

MHT CET 2023 Mathematics Memory Based Question Paper PDF

Mathematics

Question 1

If the slope of one of the lines represented by $ax^2 + (2a + 1)xy + 2y^2 = 0$ is reciprocal of the slope of the other, then the sum of squares of slopes is

Options:

- A. $\frac{17}{4}$
- B. $\frac{82}{9}$
- C. $\frac{97}{36}$
- D. 2

Question 2

In $\triangle PQR$, $\sin P$, $\sin Q$ and $\sin R$ are in A.P., then

Options:

- A. its altitudes are in A.P.
- B. its altitudes are in H.P.
- C. its medians are in G.P.
- D. its medians are in A.P.

Question 3

The value of $\tan^{-1} \left(\frac{\sqrt{1+x^2} + \sqrt{1-x^2}}{\sqrt{1+x^2} - \sqrt{1-x^2}} \right)$, $|x| < \frac{1}{2}$, $x \neq 0$

Options:

- A. $\frac{\pi}{4} + \frac{1}{2} \cos^{-1} x^2$
- B. $\frac{\pi}{4} + \cos^{-1} x^2$
- C. $\frac{\pi}{4} - \frac{1}{2} \cos^{-1} x^2$
- D. $\frac{\pi}{4} - \cos^{-1} x^2$

Question 4

If slope of a tangent to the curve $xy + ax + by = 0$ at the point $(1, 1)$ on it is 2, then $a - b$ is

Options:

- A. 3
- B. 1
- C. 2
- D. -1

Question 5

The equation of a line, whose perpendicular distance from the origin is 7 units and the angle, which the perpendicular to the line from the origin makes, is 120° with positive X-axis, is

Options:

- A. $x + \sqrt{3}y - 14 = 0$
- B. $x + \sqrt{3}y + 14 = 0$
- C. $x - \sqrt{3}y + 14 = 0$
- D. $x - \sqrt{3}y - 14 = 0$

Question 6

Let a, b, c be the lengths of sides of triangle ABC such that $\frac{a+b}{7} = \frac{b+c}{8} = \frac{c+a}{9} = k$. Then $\frac{(A(\triangle ABC))^2}{k^4} =$

Options:

- A. 36
- B. 32
- C. 38
- D. 40

Question 7

If the mean and S.D. of the data $3, 5, 7, a, b$ are 5 and 2 respectively, then a and b are the roots of the equation

Options:

- A. $x^2 - 10x + 18 = 0$
- B. $2x^2 - 20x + 19 = 0$
- C. $x^2 - 10x + 19 = 0$
- D. $x^2 - 20x + 18 = 0$

Question 8

A man takes a step forward with probability 0.4 and backwards with probability 0.6. The probability that at the end of eleven steps, he is one step away from the starting point is

Options:

- A. ${}^{11}C_6(0.24)^6$
- B. ${}^{11}C_6(0.24)^5$
- C. ${}^{11}C_6(0.4)^6(0.6)^5$
- D. ${}^{11}C_6(0.4)^5(0.6)^6$

Question 9

If $f'(x) = x - \frac{5}{x^5}$ and $f(1) = 4$, then $f(x)$ is

Options:

- A. $\frac{x^2}{2} + \frac{5}{4x^4} + \frac{5}{4}$
- B. $\frac{x^2}{2} - \frac{5}{4x^4} + \frac{9}{4}$
- C. $\frac{x^2}{2} + \frac{5}{4x^4} + \frac{9}{4}$
- D. $\frac{x^2}{2} - \frac{5}{4x^4} + \frac{5}{4}$

Question 10

A linguistic club of a certain Institute consists of 6 girls and 4 boys. A team of 4 members to be selected from this group including the selection of a Captain (from among these 4 members) for the team. If the team has to include utmost one boy, the number of ways of selecting the team is

Options:

- A. 95
- B. 260
- C. 320
- D. 380

Question 11

Negation of the statement "The payment will be made if and only if the work is finished in time." Is

Options:

- A. The work is finished in time and the payment is not made.
- B. The payment is made and the work is not finished in time.
- C. The work is finished in time and the payment is not made, or the payment is

made and the work is finished in time.

D. Either the work is finished in time and the payment is not made, or the payment is made and the work is not finished in time.

Question 12

The equation $x^3 + x - 1 = 0$ has

Options:

- A. no real root.
- B. exactly two real roots.
- C. exactly one real root.
- D. all three real roots.

Question 13

If a line L is the line of intersection of the planes $2x + 3y + z = 1$ and $x + 3y + 2z = 2$.

If line L makes an angle α with the positive X-axis, then the value of $\sec \alpha$ is

Options:

- A. $\sqrt{3}$
- B. 2
- C. 1
- D. $\sqrt{2}$

Question 14

The range of values of x for which $f(x) = x^3 + 6x^2 - 36x + 7$ is increasing in

Options:

- A. $(-\infty, -6) \cup (2, \infty)$
- B. $(-6, 2)$
- C. $(-\infty, -2) \cup (6, \infty)$
- D. $(-6, 2]$

Question 15

The maximum value of the function $f(x) = 3x^3 - 18x^2 + 27x - 40$ on the set $S = \{x \in \mathbb{R} / x^2 + 30 \leq 11x\}$ is

Options:

- A. 122
- B. 132

C. 112

D. 222

Question 16

Let p, q, r be three statements, then $[p \rightarrow (q \rightarrow r)] \leftrightarrow [(p \wedge q) \rightarrow r]$ is

Options:

A. equivalent to $p \leftrightarrow q$.

B. contingency.

C. tautology.

D. contradiction.

Question 17

$\int_1^2 \frac{dx}{(x^2-2x+4)^{3/2}} = \frac{k}{k+5}$, then k has the value

Options:

A. 1

B. 2

C. -1

D. -2

Question 18

The sides of a rectangle are given by the equations $x = -2, x = 4, y = -2$ and $y = 5$. Then the equation of the circle, whose centre is the point of intersection of the diagonals, lying within the rectangle and touching only two opposite sides, is

Options:

A. $x^2 + y^2 + 2x + 3y + 9 = 0$

B. $x^2 + y^2 - 2x + 3y + 9 = 0$

C. $x^2 + y^2 + 2x - 3y - 9 = 0$

D. $x^2 + y^2 - 2x - 3y - 9 = 0$

Question 19

$\bar{a} = \hat{i} + \hat{j} + \hat{k}, \bar{b} = \hat{j} - \hat{k}$, then vector $\bar{r}$ satisfying $\bar{a} \times \bar{r} = \bar{b}$ and $\bar{a} \cdot \bar{r} = 3$ is

Options:

A. $\frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$

B. $-\frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$

C. $\frac{5}{3}\hat{i} - \frac{2}{3}\hat{j} + \frac{2}{3}\hat{k}$

D. $-\frac{5}{3}\hat{i} + \frac{2}{3}\hat{j} + \frac{1}{3}\hat{k}$

Question 20

The magnitude of the projection of the vector $2\hat{i} + \hat{j} + \hat{k}$ on the vector perpendicular to the plane containing the vectors $\hat{i} + \hat{j} + \hat{k}$ and $\hat{i} + 2\hat{j} + 3\hat{k}$ is

Options:

- A. $\frac{2}{\sqrt{6}}$
- B. $\frac{1}{\sqrt{6}}$
- C. $\frac{5}{\sqrt{6}}$
- D. $\frac{7}{\sqrt{6}}$

Question 21

The shortest distance between the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ is

Options:

- A. $\frac{1}{\sqrt{14}}$ units.
- B. $\frac{1}{\sqrt{5}}$ units.
- C. $\frac{1}{\sqrt{11}}$ units.
- D. $\frac{1}{\sqrt{6}}$ units.

Question 22

If $\vec{a}$, $\vec{b}$ and $\vec{c}$ are any three non-zero vectors, then $(\vec{a} + 2\vec{b} + \vec{c}) \cdot [(\vec{a} - \vec{b}) \times (\vec{a} - \vec{b} - \vec{c})] =$

Options:

- A. $[\vec{a}\vec{b}\vec{c}]$
- B. $2[\vec{a}\vec{b}\vec{c}]$
- C. $3[\vec{a}\vec{b}\vec{c}]$
- D. $4[\vec{a}\vec{b}\vec{c}]$

Question 23

In $\triangle ABC$, with usual notations, $m\angle C = \frac{\pi}{2}$, if $\tan(\frac{A}{2})$ and $\tan(\frac{B}{2})$ are the roots of the equation $a_1x^2 + b_1x + c_1 = 0$ ($a_1 \neq 0$), then

Options:

- A. $a_1 + b_1 = c_1$
- B. $b_1 + c_1 = a_1$
- C. $a_1 + c_1 = b_1$
- D. $b_1 = c_1$

Question 24

If $\int \frac{\sin x}{3+4\cos^2 x} dx = A \tan^{-1}(B \cos x) + c$, (where c is a constant of integration), then the value of $A + B$ is

Options:

- A. $\frac{5}{2\sqrt{3}}$
- B. $\frac{-1}{2\sqrt{3}}$
- C. $\frac{-2}{\sqrt{3}}$
- D. $\frac{\sqrt{3}}{2}$

Question 25

Vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}| = 1$, $|\vec{b}| = 4$ and $\vec{a} \cdot \vec{b} = 2$. If $\vec{c} = 2\vec{a} \times \vec{b} - 3\vec{b}$, then the angle between $\vec{b}$ and $\vec{c}$ is

Options:

- A. $\frac{\pi}{6}$
- B. $\frac{5\pi}{6}$
- C. $\frac{\pi}{3}$
- D. $\frac{2\pi}{3}$

Question 26

If y is a function of x and $\log(x + y) = 2xy$, then the value of $y'(0)$ is

Options:

- A. 1
- B. -1
- C. 2
- D. 0

Question 27

If $\cos 2B = \frac{\cos(A+C)}{\cos(A-C)}$. Then $\tan A, \tan B, \tan C$ are in

Options:

- A. Geometric Progression.
- B. Arithmetic Progression.
- C. Harmonic Progression.
- D. Arithmetico-Geometric Progression.

Question 28

If $\log_2 x + \log_4 x + \log_8 x + \log_{16} x = \frac{25}{36}$ and $x = 2^k$ then k is

Options:

- A. 1
- B. $\frac{1}{2}$
- C. $\frac{1}{3}$
- D. $\frac{1}{8}$

Question 29

If $\begin{vmatrix} \cos(A+B) & -\sin(A+B) & \cos(2B) \\ \sin A & \cos A & \sin B \\ -\cos A & \sin A & \cos B \end{vmatrix} = 0$, then the value of B is

Options:

- A. $n\pi, n \in \mathbb{Z}$
- B. $(2n+1)\frac{\pi}{2}, n \in \mathbb{Z}$
- C. $(2n+1)\frac{\pi}{4}, n \in \mathbb{Z}$
- D. $2n\frac{\pi}{3}, n \in \mathbb{Z}$

Question 30

General solution of the differential equation $\log\left(\frac{dy}{dx}\right) = ax + by$ is

Options:

- A. $ae^{by} + be^{ax} = c_1$, where c_1 is a constant.
- B. $ae^{-by} + b^{-ax} = c_1$, where c_1 is a constant.
- C. $ae^{-by} + be^{ax} = c_1$, where c_1 is a constant.
- D. $ae^{by} + be^{-ax} = c_1$, where c_1 is a constant.

Question 31

$\int (\sqrt{\tan x} + \sqrt{\cot x}) dx =$

Options:

- A. $\sqrt{2} \sin^{-1}(\sin x - \cos x) + c$
- B. $\frac{1}{\sqrt{2}} \sin^{-1}(\sin x - \cos x) + c$
- C. $\sin^{-1}(\sin x - \cos x) + c$
- D. $2 \sin^{-1}(\sin x - \cos x) + c$

Question 32

If $Z_1 = 2 + i$ and $Z_2 = 3 - 4i$ and $\frac{\overline{Z_1}}{Z_2} = a + bi$, then the value of $-7a + b$ is

Options:

- A. 1
- B. -1
- C. $\frac{-3}{25}$
- D. $\frac{-9}{25}$

Question 33

Let $\alpha \in (0, \frac{\pi}{2})$ be fixed. If the integral $\int \frac{\tan x + \tan \alpha}{\tan x - \tan \alpha} dx = A(x) \cos 2\alpha + B(x) \sin 2\alpha + c$, then functions $A(x)$ and $B(x)$ are respectively

Options:

- A. $x + \alpha$ and $\log |\sin(x + \alpha)|$.
- B. $x - \alpha$ and $\log |\sin(x - \alpha)|$.
- C. $x - \alpha$ and $\log |\cos(x - \alpha)|$.
- D. $x + \alpha$ and $\log |\sin(x - \alpha)|$.

Question 34

Two adjacent sides of a parallelogram are $2\hat{i} - 4\hat{j} + 5\hat{k}$ and $\hat{i} - 2\hat{j} - 3\hat{k}$, then the unit vector parallel to its diagonal is

Options:

- A. $\frac{3}{7}\hat{i} - \frac{6}{7}\hat{j} + \frac{2}{7}\hat{k}$
- B. $\frac{2}{7}\hat{i} - \frac{6}{7}\hat{j} + \frac{3}{7}\hat{k}$
- C. $\frac{6}{7}\hat{i} - \frac{2}{7}\hat{j} + \frac{3}{7}\hat{k}$
- D. $\frac{1}{7}\hat{i} + \frac{1}{7}\hat{j} - \frac{3}{7}\hat{k}$

Question 35

A water tank has a shape of inverted right circular cone whose semi-vertical angle is $\tan^{-1}(\frac{1}{2})$. Water is poured into it at constant rate of 5 cubic meter/minute. The rate in meter/minute at which level of water is rising, at the instant when depth of water in the tank is 10 m is

Options:

- A. $\frac{1}{5\pi}$
- B. $\frac{1}{15\pi}$
- C. $\frac{2}{\pi}$
- D. $\frac{1}{10\pi}$

Question 36

The differential equation of all circles which pass through the origin and whose centres lie on Y-axis is

Options:

- A. $(x^2 - y^2) \frac{dy}{dx} - 2xy = 0$
- B. $(x^2 - y^2) \frac{dy}{dx} + 2xy = 0$
- C. $(x^2 - y^2) \frac{dy}{dx} + xy = 0$
- D. $(x^2 - y^2) \frac{dy}{dx} - xy = 0$

Question 37

If $x^k + y^k = a^k$ ($a, k > 0$) and $\frac{dy}{dx} + \left(\frac{x}{y}\right)^{\frac{1}{3}} = 0$, then k has the value

Options:

- A. 1/3
- B. 2/3
- C. 1/4
- D. 2/7

Question 38

The area (in sq. units) bounded by the curve $y = x|x|$, X-axis and the lines $x = -1$ and $x = 1$ is

Options:

- A. 2/3
- B. 1/3
- C. 1
- D. 4/3

Question 39

The co-ordinates of the point, where the line $\frac{x-1}{2} = \frac{y-2}{-3} = \frac{z+5}{4}$ meets the plane $2x + 4y - z = 3$, are

Options:

- A. (3, -1, -1)
- B. (3, 1, -1)
- C. (3, -1, 1)
- D. (-3, -1, -1)

Question 40

$\lim_{x \rightarrow 0} \frac{(1 - \cos 2x) \cdot \sin 5x}{x^2 \sin 3x}$ is

Options:

- A. $10/3$
- B. $5/3$
- C. $5/6$
- D. $2/3$

Question 41

If g is the inverse of f and $f'(x) = \frac{1}{1+x^3}$, then $g'(x)$ is

Options:

- A. $\frac{1}{1+(g(x))^3}$
- B. $1 + (g(x))^3$
- C. $\frac{g(x)}{1+(g(x))^3}$
- D. $\frac{(g(x))^3}{1+(g(x))^3}$

Question 42

A problem in statistics is given to three students A, B and C. Their probabilities of solving the problem are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. If all of them try independently, then the probability, that problem is solved, is

Options:

- A. $2/3$
- B. $3/4$
- C. $1/3$
- D. $1/4$

Question 43

Let $A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 3 \\ 1 & -2 & 1 \end{bmatrix}$, $B = \begin{bmatrix} 6 \\ 11 \\ 0 \end{bmatrix}$ and $X = \begin{bmatrix} a \\ b \\ c \end{bmatrix}$, if $AX = B$, then the value of

$2a + b + 2c$ is

Options:

- A. 10
- B. 8
- C. 6
- D. 12

Question 44

$f(x) = \begin{cases} \frac{1-\cos kx}{x^2}, & \text{if } x \leq 0 \\ \frac{\sqrt{x}}{\sqrt{16+\sqrt{x}-4}}, & \text{if } x > 0 \end{cases}$ is continuous at $x = 0$, then the value of k is

Options:

- A. 4
- B. 2
- C. -1
- D. -3

Question 45

If D, E and F are the mid-points of the sides BC, CA and AB of triangle ABC respectively, then $\vec{AD} + \frac{2}{3}\vec{BE} + \frac{1}{3}\vec{CF} =$

Options:

- A. $\frac{1}{2}\vec{AB}$
- B. $\frac{1}{2}\vec{AC}$
- C. $\frac{1}{2}\vec{BC}$
- D. $\frac{2}{3}\vec{AC}$

Question 46

Two cards are drawn successively with replacement from a well shuffled pack of 52 cards, then mean of number of queens is

Options:

- A. $\frac{1}{13}$
- B. $\frac{1}{169}$
- C. $\frac{2}{13}$
- D. $\frac{4}{169}$

Question 47

The equation of a plane, containing the line of intersection of the planes $2x - y - 4 = 0$ and $y + 2z - 4 = 0$ and passing through the point $(2, 1, 0)$, is

Options:

- A. $3x - 2y + z = 4$
- B. $3x + 2y + z = 4$
- C. $3x - 2y - z = 4$
- D. $3x + 2y - z = -4$

Question 48

A random variable X assumes values $1, 2, 3, \dots, n$ with equal probabilities, if $\text{var}(X) = E(X)$, then n is

Options:

- A. 4
- B. 5
- C. 7
- D. 9

Question 49

The graphical solution set for the system of inequations $x - 2y \leq 2, 5x + 2y \geq 10, 4x + 5y \leq 20, x \geq 0, y \geq 0$ is given by

Options:

- A. Fig. 2
- B. Fig. 4
- C. Fig. 1
- D. Fig. 3

Question 50

Let $f(0) = -3$ and $f'(x) \leq 5$ for all real values of x . The $f(2)$ can have possible maximum value as

Options:

- A. 10
- B. 5

- C. 7
- D. 13

Chemistry

Question 51

Identify monodentate ligand from the following.

Options:

- A. Cyanide ion
- B. Ethylenediamine
- C. Oxalate ion
- D. Ethylenediaminetetraacetate

Question 52

Identify linear polymer from the following.

Options:

- A. High density polythene
- B. Low density polythene
- C. Bakelite
- D. Melamine

Question 53

What is the conductivity of 0.05 M $BaCl_2$ solution if its molar conductivity is $220 \Omega^{-1}cm^2mol^{-1}$?

Options:

- A. $0.011 \Omega^{-1}cm^{-1}$
- B. $0.022 \Omega^{-1}cm^{-1}$
- C. $0.033 \Omega^{-1}cm^{-1}$
- D. $0.044 \Omega^{-1}cm^{-1}$

Question 54

Which from following polymers is grouped in the category of elastomers?

Options:

- A. Nylon 6,6

- B. Buna-S
- C. Terylene
- D. Polythene

Question 55

Which element from following exhibits diagonal relationship with beryllium?

Options:

- A. B
- B. Na
- C. Mg
- D. Al

Question 56

What is the stock notation of Manganese dioxide?

Options:

- A. $Mn(I)O_2$
- B. $Mn(II)O_2$
- C. $Mn(III)O_2$
- D. $Mn(IV)O_2$

Question 57

A reaction, $Ni_{(s)} + Cu_{((M))}^{++} \rightarrow Ni_{(IM)}^{++} + Cu_{(s)}$ occurs in a cell. Calculate E_{cell}° if $E_{Cu}^\circ = 0.337V$ and $E_{Ni}^\circ = -0.257V$

Options:

- A. 0.594 V
- B. -0.594V
- C. -0.08V
- D. 0.08 V

Question 58

What volume of ammonia is formed when $10dm^3$ dinitrogen reacts with $30dm^3$

dihydrogen at same temperature and pressure?

Options:

- A. $30dm^3$
- B. $20dm^3$
- C. $15dm^3$
- D. $10dm^3$

Question 59

What is the number of moles of sp^2 hybrid carbon atoms present in n moles of isopentane?

Options:

- A. zero
- B. one
- C. two
- D. three

Question 60

Find solubility of PbI_2 if its solubility product is 7.0×10^{-9} .

Options:

- A. $1.21 \times 10^{-3}molL^{-1}$
- B. $3.228 \times 10^{-3}molL^{-1}$
- C. $2.831 \times 10^{-3}molL^{-1}$
- D. $1.811 \times 10^{-3}molL^{-1}$

Question 61

Identify the product formed when vapours of 2-methylpropan-2-ol are passed over hot copper.

Options:

- A. Propanone
- B. 2-Methylpropene
- C. 2-Methylpropanoic acid

D. Propanal

Question 62

Calculate the rate constant of first order reaction if the concentration of the reactant decreases by 90% in 30 minutes.

Options:

- A. $7.7 \times 10^{-2} \text{minute}^{-1}$
- B. $4.2 \times 10^{-2} \text{minute}^{-1}$
- C. $2.1 \times 10^{-2} \text{minute}^{-1}$
- D. $3.5 \times 10^{-2} \text{minute}^{-1}$

Question 63

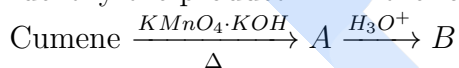
What different elements are found in baryte?

Options:

- A. Ca, S, O
- B. Zn, S, O
- C. Ba, S, O
- D. Mg, S, H, O

Question 64

Identify the product 'B' in the following reaction.



Options:

- A. Phenol
- B. Potassium benzoate
- C. Benzoic acid
- D. Aniline

Question 65

Which of the following on reaction with ammoniacal silver nitrate forms silver precipitate?

Options:

- A. Ethanol
- B. Ethanal
- C. Ethoxyethane

D. Ethanoic acid

Question 66

Identify an aromatic, mixed, 3° amine from following.

Options:

A. B. $(C_2H_5)_3N$

C. $(CH_3)_3C - NH_2$

D.

Question 67

For $NaCl_{(s)}$ enthalpy of solution is $4kJmol^{-1}$ and lattice enthalpy is $790kJmol^{-1}$.

What is hydration enthalpy of NaCl?

Options:

A. 786 kJ

B. 794 kJ

C. $-786kJ$

D. $-794kJ$

Question 68

Which from following statements regarding transition elements is NOT CORRECT?

Options:

A. These exhibit properties between 's' and 'p' block elements.

B. These form cations with incomplete d-subshell.

C. 5d series consists of all elements from lanthanum to mercury of periodic table.

D. These are arranged in four different 'd' series.

Question 69

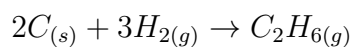
A solution of 8 g of certain organic compound in 2dm^3 water develops osmotic pressure 0.6 atm at 300 K. Calculate the molar mass of compound. [$R = 0.082\text{atmdm}^3\text{K}^{-1}\text{mol}^{-1}$]

Options:

- A. 148gmol^{-1}
- B. 164gmol^{-1}
- C. 172gmol^{-1}
- D. 180gmol^{-1}

Question 70

What is the value of $\Delta H - \Delta U$ for the following reaction?



Options:

- A. $4RT$
- B. $-5RT$
- C. RT
- D. $-2RT$

Question 71

Which from the following compound solutions in water of equal concentration has electrical conductivity nearly same as distilled water?

Options:

- A. Urea
- B. Sodium chloride
- C. Sodium hydroxide
- D. Acetic acid

Question 72

What is the pH of a solution containing $2.2 \times 10^{-6}\text{M}$ hydrogen ions?

Options:

- A. 6.34
- B. 5.66
- C. 4.34
- D. 3.80

Question 73

Which of the following statements is NOT true about Rutherford atomic model?

Options:

- A. Each atom consists of massive, +vely charged centre.
- B. The electrons are revolving continuously around the nucleus.
- C. This model does not describe the distribution of electrons around the nucleus.
- D. This model describes the energies of electrons.

Question 74

What is IUPAC name of propylene glycerol?

Options:

- A. Propane-1,2-diol
- B. Propane-1,3-diol
- C. Propane-1,2,3-triol
- D. Propene-1,2,3-triol

Question 75

Identify the CORRECT decreasing order of melting point of cluster of sodium atoms depending on size.

Options:

- A. Cluster of 10^3 atoms ; cluster of 10^4 atoms ; Bulk sodium
- B. Bulk sodium ; cluster of 10^4 atoms ; Cluster of 10^3 atoms
- C. Cluster of 10^4 atoms ; Cluster of 10^3 atoms ; Bulk sodium
- D. Bulk sodium ; cluster of 10^3 atoms ; Cluster of 10^4 atoms

Question 76

Which from the following coordinate complexes contains anionic and neutral ligands in it?

Options:

- A. Potassium trioxalatoaluminate(III)
- B. Hexacyanoferrate (II)
- C. Pentaamminecarbonatocobalt (III) chloride
- D. Tetraamminecopper(II) ion

Question 77

Which among the following is allylic halide?

Options:

- A. $CH_3 - CH_2 - CH_2 - X$
- B. $C_6H_5 - CH_2 - X$
- C. $CH_2 = CH - CH_2X$
- D. $CH_3 - CH = CH - X$

Question 78

Which of the following compounds has the highest boiling point?

Options:

- A. Chloromethane
- B. Fluoromethane
- C. Iodomethane
- D. Bromomethane

Question 79

A solution of nonvolatile solute is obtained by dissolving 1 g in 100 g solvent, decreases its freezing point by 0.3 K. Calculate cryoscopic constant of solvent if molar mass of solute is 60g mol^{-1} .

Options:

- A. 1.0K kg mol^{-1}
- B. 1.4K kg mol^{-1}
- C. 2.4K kg mol^{-1}
- D. 1.8K kg mol^{-1}

Question 80

What is the IUPAC name of allylamine?

Options:

- A. Propan-1-amine
- B. Prop-2-en-1-amine
- C. Prop-1-en-2-amine
- D. Propan-2-amine

Question 81

What is the wave number of photon emitted during transition from orbit, $n = 4$ to $n = 2$ in hydrogen atom [$R_H = 109677\text{cm}^{-1}$]

Options:

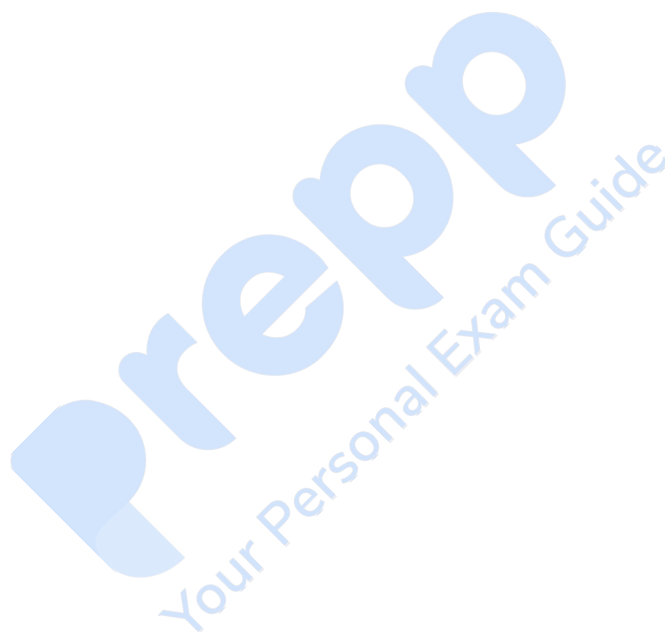
- A. 20564.44cm^{-1}
- B. 23032.17cm^{-1}
- C. 15354.78cm^{-1}
- D. 25225.7cm^{-1}

Question 82

Which from following is a CORRECT bond line formula of $\text{HO}(\text{CH}_2)_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$

Options:

- A. B. C. D.



Question 83

Identify the carbon atoms of α -glucose and β -fructose forming glycosidic linkage in sucrose.

Options:

- A. C - 1 of β -fructose and C - 2 of α -glucose
- B. C - 1 of α -glucose and C - 2 of β -fructose
- C. C - 1 of α -glucose and C - 1 of β -fructose
- D. C - 2 of α -glucose and C - 2 of β -fructose

Question 84

Calculate the molar mass of an element having density 21gcm^{-3} that forms fcc unit cell $[a^3 \cdot N_A = 36\text{cm}^3\text{mol}^{-1}]$

Options:

- A. 292.00gmol^{-1}
- B. 189.00gmol^{-1}
- C. 140.00gmol^{-1}
- D. 108.00gmol^{-1}

Question 85

Which of the following is the SI unit of coefficient of viscosity?

Options:

- A. $\text{Ns}^{-1}\text{m}^{-2}$
- B. Nsm^{-2}
- C. Nsm^2
- D. $\text{Ns}^{-1}\text{m}^{-1}$

Question 86

Which from following metal has ccp crystal structure?

Options:

- A. Cu
- B. Zn
- C. Mg
- D. Po

Question 87

Identify the reagent 'A' used in the following conversion.

Ethyl bromide $\xrightarrow{\text{A}}$ Ethylpropanoate

Options:

- A. Sodium propoxide
- B. Ethoxy propane
- C. Silver propanoate
- D. Silver ethanoate

Question 88

What is the concentration of $[H_3O^+]$ ion in $molL^{-1}$ of 0.001 M acetic acid ($\alpha = 0.134$) ?

Options:

- A. 1.34×10^{-4}
- B. 1.54×10^{-4}
- C. 1.80×10^{-4}
- D. 1.70×10^{-4}

Question 89

Which group elements from following are called as chalcogens?

Options:

- A. group 13
- B. group 15
- C. group 16
- D. group 17

Question 90

What is the number of electrons around sulfur in H_2SO_4 molecule?

Options:

- A. 4
- B. 6
- C. 10
- D. 12

Question 91

An ideal gas expands by 1.5 L against a constant external pressure of 2 atm at 298

K. Calculate the work done?

Options:

- A. $-75J$
- B. $-303.9J$
- C. 13.3 J
- D. $-30J$

Question 92

The rate law for the reaction $A + B \rightarrow \text{product}$ is given by $\text{rate} = k[A][B]$. Calculate $[A]$ if rate of reaction and rate constant are $0.25 \text{ mol dm}^{-3} \text{ s}^{-1}$ and $6.25 \text{ mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$ respectively $[B] = 0.25 \text{ mol dm}^{-3}$

Options:

- A. 0.22 mol dm^3
- B. 0.16 mol dm^3
- C. 0.30 mol dm^3
- D. 0.25 mol dm^3

Question 93

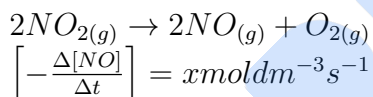
Which among the following has the lowest boiling point?

Options:

- A. Butyric acid
- B. Valeric acid
- C. Acetic acid
- D. Formic acid

Question 94

Find the average rate of formation $O_{2(g)}$ in the following reaction.



Options:

- A. $\frac{x}{2} \text{ mol dm}^{-3} \text{ s}^{-1}$
- B. $x \text{ mol dm}^{-3} \text{ s}^{-1}$
- C. $2x \text{ mol dm}^{-3} \text{ s}^{-1}$
- D. $4x \text{ mol dm}^{-3} \text{ s}^{-1}$

Question 95

Which among the following reactions occurs by breaking of C - O bond in alcohol?

Options:

- A. Reaction with propionic acid.
- B. Reaction with acetic anhydride
- C. Reaction with phosphorus trichloride
- D. Reaction with acetyl chloride

Question 96

Which among the following gases exhibits very low solubility in water at room temperature?

Options:

- A. O_2
- B. CO_2
- C. NH_3
- D. HCl

Question 97

Identify the trisaccharide from following.

Options:

- A. Maltose
- B. Lactose
- C. Raffinose
- D. Stachyose

Question 98

Identify the element from following having six unpaired electrons in observed electronic configuration?

Options:

- A. Cu
- B. Zn
- C. Cr
- D. Ti

Question 99

Find the radius of metal atom in simple cubic unit cell having edge length 334.7 pm?

Options:

- A. 167.35 pm
- B. 334.70 pm
- C. 144.93 pm
- D. 118.32 pm

Question 100

Which of the following colloids is NOT a gel?

Options:

- A. Cheese
- B. Milk
- C. Butter
- D. Jellies

Physics

Question 101

Light of wavelength ' λ ' is incident on a slit of width ' d '. The resulting diffraction pattern is observed on a screen at a distance ' D '. The linear width of the principal maximum is then equal to the width of the slit if D equals

Options:

- A. $\frac{d}{\lambda}$
- B. $\frac{d^2}{2\lambda}$
- C. $\frac{2\lambda}{d}$
- D. $\frac{2\lambda^2}{d}$

Question 102

Two S.H.Ms. are represented by equations $y_1 = 0.1 \sin(100\pi t + \frac{\pi}{3})$ and $y_2 = 0.1 \cos(100\pi t)$ The phase difference between the speeds of the two particles is

Options:

- A. $\frac{\pi}{3}$
- B. $-\frac{\pi}{6}$
- C. $+\frac{\pi}{6}$
- D. $-\frac{\pi}{3}$

Question 103

A film of soap solution is formed between two straight parallel wires of length 10 cm each separated by 0.5 cm. If their separation is increased by 1 mm while still maintaining their parallelism. How much work will have to be done?

(surface tension of solution = $65 \times 10^{-2} \text{ N/m}$)

Options:

- A. $7.22 \times 10^{-6} J$
- B. $13.0 \times 10^{-5} J$
- C. $2.88 \times 10^{-5} J$
- D. $5.76 \times 10^{-5} J$

Question 104

An ideal gas in a container of volume 500 c.c. is at a pressure of $2 \times 10^{+5} N/m^2$. The average kinetic energy of each molecule is $6 \times 10^{-21} J$. The number of gas molecules in the container is

Options:

- A. 5×10^{25}
- B. 5×10^{23}
- C. 25×10^{23}
- D. 2.5×10^{22}

Question 105

A gas at N.T.P. is suddenly compressed to one-fourth of its original volume. If $\gamma = 1.5$, then the final pressure is

Options:

- A. 4 times
- B. 1.5 times
- C. 8 times
- D. $\frac{1}{4}$ times

Question 106

A particle of mass 'm' moves along a circle of radius 'r' with constant tangential acceleration. If K.E. of the particle is 'E' by the end of third revolution after beginning of the motion, then magnitude of tangential acceleration is

Options:

- A. $\frac{E}{2\pi r m}$
- B. $\frac{E}{6\pi r m}$
- C. $\frac{E}{8\pi r m}$
- D. $\frac{E}{4\pi r m}$

Question 107

An e.m.f. $E = 4\cos(1000t)$ volt is applied to an LR circuit of inductance 3 mH and resistance 4Ω . The maximum current in the circuit is

Options:

- A. $\frac{4}{\sqrt{7}}A$
- B. 1.0 A
- C. $\frac{4}{7}A$
- D. 0.8 A

Question 108

In the reverse biasing of a p-n junction diode :

Options:

- A. the width of the depletion layer decreases.
- B. the width of the depletion layer increases.
- C. the number of minority charge carriers increase.
- D. the number of majority charge carriers increase.

Question 109

When a charge of 3 C is placed in uniform electric field, it experiences a force of 3000 N. Within this field, potential difference between two points separated by a distance of 1 cm is

Options:

- A. 10 V
- B. 90 V
- C. 1000 V
- D. 3000 V

Question 110

A soap bubble of radius 'R' is blown. After heating a solution, a second bubble of radius '2R' is blown. The work required to blow the 2nd bubble in comparison to that required for the 1st bubble is

Options:

- A. exactly double.
- B. slightly more than 4 times.
- C. slightly less than 4 times.

D. slightly less than double.

Question 111

In a transistor, in common emitter configuration, the ratio of power gain to voltage gain is

Options:

- A. α
- B. $\frac{\beta}{\alpha}$
- C. $\beta\alpha$
- D. β

Question 112

A galvanometer of resistance 20Ω gives a deflection of 5 divisions when 1 mA current flows through it. The galvanometer scale has 50 divisions. To convert the galvanometer into a voltmeter of range 25 volt, we should connect a resistance of

Options:

- A. 1240Ω in series.
- B. 2480Ω in series.
- C. 2480Ω in parallel.
- D. 20Ω in parallel.

Question 113

The equation of simple harmonic progressive wave is given by $y = a \sin 2\pi(bt - cx)$.

The maximum particle velocity will be half the wave velocity, if $c =$

Options:

- A. $2\pi a$
- B. $\frac{1}{4\pi a}$
- C. $\frac{1}{2\pi a}$
- D. $4\pi a$

Question 114

Five current carrying conductors meet at a point 'O' as shown in figure. The magnitude and direction of the current in conductor 'OP' is

Options:

- A. 6.5 A from O to P.

- B. 9 A from P to O.
- C. 10.5 A from P to O.
- D. 11.5 A from O to P.

Question 115

An alternating voltage of frequency ' ω ' is induced in electric circuit consisting of an inductance 'L' and capacitance 'C', connected in parallel. Then across the inductance coil

Options:

- A. current is maximum when $\omega^2 = \frac{1}{LC}$
- B. current is zero
- C. voltage is minimum when $\omega^2 = \frac{1}{LC}$
- D. voltage is maximum when $\omega^2 = \frac{1}{LC}$

Question 116

A gas is compressed at a constant pressure of 50N/m^2 from a volume of 10m^3 to a volume of 4m^3 . Energy of 100 J is then added to the gas by heating. Its internal energy is

Options:

- A. increased by 400 J
- B. increased by 200 J
- C. increased by 100 J
- D. decreased by 200 J

Question 117

The reactance of capacitor at 50 Hz is 5Ω . If the frequency is increased to 100 Hz, the new reactance is

Options:

- A. 5Ω
- B. 10Ω

- C. 2.5Ω
- D. 125Ω

Question 118

Stationary waves can be produced in

Options:

- A. only solid and gaseous media
- B. only liquid and gaseous media
- C. only solid and liquid media
- D. solid, liquid and gaseous media

Question 119

The pressure exerted by an ideal gas at a particular temperature is directly proportional to

Options:

- A. the mean speed of the gas molecules.
- B. mean of the square of the speed of the gas molecules.
- C. the square of the mean speed of the gas molecules.
- D. the root mean square speed of the gas molecules.

Question 120

If a ray of light in denser medium strikes a rarer medium at angle of incidence i , the angles of reflection and refraction are r and r' respectively. If the reflected and refracted rays are at right angles to each other, the critical angle for the given pair of media is

Options:

- A. $\sin^{-1}(\tan r')$
- B. $\sin^{-1}(\tan r)$
- C. $\tan^{-1}(\sin i)$
- D. $\cot^{-1}(\tan i)$

Question 121

A spring has a certain mass suspended from it and its period for vertical oscillations is ' T_1 '. The spring is now cut in to two equal halves and the same mass is suspended from one of the halves. The period of vertical oscillations is now ' T_2 '. The ratio T_1/T_2 is

Options:

- A. 2
- B. $\sqrt{2}$
- C. $\frac{1}{\sqrt{2}}$
- D. $\frac{1}{2}$

Question 122

When photons of energies twice and thrice the work function of a metal are incident on the metal surface one after other, the maximum velocities of the photoelectrons emitted in the two cases are v_1 and v_2 respectively. The ratio $v_1 : v_2$ is

Options:

- A. $\sqrt{2} : 1$
- B. $\sqrt{3} : 1$
- C. $\sqrt{3} : \sqrt{2}$
- D. $1 : \sqrt{2}$

Question 123

A simple pendulum of length 2 m is given a horizontal push through angular displacement of 60° . If the mass of bob is 200 gram, the angular velocity of the bob will be (Take Acceleration due to gravity = $10m/s^2$)

($\sin 30^\circ = \cos 60^\circ = 0.5$, $\cos 30^\circ = \sin 60^\circ = \frac{\sqrt{3}}{2}$)

Options:

- A. $2\sqrt{2}$ rad/s
- B. $3\sqrt{2}$ rad/s
- C. $2\sqrt{2.5}$ rad/s
- D. $3\sqrt{2.5}$ rad/s

Question 124

The force acting on the electron in hydrogen atom (Bohr's theory) is related to the principle quantum number ' n ' as

Options:

- A. n^4
- B. n^{-4}
- C. n^2
- D. n^{-2}

Question 125

If the frequency of the input voltage is 50 Hz, applied to a (a) half wave rectifier and (b) full wave rectifier. The output frequency in both cases is respectively

Options:

- A. 50 Hz, 50 Hz
- B. 50 Hz, 100 Hz
- C. 100 Hz, 100 Hz
- D. 100 Hz, 50 Hz

Question 126

Periodic time of a satellite revolving above the earth's surface at a height equal to radius of the earth ' R ' is [g = acceleration due to gravity]

Options:

- A. $2\pi\sqrt{\frac{2R}{g}}$
- B. $4\pi\sqrt{\frac{2R}{g}}$
- C. $2\pi\sqrt{\frac{R}{g}}$
- D. $8\pi\sqrt{\frac{R}{g}}$

Question 127

The wavelength of light for the least energetic photons emitted in the Lyman series of the hydrogen spectrum is nearly [Take $hc = 1240 \text{ eV} \cdot \text{nm}$, change in energy of the levels = 10.2 eV]

Options:

- A. 150 nm
- B. 122 nm
- C. 102 nm

D. 82 nm

Question 128

In Young's double slit experiment, the wavelength of light used is ' λ '. The intensity at a point is ' I ' where path difference is $(\frac{\lambda}{4})$. If I_0 denotes the maximum intensity, then the ratio $(\frac{I}{I_0})$ is

$$(\sin \frac{\pi}{4} = \cos \frac{\pi}{4} = \frac{1}{\sqrt{2}})$$

Options:

- A. $\frac{1}{\sqrt{2}}$
- B. $\frac{1}{2}$
- C. $\frac{3}{4}$
- D. $\frac{\sqrt{3}}{2}$

Question 129

The side of a copper cube is 1 m at 0°C . What will be the change in its volume, when it is heated to 100°C ? [$\alpha_{\text{copper}} = 18 \times 10^{-6}/^\circ\text{C}$]

Options:

- A. $45 \times 10^{-4}\text{m}^3$
- B. $54 \times 10^{-4}\text{m}^3$
- C. $34 \times 10^{-4}\text{m}^3$
- D. $64 \times 10^{-4}\text{m}^3$

Question 130

If current ' I ' is flowing in the closed circuit with collective resistance ' R ', the rate of production of heat energy in the loop as we pull it along with a constant speed ' V ' is (L = length of conductor, B = magnetic field)

Options:

- A. $\frac{BLV}{R}$
- B. $\frac{B^2L^2V^2}{R^2}$
- C. $\frac{BLV}{R^2}$
- D. $\frac{B^2L^2V^2}{R}$

Question 131

Two coils A and B have mutual inductance 0.008 H. The current changes in the coil A, according to the equation $I = I_m \sin \omega t$, where $I_m = 5\text{A}$ and $\omega = 200\pi$ rad

s^{-1} . The maximum value of the e.m.f. induced in the coil B in volt is

Options:

- A. 4π
- B. 8π
- C. 10π
- D. 16π

Question 132

A thin rod of length L has magnetic moment M when magnetised. If rod is bent in a semicircular arc what is magnetic moment in new shape?

Options:

- A. $\frac{M}{L}$
- B. $\frac{M}{\pi}$
- C. $\frac{M}{2\pi}$
- D. $\frac{2M}{\pi}$

Question 133

A fluid of density ' ρ ' and viscosity ' η ' is flowing through a pipe of diameter ' d ', with a velocity ' v '. Reynold number is

Options:

- A. $\frac{2d\rho v}{\eta}$
- B. $\frac{d\rho v}{\eta}$
- C. $\frac{d\rho v}{\eta^2}$
- D. $\frac{2\eta dv}{\rho}$

Question 134

In Young's double slit experiment, the fringe width is 2 mm. The separation between the 13th bright fringe and the 4th dark fringe from the centre of the screen on same side will be

Options:

- A. 13 mm.
- B. 17 mm.
- C. 19 mm.
- D. 23 mm.

Question 135

A current is flowing in two straight parallel wires in the same direction. Force of attraction between them is $1 \times 10^{-3} N$. If the current is doubled in both the wires the force will be

Options:

- A. $1 \times 10^{-3} N$
- B. $2 \times 10^{-3} N$
- C. $4 \times 10^{-3} N$
- D. $0.25 \times 10^{-3} N$

Question 136

Consider a planet whose density is same as that of the earth but whose radius is three times the radius ' R ' of the earth. The acceleration due to gravity ' g_n ' on the surface of planet is $g_n = x.g$ where g is acceleration due to gravity on surface of earth. The value of ' x ' is

Options:

- A. 9
- B. 3
- C. $\frac{1}{3}$
- D. $\frac{1}{9}$

Question 137

When a certain metal surface is illuminated with light of frequency ν , the stopping potential for photoelectric current is V_0 . When the same surface is illuminated by light of frequency $\frac{\nu}{2}$, the stopping potential is $\frac{V_0}{4}$, the threshold frequency of photoelectric emission is

Options:

- A. $\frac{\nu}{6}$
- B. $\frac{\nu}{3}$
- C. $\frac{2\nu}{3}$
- D. $\frac{4\nu}{3}$

Question 138

If the length of an open organ pipe is 33.3 cm, then the frequency of fifth overtone is [Neglect end correction, velocity of sound = 333 m/s]

Options:

- A. 3500 Hz
- B. 3000 Hz
- C. 2500 Hz
- D. 2000 Hz

Question 139

A transparent glass cube of length 24 cm has a small air bubble trapped inside. When seen normally through one surface from air outside, its apparent distance is 10 cm from the surface. When seen normally from opposite surface, its apparent distance is 6 cm. The distance of the air bubble from first surface is

Options:

- A. 15 cm
- B. 14 cm
- C. 12 cm
- D. 8 cm

Question 140

The temperature of an ideal gas is increased from 27°C to 927°C . The r.m.s. speed of its molecules becomes

Options:

- A. twice
- B. four times.
- C. half.
- D. one-fourth.

Question 141

A disc of radius R and thickness $\frac{R}{6}$ has moment of inertia I about an axis passing through its centre and perpendicular to its plane. Disc is melted and recast into a solid sphere. The moment of inertia of a sphere about its diameter is

Options:

- A. $\frac{I}{5}$
- B. $\frac{I}{6}$
- C. $\frac{I}{32}$
- D. $\frac{I}{64}$

Question 142

A charge ' q ' moves with velocity ' v ' through electric (E) as well as magnetic field (B). Then the force acting on it is

Options:

- A. $q(\vec{v} \times \vec{B})$
- B. $q(\vec{B} \times \vec{v})$
- C. $q(\vec{E} \times \vec{v})$
- D. $q\vec{E} + q(\vec{v} \times \vec{B})$

Question 143

A parallel combination of two capacitors of capacities ' $2C$ ' and ' C ' is connected across $5V$ battery. When they are fully charged, the charges and energies stored in them be ' Q_1 ', ' Q_2 ' and ' E_1 ', ' E_2 ' respectively. Then $\frac{E_1 - E_2}{Q_1 - Q_2}$ in J/C is (capacity is in Farad, charge in Coulomb and energy in J)

Options:

- A. $\frac{5}{4}$
- B. $\frac{4}{5}$
- C. $\frac{5}{2}$
- D. $\frac{2}{5}$

Question 144

Consider the following statements A and B. Identify the correct choice in the given answers.

- A. In an inelastic collision, there is no loss in kinetic energy during collision.
- B. During a collision, the linear momentum of the entire system of particles is conserved if there is no external force acting on the system.

Options:

- A. Both A and B are wrong.
- B. Both A and B are correct.
- C. A is wrong and B is correct.
- D. A is correct and B is wrong.

Question 145

The charges $2q, -q, -q$ are located at the vertices of an equilateral triangle. At the circumcentre of the triangle

Options:

- A. the field is zero but potential is not zero.
- B. the field is non-zero but the potential is zero.
- C. both, field and potential are zero.
- D. both, field and potential are non-zero.

Question 146

The magnetic field at a point P situated at perpendicular distance ' R ' from a long straight wire carrying a current of 12 A is $3 \times 10^{-5} \text{ Wb/m}^2$. The value of ' R ' in mm is $[\mu_0 = 4\pi \times 10^{-7} \text{ Wb/Am}]$

Options:

- A. 0.08
- B. 0.8

- C. 8
- D. 80

Question 147

A particle at rest starts moving with constant angular acceleration 4 rad/s^2 in circular path. At what time the magnitudes of its tangential acceleration and centrifugal acceleration will be equal?

Options:

- A. 0.4 s
- B. 0.5 s
- C. 0.8 s
- D. 1.0 s

Question 148

If the end correction of an open pipe is 0.8 cm, then the inner radius of that pipe is

Options:

- A. $\frac{1}{3}$ cm
- B. $\frac{2}{3}$ cm
- C. $\frac{3}{2}$ cm
- D. 0.2 cm

Question 149

The mutual inductance (M) of the two coils is 3 H. The self inductances of the coils are 4 H and 9 H respectively. The coefficient of coupling between the coils is

Options:

- A. 0.3
- B. 0.4
- C. 0.5
- D. 0.6

Question 150

A particle is vibrating in S.H.M. with an amplitude of 4 cm. At what displacement from the equilibrium position is its energy half potential and half kinetic?

Options:

- A. 1 cm

- B. $\sqrt{2}$ cm
- C. 2 cm
- D. $2\sqrt{2}$ cm

