (D) out of which **ONE OR MORE THAN ONE** is correct

11. Which of following is chiral



12. Consider the following redox reaction:



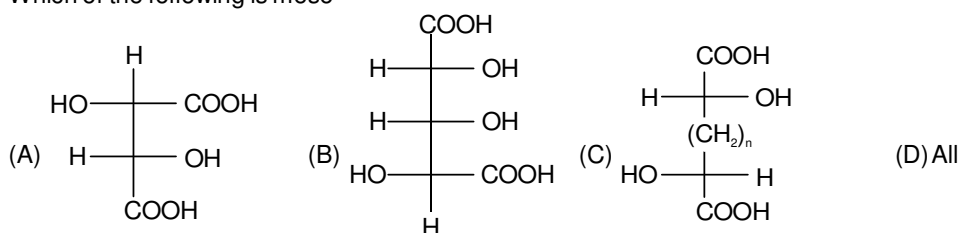
Which of the following is (are) true regarding the above redox reaction?

- (A) $\frac{5}{8}$ mol of $\text{Na}_2\text{S}_2\text{O}_3$ is oxidized by one mole of KMnO_4
 (B) Oxidation number of sulphur changes from + 4 to + 12 .
 (C) Change of medium from acidic to basic will have no effect on the stoichiometry of reaction.
 (D) Change in medium from acidic to basic will change the nature of product.

(SPACE FOR ROUGH WORK)



13. Which of the following is meso



14. Which of the following are correct;

- (A) Each atom has at least one orbital symmetrical about the nucleus.
 (B) Each orbit has at least one orbital symmetrical about the nucleus .
 (C) Number of electrons in Ne having their angular momentum equal to zero are four.
 (D) Number of waves made by an electron in an orbit is equal to number of orbit.



Where K_1 & K_2 are dissociation constants of (a) and K'_1 and K'_2 are dissociation constants of (b).

Which is the following option is/are incorrect.

- (A) $K_1 > K_2$ (B) $K'_1 > K'_2$ (C) $K_1 > K'_1$ (D) $K'_2 < K_2$

(SPACE FOR ROUGH WORK)



[COMPREHENSION TYPE]

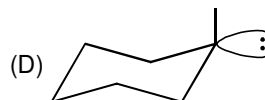
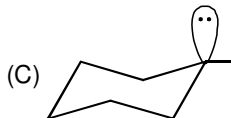
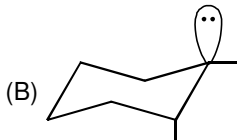
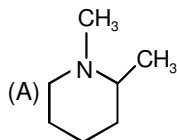
Q.16 to Q.18 are based upon a paragraph. Each questions has four choice (A), (B), (C), (D) out of which **ONE OR MORE THAN ONE** is correct

Conformers are formed due to free rotation of σ bond. Generally antistaggered form is more stable than gauche form but in some cases gauche becomes more stable. In case of cyclohexane chair form is more stable then boat form.

The stability of conformers of cyclohexane follows the order:

Chair > Twist boat > boat > half chair

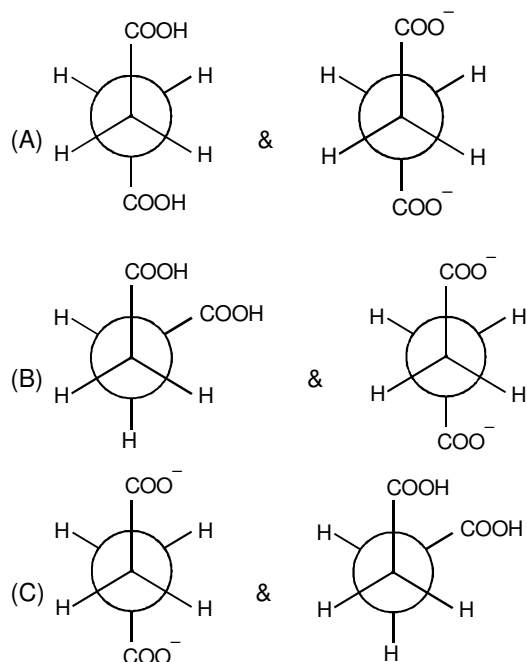
16. The most stable conformers of N, 2-dimethyl piperidene



(SPACE FOR ROUGH WORK)



17. The most stable conformer of succinic acid at $P^H = 10$ & $P^H = 3$

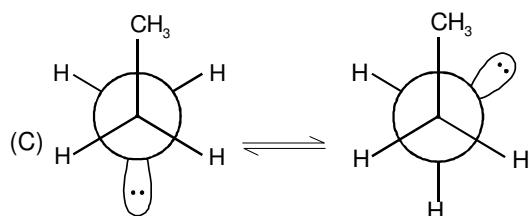
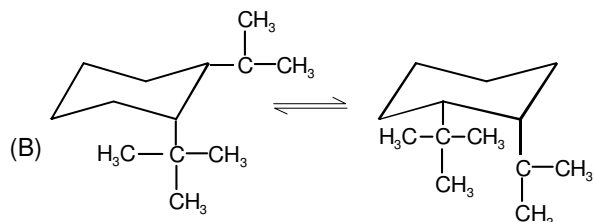
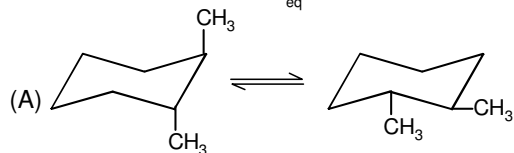


(D) None of these

(SPACE FOR ROUGH WORK)



18. In which transformation $k_{eq} > 1$.



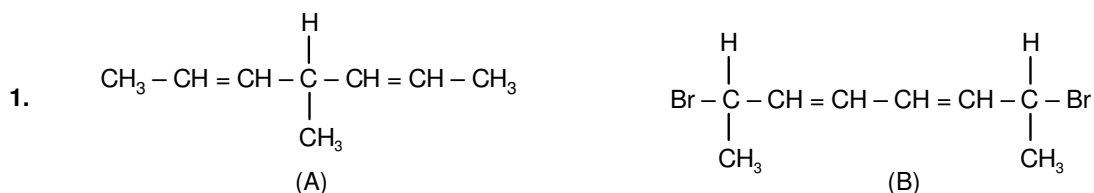
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SECTION - C

[INTEGER ANSWER TYPE]

Q.1 to Q.2 are **INTEGER ANSWER TYPE** Questions. (The answer of each of the questions are upto 4 digits)



Total stereo isomers of (A) is x & the total racemic mixture of (B) is y. Then sum of x and y is:

2. Total no. of isomers including optical & geometrical of Methyl-2,6-dibromo-5-ethyl-3,2-dimethylcyclohexanecarboxylate is :

(SPACE FOR ROUGH WORK)



Rough Space



MOTION IIT-JEE
(Where Faith Counts the Success)