

MHT CET 2023 Mathematics Memory Based Question Paper PDF

Mathematics

Question 1

Let $z \in \mathbb{C}$ with $\text{Im}(z) = 10$ and it satisfies $\frac{2z-n}{2z+n} = 2i - 1, i = \sqrt{-1}$ for some natural number n , then

Options:

- A. $n = 20$ and $\text{Re}(z) = -10$
- B. $n = 40$ and $\text{Re}(z) = -10$
- C. $n = 40$ and $\text{Re}(z) = 10$
- D. $n = 20$ and $\text{Re}(z) = 10$

Question 2

Let $\vec{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\vec{b} = \hat{i} + \hat{j}$. If $\vec{c}$ is a vector such that $\vec{a} \cdot \vec{c} = |\vec{c}|$, $|\vec{c} - \vec{a}| = 2\sqrt{2}$ and the angle between $\vec{a} \times \vec{b}$ and $\vec{c}$ is $\frac{2\pi}{3}$, then $|(\vec{a} \times \vec{b}) \times \vec{c}| =$

Options:

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

Question 3

If both mean and variance of 50 observations $x_1, x_2, \dots, x_{50}$ are equal to 16 and 256 respectively, then mean of $(x_1 - 5)^2, (x_2 - 5)^2, \dots, (x_{50} - 5)^2$ is

Options:

- A. 357
- B. 367
- C. 377
- D. 387

Question 4

If the statement $p \leftrightarrow (q \rightarrow p)$ is false, then true statement/statement pattern is

Options:

- A. p
- B. $p \rightarrow (p \vee \sim q)$
- C. $p \wedge (\sim p \wedge q)$
- D. $(p \vee \sim q) \rightarrow p$

Question 5

If $|\vec{a}| = 2$, $|\vec{b}| = 3$, $|\vec{c}| = 5$ and each of the angles between the vectors $\vec{a}$ and $\vec{b}$, $\vec{b}$ and $\vec{c}$, and $\vec{c}$ and $\vec{a}$ is 60° , then the value of $|\vec{a} + \vec{b} + \vec{c}|$ is

Options:

- A. $\sqrt{69}$
- B. $\sqrt{70}$
- C. $\sqrt{80}$
- D. $\sqrt{39}$

Question 6

The shaded region in the following figure represents the solution set for a certain linear programming problem. Then linear constraints for this region are given by

Options:

- A. $2x + 3y \geq 6, -x + 2y \geq 2, 3x + 6y \leq 18, x - 3y \geq 3, x \geq 0, y \geq 0$
- B. $2x + 3y \geq 6, -x + 2y \leq 2, x - 3y \leq 3, x + 2y \geq 18, x \geq 0, y \geq 0$
- C. $2x + 3y \leq 6, -x + 2y \geq 2, 3x + 6y \leq 18, -3y \leq 3, x \geq 0, y \geq 0$
- D. $2x + 3y \geq 6, 3x + 6y \leq 18, x - 3y \leq 3, -x + 2y \leq 2, x \geq 0, y \geq 0$

Question 7

The function f defined on $(-\frac{1}{3}, \frac{1}{3})$ by $f(x) = \begin{cases} \frac{1}{x} \log \left(\frac{1+3x}{1-2x} \right) & , x \neq 0 \\ k & , x = 0 \end{cases}$ is continuous at $x = 0$, then k is

Options:

- A. 6
- B. 1
- C. 5
- D. -5

Question 8

The mirror image of $P(2, 4, -1)$ in the plane $x - y + 2z - 2 = 0$ is (a, b, c) , then the value of $a + b + c$ is

Options:

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

Question 9

If the slope of the tangent of the curve at any point is equal to $-y + e^{-x}$, then the equation of the curve passing through origin is

Options:

- A. $y + xe^x = 0$
- B. $ye^x + x = 0$
- C. $ye^x - x = 0$
- D. $y - xe^x = 0$

Question 10

If $A = \begin{bmatrix} 1 & -1 \\ 2 & -1 \end{bmatrix}$, $B = \begin{bmatrix} 1 & 1 \\ 4 & -1 \end{bmatrix}$, then $(A + B)^{-1}$ is

Options:

- A. $\begin{bmatrix} -\frac{1}{2} & 0 \\ -\frac{3}{2} & \frac{1}{2} \end{bmatrix}$
- B. $\begin{bmatrix} \frac{1}{2} & 0 \\ \frac{3}{2} & -\frac{1}{2} \end{bmatrix}$
- C. $\begin{bmatrix} \frac{1}{2} & 0 \\ -\frac{3}{2} & \frac{1}{2} \end{bmatrix}$
- D. $\begin{bmatrix} \frac{1}{2} & 0 \\ \frac{3}{2} & \frac{1}{2} \end{bmatrix}$

Question 11

The function $f(x) = x^3 - 6x^2 + 9x + 2$ has maximum value when x is

Options:

- A. 1
- B. 2
- C. 3
- D. 6

Question 12

If $I_n = \int_0^{\pi/4} \tan^n \theta d\theta$, then $I_{12} + I_{10} =$

Options:

- A. $\frac{1}{8}$
- B. $\frac{1}{12}$
- C. $\frac{1}{11}$
- D. $\frac{1}{10}$

Question 13

The centre of the circle whose radius is 3 units and touching internally the circle $x^2 + y^2 - 4x - 6y - 12 = 0$ at the point $(-1, -1)$ is

Options:

- A. $(\frac{4}{5}, \frac{7}{5})$
- B. $(\frac{4}{5}, -\frac{7}{5})$
- C. $(-\frac{4}{5}, -\frac{7}{5})$
- D. $(-\frac{4}{5}, \frac{7}{5})$

Question 14

A fair die with numbers 1 to 6 on their faces is thrown. Let X denote the number of factors of the number, on the uppermost face, then the probability distribution of X is

Options:

- A.

$X = x$	1	2	3	4
$P(X = x)$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{6}$	$\frac{1}{6}$
- B.

$X = x$	1	2	3	4
$P(X = x)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{2}$
- C.

$X = x$	1	2	3	4
$P(X = x)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$
- D.

$X = x$	1	2	3	4
$P(X = x)$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{2}$	$\frac{1}{6}$

Question 15

Let $\bar{u}, \bar{v}$ and $\bar{w}$ be the vectors such that $|\bar{u}| = 1; |\bar{v}| = 2; |\bar{w}| = 3$. If the projection of $\bar{v}$ along $\bar{u}$ is equal to that of $\bar{w}$ along $\bar{u}$ and $\bar{v}, \bar{w}$ are perpendicular to each other, then $|\bar{u} - \bar{v} + \bar{w}|$ is equal to

Options:

- A. 2
- B. $\sqrt{7}$
- C. $\sqrt{14}$
- D. 14

Question 16

If $y = 4x - 5$ is a tangent to the curve $y^2 = px^3 + q$ at $(2, 3)$, then $p - q$ is

Options:

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

Question 17

If $x = \sqrt{e^{\sin^{-1} t}}$ and $y = \sqrt{e^{\cos^{-1} t}}$, then $\frac{d^2 y}{dx^2}$ is

Options:

- A. $\frac{-y}{x^2}$
- B. $\frac{y^2}{2x^2}$
- C. $\frac{2y}{x^2}$
- D. $\frac{-2y}{x^2}$

Question 18

If $\sum_{r=1}^{50} \tan^{-1} \frac{1}{2r^2} = p$ then $\tan p$ is

Options:

- A. $\frac{100}{101}$
- B. $\frac{51}{50}$
- C. $\frac{50}{51}$
- D. $\frac{101}{102}$

Question 19

The value of $\int e^x \left(\frac{x^2+4x+4}{(x+4)^2} \right) dx$ is :

Options:

- A. $e^x \left(\frac{x}{x+4} \right) + c$, where c is a constant of integration.
- B. $e^x \left(\frac{4}{x+4} \right) + c$, where c is a constant of integration.
- C. $e^x \left(\frac{x}{(x+4)^2} \right) + c$, where c is a constant of integration.
- D. $e^x \left(\frac{4}{(x+4)^2} \right) + c$, where c is a constant of integration.

Question 20

The diagonal of a square is changing at the rate of 0.5 cm/sec. Then the rate of change of area when the area is 400 cm² is equal to

Options:

- A. $20\sqrt{2}$ cm²/sec
- B. $10\sqrt{2}$ cm²/sec
- C. $\frac{1}{10\sqrt{2}}$ cm²/sec
- D. $\frac{10}{\sqrt{2}}$ cm²/sec

Question 21

Let $\vec{a} = \hat{i} + 2\hat{j} - \hat{k}$ and $\vec{b} = \hat{i} + \hat{j} - \hat{k}$ be two vectors. If $\vec{c}$ is a vector such that $\vec{b} \times \vec{c} = \vec{b} \times \vec{a}$ and $\vec{c} \cdot \vec{a} = 0$, then $\vec{c} \cdot \vec{b}$ is

Options:

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

Question 22

Let $P \equiv (-3, 0)$, $Q \equiv (0, 0)$ and $R \equiv (3, 3\sqrt{3})$ be three points. Then the equation of the bisector of the angle PQR is

Options:

- A. $\frac{\sqrt{3}}{2}x + y = 0$
- B. $x + \sqrt{3}y = 0$
- C. $\sqrt{3}x + y = 0$
- D. $x + \frac{\sqrt{3}}{2}y = 0$

Question 23

If in a regular polygon, the number of diagonals are 54, then the number of sides of the polygon are

Options:

- A. 10
- B. 12
- C. 9
- D. 6

Question 24

Let x_0 be the point of local minima of $f(x) = \bar{a} \cdot (\bar{b} \times \bar{c})$ where $\bar{a} = x\hat{i} - 2\hat{j} + 3\hat{k}$, $\bar{b} = -2\hat{i} + x\hat{j} - \hat{k}$, $\bar{c} = 7\hat{i} - 2\hat{j} + x\hat{k}$, then value of $\bar{a} \cdot \bar{b}$ at $x = x_0$ is

Options:

- A. 15
- B. -15
- C. 12
- D. -12

Question 25

If a body cools from 80°C to 50°C in the room temperature of 25°C in 30 minutes, then the temperature of the body after 1 hour is

Options:

- A. 31.36°C
- B. 32.25°C
- C. 36.36°C
- D. 33.25°C

Question 26

If $f(a) = 2$, $f'(a) = 1$, $g(a) = -1$, $g'(a) = 2$, then as x approaches a , $\frac{g(x)f(a) - g(a)f(x)}{(x-a)}$ approaches

Options:

- A. 3
- B. 5
- C. 0
- D. 2

Question 27

The differential equation representing the family of curves $y^2 = 2c(x + \sqrt{c})$, where c is a positive parameter, is of

Options:

- A. order 1, degree 4
- B. order 2, degree 3
- C. order 2, degree 4
- D. order 1, degree 3

Question 28

If $\cos^{-1} x - \cos^{-1} \frac{y}{3} = \alpha$, where $-1 \leq x \leq 1, -3 \leq y \leq 3, x \leq \frac{y}{3}$, then for all $x, y, 9x^2 - 6xy \cos \alpha + y^2$ is equal to

Options:

- A. $\sin^2 \alpha$
- B. $3 \sin^2 \alpha$
- C. $9 \sin^2 \alpha$
- D. $\frac{4}{9} \sin^2 \alpha$

Question 29

In a triangle ABC, $m\angle A, m\angle B, m\angle C$ are in A.P. and lengths of two larger sides are 10 units, 9 units respectively, then the length (in units) of the third side is

Options:

- A. $5 + \sqrt{6}$
- B. $\sqrt{5} - 1$
- C. $\sqrt{6} + 1$
- D. $\sqrt{5} + 1$

Question 30

The value of $\tan^{-1} \left(\frac{1}{8} \right) + \tan^{-1} \left(\frac{1}{2} \right) + \tan^{-1} \left(\frac{1}{5} \right)$ is

Options:

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

Question 31

The p.m.f. of a random variable X is $P(x) = \begin{cases} \frac{2x}{n(n+1)}, & x = 1, 2, 3, \dots, n \\ 0, & \text{otherwise} \end{cases}$, then E(X) is

Options:

- A. $\frac{n+1}{6}$
- B. $\frac{2n+1}{6}$
- C. $\frac{n+1}{3}$
- D. $\frac{2n+1}{3}$

Question 32

If the lines $\frac{x-k}{2} = \frac{y+1}{3} = \frac{z-1}{4}$ and $\frac{x-3}{1} = \frac{y-\frac{9}{2}}{2} = \frac{z}{1}$ intersect, then the value of k is

Options:

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

Question 33

If $|\vec{a}| = \sqrt{3}$, $|\vec{b}| = 5$, $\vec{b} \cdot \vec{c} = 10$, angle between $\vec{b}$ and $\vec{c}$ is $\frac{\pi}{3}$, $\vec{a}$ is perpendicular to $\vec{b} \times \vec{c}$. Then the value of $|\vec{a} \times (\vec{b} \times \vec{c})|$ is

Options:

- A. 20
- B. 30
- C. 60
- D. 40

Question 34

If $\int \frac{x^2}{\sqrt{1-x}} dx = p\sqrt{1-x}(3x^2 + 4x + 8) + c$ where c is a constant of integration, then the value of p is

Options:

- A. $-\frac{2}{15}$
- B. $\frac{2}{15}$
- C. $\frac{4}{15}$
- D. $-\frac{4}{15}$

Question 35

The centroid of the triangle formed by the lines $x + 3y = 10$ and $6x^2 + xy - y^2 = 0$ is

Options:

- A. $(\frac{1}{3}, \frac{-7}{3})$
- B. $(\frac{-1}{3}, \frac{-7}{3})$
- C. $(\frac{-1}{3}, \frac{7}{3})$
- D. $(\frac{1}{3}, \frac{7}{3})$

Question 36

The statement $[p \wedge (q \vee r)] \vee [\sim r \wedge \sim q \wedge p]$ is equivalent to

Options:

- A. $\sim r$
- B. p
- C. $\sim q$
- D. q

Question 37

If $f(x) = \frac{2x-3}{3x-4}$, $x \neq \frac{4}{3}$, then the value of $f^{-1}(x)$ is

Options:

- A. $\frac{4x-3}{3x-2}$
- B. $\frac{3x-2}{4x+3}$
- C. $\frac{3x-4}{4x-2}$
- D. $\frac{2x+3}{4x-3}$

Question 38

If $f'(x) = \sin(\log x)$ and $y = f\left(\frac{2x+3}{3-2x}\right)$, then $\frac{dy}{dx}$ at $x = 1$ is

Options:

- A. $6 \sin(\log 5)$
- B. $5 \sin(\log 6)$
- C. $12 \sin(\log 5)$
- D. $5 \sin(\log 12)$

Question 39

The area bounded by the curve $y = |x - 2|$, $x = 1$, $x = 3$ and X-axis is

Options:

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

Question 40

$\int \frac{dx}{\cot^2 x - 1} = \frac{1}{A} \log |\sec 2x + \tan 2x| - \frac{x}{B} + c$, (where c is constant of integration), then $A + B =$

Options:

- A. -6
- B. 6
- C. -5
- D. 5

Question 41

There are 6 positive and 8 negative numbers. From these four numbers are chosen at random and multiplied. Then the probability, that the product is a negative number, is

Options:

- A. $\frac{496}{1001}$
- B. $\frac{505}{1001}$
- C. $\frac{490}{1001}$
- D. $\frac{504}{1001}$

Question 42

If $a \cos 2\theta + b \sin 2\theta = c$ has α and β as its roots, then the value of $\tan \alpha + \tan \beta$ is

Options:

- A. $\frac{2b}{c+a}$
- B. $\frac{2a}{b+c}$
- C. $\frac{b}{c+a}$
- D. $\frac{a}{b+c}$

Question 43

A lot of 100 bulbs contains 10 defective bulbs. Five bulbs are selected at random from the lot and are sent to retail store. Then the probability that the store will receive at most one defective bulb is

Options:

- A. $\frac{7}{5} \left(\frac{9}{10}\right)^4$
- B. $\frac{7}{5} \left(\frac{9}{10}\right)^5$
- C. $\frac{6}{5} \left(\frac{9}{10}\right)^4$
- D. $\frac{6}{5} \left(\frac{9}{10}\right)^5$

Question 44

Given $0 \leq x \leq \frac{1}{2}$, then the value of $\tan \left(\sin^{-1} \left(\frac{x}{\sqrt{2}} + \frac{\sqrt{1-x^2}}{\sqrt{2}} \right) - \sin^{-1} x \right)$ is

Options:

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

Question 45

A vector parallel to the line of intersection of the planes $\vec{r} \cdot (3\hat{i} - \hat{j} + \hat{k}) = 1$ and $\vec{r} \cdot (\hat{i} + 4\hat{j} - 2\hat{k}) = 2$ is

Options:

- A. $-2\hat{i} + 7\hat{j} + 13\hat{k}$
- B. $2\hat{i} - 7\hat{j} + 13\hat{k}$
- C. $-\hat{i} + 4\hat{j} + 7\hat{k}$
- D. $\hat{i} - 4\hat{j} + 7\hat{k}$

Question 46

The length of the perpendicular drawn from the point $(1, 2, 3)$ to the line $\frac{x-6}{3} = \frac{y-7}{2} = \frac{z-7}{-2}$ is

Options:

- A. 4 units
- B. 5 units
- C. 6 units
- D. 7 units

Question 47

If $I = \int \frac{dx}{\sin(x-a)\sin(x-b)}$, then I is given by

Options:

- A. $\frac{1}{\sin(b-a)} \log |\sin(x-a)\sin(x-b)| + c$, where c is a constant of integration.
- B. $\log \left| \frac{\sin(x-a)}{\sin(x-b)} \right| + c$, where c is a constant of integration.
- C. $\frac{1}{\sin(b-a)} \log \left| \frac{\sin(x-a)}{\sin(x-b)} \right| + c$, where c is a constant of integration.
- D. $\frac{1}{\sin(b-a)} \log \left| \frac{\sin(x-b)}{\sin(x-a)} \right| + c$, where c is a constant of integration.

Question 48

Let $P(x)$ be a polynomial of degree 2, with $P(2) = -1, P'(2) = 0, P''(2) = 2$, then $P(1.001)$ is

Options:

- A. 0.002
- B. -0.002
- C. 0.004
- D. -0.004

Question 49

If $y = \sqrt{(x - \sin x) + \sqrt{(x - \sin x) + \sqrt{(x - \sin x) + \dots}}}$, then $\frac{dy}{dx} =$

Options:

- A. $\frac{1 - \cos x}{2y - 1}$
- B. $\frac{1 + \cos x}{2y - 1}$
- C. $\frac{1 - \cos x}{2y + 1}$
- D. $\frac{1 - \sin x}{2y - 1}$

Question 50

Let $f(x) = 5 - |x - 2|$ and $g(x) = |x + 1|, x \in \mathbb{R}$. If $f(x)$ attains maximum value at α and $g(x)$ attains minimum value at β , then $\lim_{x \rightarrow -\alpha\beta} \frac{(x-1)(x^2-5x+6)}{x^2-6x+8}$ is equal to

Options:

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

Chemistry

Question 51

Which of the following is a structural formula of DDT?

Options:

Question 52

Which among the following is haloalkyne?

Options:

- A. Chloroethyne
- B. 3-Chlorobut-1-yne
- C. 1-Chloropent-2-yne
- D. 4-Chloropent-2-yne

Question 53

What type of peptide is the glycylalanine?

Options:

- A. Dipeptide
- B. Tripeptide
- C. Tetrapeptide
- D. Pentapeptide

Question 54

What is Henry's law constant of a gas if solubility of gas in water at 25°C is $0.028 \text{ mol dm}^{-3}$? [Partial pressure of gas = 0.346 bar]

Options:

- A. $0.081 \text{ mol dm}^{-3}\text{bar}^{-1}$
- B. $0.075 \text{ mol dm}^{-3}\text{bar}^{-1}$
- C. $0.093 \text{ mol dm}^{-3}\text{bar}^{-1}$
- D. $0.049 \text{ mol dm}^{-3}\text{bar}^{-1}$

Question 55

Calculate the rate constant of the first order reaction if 80% of the reactant decomposes in 60 minutes.

Options:

- A. $2.68 \times 10^{-2} \text{ minute}^{-1}$
- B. $5.36 \times 10^{-2} \text{ minute}^{-1}$
- C. $1.34 \times 10^{-2} \text{ minute}^{-1}$
- D. $8.1 \times 10^{-2} \text{ minute}^{-1}$

Question 56

Which from following polymers is classified fibres depending on inter molecular forces?

Options:

- A. Vulcanized rubber
- B. Buna-S
- C. Terylene
- D. Polystyrene

Question 57

Calculate the frequency if wavelength is 750 nm.

Options:

- A. $2 \times 10^{14} \text{ Hz}$
- B. $4 \times 10^{14} \text{ Hz}$
- C. $6 \times 10^{15} \text{ Hz}$
- D. $8 \times 10^{15} \text{ Hz}$

Question 58

Calculate the edge length of bcc unit cell if radius of metal atom is 227 pm.

Options:

- A. 4.54×10^{-8} cm
- B. 5.24×10^{-8} cm
- C. 6.42×10^{-8} cm
- D. 1.135×10^{-8} cm

Question 59

Identify the compound 'A' in the following sequence of reactions. $A \xrightarrow[\text{Dry ether}]{\text{C}_2\text{H}_5\text{MgBr}} B \xrightarrow{\text{H}_3\text{O}^+} \text{3-Methylpentan-3-ol}$

Options:

- A. Propanal
- B. Propanone
- C. Butanal
- D. Butanone

Question 60

A solution of nonvolatile solute is obtained by dissolving 15 g in 200 mL water has depression in freezing point 0.75 K. Calculate the molar mass of solute if cryoscopic constant of water is $1.86 \text{ K kg mol}^{-1}$.

Options:

- A. 160 g mol^{-1}
- B. 172 g mol^{-1}
- C. 186 g mol^{-1}
- D. 198 g mol^{-1}

Question 61

For a reaction $A + B \rightarrow \text{products}$ ΔH is -84.2 kJ and ΔS is -200 J K^{-1} . Calculate the highest value of temperature so that the reaction will proceed in forward direction.

Options:

- A. 421 K
- B. 237 K
- C. 168 K
- D. 273 K

Question 62

The solubility product of PbCl_2 at 298 K is 3.2×10^{-5} . What is its solubility in mol dm^{-3} ?

Options:

- A. 8×10^{-6}
- B. 2×10^{-2}
- C. 5.6×10^{-3}
- D. 5.0×10^{-2}

Question 63

Which among the following elements does NOT exhibit ferromagnetic properties?

Options:

- A. Cr
- B. Fe
- C. Co
- D. Ni

Question 64

Which of the following is a secondary allylic alcohol?

Options:

Question 65

Which from following elements is in liquid state at room temperature?

Options:

- A. Se
- B. Br
- C. I
- D. S

Question 66

Identify major product formed in the following reaction. 3-Bromo-2-methylpentane $\xrightarrow[\Delta]{\text{Alc.KOH}}$ Major product

Options:

- A. 2-Methylpentan-3-ol
- B. 2-Methylpent-2-ene
- C. 4-Methylpent-3-ene
- D. 4-Methylpentan-3-ol

Question 67

What is molecular formula of cyclohexylamine?

Options:

- A. $\text{C}_6\text{H}_8\text{N}$
- B. $\text{C}_6\text{H}_{10}\text{N}$
- C. $\text{C}_6\text{H}_{12}\text{N}$
- D. $\text{C}_6\text{H}_{13}\text{N}$

Question 68

Identify base₂ for following equation according to Bronsted-Lowry theory. $\text{HCl}_{(aq)} + \text{H}_2\text{O}_{(l)} \rightleftharpoons \text{H}_3\text{O}_{(aq)}^+ + \text{Cl}_{(aq)}^-$

Options:

- A. $\text{H}_3\text{O}_{(aq)}^+$
- B. $\text{H}_2\text{O}_{(l)}$
- C. $\text{Cl}_{(aq)}^-$
- D. $\text{HCl}_{(aq)}$

Question 69

Which of the following is Clemmensen reduction?

Options:

Question 70

Which of the following gases is readily adsorbed by solid adsorbent?

Options:

- A. Cl_2
- B. N_2
- C. O_2
- D. H_2

Question 71

Which from following is an example of two dimensional nanostructures?

Options:

- A. Nanoparticles
- B. Thin films
- C. Quantum dots
- D. Nanowires

Question 72

A conductivity cell containing 0.001 M AgNO_3 solution develops resistance 6530 ohm at 25°C . Calculate the electrical conductivity of solution at same temperature if the cell constant is 0.653 cm^{-1} .

Options:

- A. $1.3 \times 10^{-4} \Omega^{-1} \text{ cm}^{-1}$
- B. $1.5 \times 10^{-4} \Omega^{-1} \text{ cm}^{-1}$
- C. $1.7 \times 10^{-4} \Omega^{-1} \text{ cm}^{-1}$
- D. $1.0 \times 10^{-4} \Omega^{-1} \text{ cm}^{-1}$

Question 73

What is the number of sp^3 hybrid carbon atoms in $\text{HO}(\text{CH}_2)_3\text{CH}(\text{CH}_3)\text{CH}(\text{CH}_3)_2$?

Options:

- A. Five
- B. Two
- C. Eight
- D. Four

Question 74

Which from following thermodynamic properties is a path function?

Options:

- A. Internal energy
- B. Work
- C. Entropy
- D. Enthalpy

Question 75

Which among the following species is reduced by tin easily?

Options:

- A. Iodine
- B. Iron
- C. Zinc
- D. Sodium

Question 76

Which from following combinations is an example for construction of n-type semiconductor?

Options:

- A. Si doped with B
- B. Si doped with P
- C. Si doped with Ga
- D. Si doped with In

Question 77

Calculate the density of metal having molar mass 210 g mol^{-1} that forms simple cubic unit cell. ($a^3 \cdot N_A = 21.5 \text{ cm}^3 \text{ mol}^{-1}$)

Options:

- A. 9.77 g cm^{-3}
- B. 7.15 g cm^{-3}
- C. 8.12 g cm^{-3}
- D. 6.94 g cm^{-3}

Question 78

Which element from following rapidly loses its luster in air and tarnishes?

Options:

- A. Ba
- B. Be
- C. K
- D. Mg

Question 79

A neon-dioxygen mixture contains 64 g O_2 and 160 g Ne. If the total pressure is 25 bar, calculate the partial pressure of dioxygen.

Options:

- A. 5 bar
- B. 7.5 bar
- C. 10 bar
- D. 20 bar

Question 80

Identify anionic sphere complex from following.

Options:

- A. Hexaamminecobalt(III) chloride
- B. Potassium hexacyanoferrate(II)
- C. Tetraamminedichlorocobalt(III) ion
- D. Pentaamminechlorocobalt(III) sulphate

Question 81

What is the number of moles of ethane obtained from $2n$ moles of bromomethane using $2n$ moles of sodium atoms in dry ether medium?

Options:

- A. $4n$
- B. $3n$
- C. $2n$
- D. n

Question 82

Calculate E_{cell}^0 for $\text{Cd}_{(s)}|\text{Cd}_{(1M)}^{++}||\text{Ag}_{(1M)}^{+}|\text{Ag}_{(s)}$. [$E_{\text{Cd}}^0 = -0.403 \text{ V}$; $E_{\text{Ag}}^0 = 0.799 \text{ V}$]

Options:

- A. 1.202 V
- B. -1.202 V
- C. 0.396 V
- D. -0.396 V

Question 83

Find the number of unpaired electrons for copper in ground state configuration.

Options:

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

Question 84

Identify the element having highest ionization enthalpy.

Options:

- A. Ti
- B. Sc
- C. Zn
- D. Ni

Question 85

What is the oxidation number of Pt in PtCl_6^{2-} ?

Options:

- A. +6
- B. +4
- C. -6
- D. -4

Question 86

What is the value of rate constant for first order reaction if slope for the graph of rate versus concentration is 2.5×10^{-3} ?

Options:

- A. $2.5 \times 10^{-3} \text{ time}^{-1}$
- B. $5.0 \times 10^{-3} \text{ time}^{-1}$
- C. $7.5 \times 10^{-3} \text{ time}^{-1}$
- D. $1.25 \times 10^{-3} \text{ time}^{-1}$

Question 87

An organic monobasic acid has dissociation constant 2.25×10^{-6} . What is percent dissociation in its 0.01 M solution?

Options:

- A. 1.5%
- B. 15%
- C. 5%
- D. 0.5%

Question 88

Which of the following pair of compounds demonstrates the law of multiple proportions?

Options:

- A. $\text{CH}_4, \text{CCl}_4$
- B. BF_3, NH_3
- C. CO, CO_2
- D. NO_2, CO_2

Question 89

Which of the following amines on heating with chloroform generate foul smelling product?

Options:

- A. Ethanamine
- B. Ethylmethanamine
- C. Ethyldimethanamine
- D. Diethylmethanamine

Question 90

The rate law for the reaction $A + B \rightarrow \text{product}$ is $\text{rate} = k[A][B]$. When will the rate of reaction increase by factor two?

Options:

- A. $[A]$ and $[B]$ both are doubled
- B. $[A]$ is doubled and $[B]$ is kept constant
- C. $[B]$ is doubled and $[A]$ is halved
- D. $[A]$ is kept constant $[B]$ is halved

Question 91

What is IUPAC name of following compound?

Options:

- A. 1-Methoxy-3,3-dimethylcyclobutane
- B. 3-Methoxy-1,1-dimethylcyclobutane
- C. 3,3-Dimethylcyclobutoxymethane
- D. 1-Methoxy-3-isopropylbutane

Question 92

Identify substrate 'A' in the following reaction. $2nA \xrightarrow{\text{Dimethyl cadmium}} 2n \text{ Propanone} + n \text{ Cadmium chloride}$

Options:

- A. Ethyl chloride
- B. Ethylene dichloride
- C. Ethanoyl chloride
- D. Ethylidene dichloride

Question 93

Which of the following is NOT a basic amino acid?

Options:

- A. Proline
- B. Lysine
- C. Arginine
- D. Histidine

Question 94

Calculate the PV type of work for the following reaction at 1 bar pressure. $\text{C}_3\text{H}_6(g) + \text{HCl}(g) \rightarrow \text{C}_3\text{H}_7\text{Cl}(g)$ (150 mL) (150 mL) (150 mL)

Options:

- A. 5.2 J
- B. 10.21 J
- C. 15.00 J
- D. 18.2 J

Question 95

Which among the following is NOT dicarboxylic acid?

Options:

- A. Malonic acid
- B. Caproic acid
- C. Glutaric acid
- D. Succinic acid

Question 96

Identify the element having positive electron gain enthalpy.

Options:

- A. Ne
- B. I
- C. S
- D. O

Question 97

Identify the use of HDP from following.

Options:

- A. Insulation of electric cables
- B. Manufacture of toys
- C. Submarine cable insulation
- D. Producing extruded films

Question 98

Which coordination complex from following contains neutral ligand?

Options:

- A. Pentacarbonyl iron(0)
- B. Trioxalatocobaltate(III) ion
- C. Sodium hexanitrocobaltate(III)
- D. Tetracyanonickelate(II) ion

Question 99

What type of following solutions is the gasoline?

Options:

- A. Liquid as solute and liquid as solvent
- B. Liquid as solute and solid as solvent
- C. Solid as solute and liquid as solvent
- D. Gas as solute and liquid as solvent

Question 100

What is formal charge on carbon in the following Lewis structure?

Options:

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

Physics

Question 101

The power factor of an R-L circuit is $\frac{1}{\sqrt{2}}$. If the frequency of AC is doubled the power factor will now be

Options:

- A. $\frac{1}{\sqrt{3}}$
- B. $\frac{1}{\sqrt{5}}$
- C. $\frac{1}{\sqrt{7}}$
- D. $\frac{1}{\sqrt{11}}$

Question 102

Ratio of longest wavelength corresponding to Lyman and Balmer series in hydrogen spectrum is

Options:

- A. $\frac{7}{29}$
- B. $\frac{9}{31}$
- C. $\frac{5}{27}$
- D. $\frac{3}{23}$

Question 103

A uniform circular disc of mass 12 kg is held by two identical springs. When the disc is slightly pressed down and released, it executes S.H.M. of period 2 second. The force constant of each spring is (nearly) (Take $\pi^2 = 10$)

Options:

- A. 230 Nm^{-1}
- B. 120 Nm^{-1}
- C. 60 Nm^{-1}
- D. 30 Nm^{-1}

Question 104

A charge 17.7×10^{-4} C is distributed uniformly over a large sheet of area 200 m^2 . The electric field intensity at a distance 20 cm from it in air will be [$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$]

Options:

- A. $5 \times 10^5 \text{ N/C}$
- B. $6 \times 10^5 \text{ N/C}$
- C. $7 \times 10^5 \text{ N/C}$
- D. $8 \times 10^5 \text{ N/C}$

Question 105

Sound waves of frequency 600 Hz fall normally on a perfectly reflecting wall. The shortest distance from the wall at which all particles will have maximum amplitude of vibration is (speed of sound = 300 ms^{-1})

Options:

- A. $\frac{1}{4} \text{ m}$
- B. $\frac{1}{8} \text{ m}$
- C. $\frac{3}{8} \text{ m}$
- D. $\frac{7}{8} \text{ m}$

Question 106

A long solenoid has 1500 turns. When a current of 3.5 A flows through it, the magnetic flux linked with each turn of solenoid is 2.8×10^{-3} weber. The self-inductance of solenoid is

Options:

- A. 1.2 H
- B. 2.4 H
- C. 3.6 H
- D. 6 H

Question 107

A metal rod cools at the rate of $4^\circ\text{C}/\text{min}$ when its temperature is 90°C and the rate of $1^\circ\text{C}/\text{min}$ when its temperature is 30°C . The temperature of the surrounding is

Options:

- A. 20°C
- B. 15°C
- C. 10°C
- D. 5°C

Question 108

On replacing a thin film of mica of thickness 12×10^{-5} cm in the path of one of the interfering beams in Young's double slit experiment using monochromatic light, the fringe pattern shifts through a distance equal to the width of bright fringe. If $\lambda = 6 \times 10^{-5}$ cm, the refractive index of mica is

Options:

- A. 1.1
- B. 1.3
- C. 1.5
- D. 1.4

Question 109

In the hysteresis curve the value of magnetization (B) which will be present in a substance when value of magnetizing force (H) is made zero ($H = 0$) is called as

Options:

- A. coercivity
- B. retentivity
- C. domain
- D. saturation

Question 110

The output of following combination is same as that of

Options:

- A. AND gate
- B. OR gate
- C. NAND gate
- D. NOR gate

Question 111

A parallel plate capacitor with air medium between the plates has a capacitance of $10\mu\text{F}$. The area of capacitor is divided into two equal halves and filled with two media (as shown in figure) having dielectric constant $K_1 = 2$ and $K_2 = 4$. The capacitance of the system will be

Options:

- A. $10\mu\text{F}$
- B. $20\mu\text{F}$
- C. $30\mu\text{F}$
- D. $40\mu\text{F}$

Question 112

Refractive index of a glass convex lens is 1.5. The radius of curvature of each of the two surfaces of the lens is 20 cm. The ratio of the power of the lens when immersed in a liquid of refractive index 1.25 to that when placed in air is

Options:

- A. 2 : 3
- B. 2 : 5
- C. 3 : 5
- D. 5 : 2

Question 113

Earth is assumed to be a sphere of radius R . If ' g_ϕ ' is value of effective acceleration due to gravity at latitude 30° and ' g ' is the value at equator, then the value of $|g - g_\phi|$ is (ω is angular velocity of rotation of earth, $\cos 30^\circ = \frac{\sqrt{3}}{2}$)

Options:

- A. $\frac{1}{4}\omega^2 R$
- B. $\frac{3}{4}\omega^2 R$
- C. $\omega^2 R$
- D. $\frac{1}{2}\omega^2 R$

Question 114

Four identical uniform solid spheres each of same mass 'M' and radius 'R' are placed touching each other as shown in figure, with centres A, B, C, D. I_A, I_B, I_C and I_D are the moment of inertia of these spheres respectively about an axis passing through centre and perpendicular to the plane. The difference in I_A , and I_B is

Options:

- A. $24 MR^2$
- B. $32 MR^2$
- C. $56 MR^2$
- D. $80 MR^2$

Question 115

Two condensers one of capacity $\frac{C}{2}$ and other capacity C are connected to a battery of voltage V as shown. The work done in charging fully both the condensers is

Options:

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

Question 116

When two light waves each of amplitude 'A' and having a phase difference of $\frac{\pi}{2}$ superimposed then the amplitude of resultant wave is

Options:

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

Question 117

In an n-p-n transistor, the collector current is 28 mA. If 80% of electrons reach the collector, its base current in mA is

Options:

- A. 35
- B. 24
- C. 14
- D. 7

Question 118

A light spring is suspended with mass m_1 at its lower end and its upper end fixed to a rigid support. The mass is pulled down a short distance and then released. The period of oscillation is T second. When a mass m_2 is added to m_1 and the system is made to oscillate, the period is found to be $\frac{3}{2}T$. The ratio $m_1 : m_2$ is

Options:

- A. 2 : 3
- B. 3 : 4
- C. 4 : 5
- D. 5 : 6

Question 119

The molecular mass of a gas having r.m.s. speed four times as that of another gas having molecular mass 32 is

Options:

- A. 2
- B. 4
- C. 16
- D. 32

Question 120

The position 'x' of a particle varies with a time as $x = at^2 - bt^3$ where 'a' and 'b' are constants. The acceleration of the particle will be zero at

Options:

- A. $\frac{2a}{3b}$
- B. $\frac{a}{b}$
- C. $\frac{a}{3b}$
- D. zero

Question 121

When the conductivity of a semiconductor is only due to the breaking of the covalent bonds, the semiconductor is called

Options:

- A. donor
- B. intrinsic
- C. acceptor
- D. extrinsic

Question 122

A coil having effective area A, is held with its plane normal to magnetic field of induction B. The magnetic induction is quickly reduced by 25% of its initial value in 2 second. Then the e.m.f. induced across the coil will be

Options:

- A. $\frac{AB}{8}$
- B. $\frac{AB}{2}$
- C. $\frac{3AB}{4}$
- D. $\frac{3AB}{8}$

Question 123

At constant temperature, increasing the pressure of a gas by 5% its volume will decrease by

Options:

- A. 5%
- B. 5.26%
- C. 4.20%
- D. 4.70%

Question 124

Half life of radio-active element is 1600 years. The fraction of sample remains undecayed after 6400 years will be

Options:

- A. $\frac{1}{16}$
- B. $\frac{1}{4}$
- C. $\frac{1}{8}$
- D. $\frac{1}{24}$

Question 125

Figure shows two semicircular loops of radii R_1 and R_2 carrying current I . The magnetic field at the common centre 'O' is

Options:

- A. $\frac{\mu_0 I}{4} \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$
- B. $\frac{\mu_0 I}{4} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$
- C. $\frac{\mu_0 I}{2\pi} \left(\frac{1}{R_1} + \frac{1}{R_2} \right)$
- D. $\frac{\mu_0 I}{2\pi} \left(\frac{1}{R_1} - \frac{1}{R_2} \right)$

Question 126

When radiation of wavelength ' λ ' is incident on a metallic surface, the stopping potential is 4.8 V. If the surface is illuminated with radiation of double the wavelength then the stopping potential becomes 1.6 V. The threshold wavelength for the surface is

Options:

- A. 2λ
- B. 4λ
- C. 6λ
- D. 8λ

Question 127

A long wire is bent into a circular coil of one turn and then into a circular coil of smaller radius having n turns. If the same current passes in both the cases, the ratio of magnetic fields produced at the centre for one turn to that of n turns is

Options:

- A. $1 : n$
- B. $n : 1$
- C. $1 : n^2$
- D. $n^2 : 1$

Question 128

When moving coil galvanometer (MCG) is converted into a voltmeter, the series resistance is ' n ' times the resistance of galvanometer. How many times that of MCG the voltmeter is now capable of measuring voltage?

Options:

- A. n
- B. $\frac{n+1}{n}$
- C. $n + 1$
- D. $n - 1$

Question 129

The self induction (L) produced by solenoid of length ' l ' having ' N ' number of turns and cross sectional area ' A ' is given by the formula (ϕ = magnetic flux, μ_0 = permeability of vacuum)

Options:

- A. $L = N\phi$
- B. $L = \mu_0 N A l$
- C. $L = \frac{\mu_0 N^2 A}{l}$
- D. $L = \frac{\mu_0 N A}{l}$

Question 130

A wire PQ has length 4.8 m and mass 0.06 kg. Another wire QR has length 2.56 m and mass 0.2 kg. Both wires have same radii and are joined as a single wire. This wire is under tension of 80 N. A wave pulse of amplitude 3.5 cm is sent along the wire PQ from end P. the time taken by the wave pulse to travel along the wire from point P to R is ?

Options:

- A. 0.1 s
- B. 0.12 s
- C. 0.14 s
- D. 0.16 s

Question 131

When a monochromatic ray of light is passed through an equilateral glass prism, it is found that the refracted ray in glass is parallel to the base of the prism. If 'i' and 'e' denote the angles of incidence and emergence respectively, then

Options:

- A. $i > e$
- B. $i < e$
- C. $i = e$
- D. $i + e = 90^\circ$

Question 132

A solid cylinder and a solid sphere having same mass and same radius roll down on the same inclined plane. The ratio of the acceleration of the cylinder ' a_c ' to that of sphere ' a_s ' is

Options:

- A. $\frac{11}{15}$
- B. $\frac{13}{14}$
- C. $\frac{15}{14}$
- D. $\frac{14}{15}$

Question 133

An alternating voltage $E = 200\sqrt{2}\sin(100t)$ volt is connected to a $1\mu\text{f}$ capacitor through an a.c. ammeter. The reading of the ammeter shall

Options:

- A. 10 mA
- B. 20 mA
- C. 40 mA
- D. 80 mA

Question 134

A sonometer wire 49 cm long is in unison with a tuning fork of frequency 'n'. If the length of the wire is decreased by 1 cm and it is vibrated with the same tuning fork, 6 beats are heard per second. The value of 'n' is

Options:

- A. 256 Hz
- B. 288 Hz
- C. 320 Hz
- D. 384 Hz

Question 135

Two spherical soap bubbles of radii 'a' and 'b' in vacuum coalesce under isothermal conditions. The resulting bubble has a radius equal to

Options:

- A. $a + b$
- B. $\frac{a+b}{2}$
- C. $\sqrt{a^2 + b^2}$
- D. $\frac{a+b}{ab}$

Question 136

A mass 'M' is moving with constant velocity parallel to X-axis. Its angular momentum with respect to the origin is

Options:

- A. constant
- B. zero
- C. decreasing
- D. increasing

Question 137

A block of mass 'M' rests on a piston executing S.H.M. of period one second. The amplitude of oscillations, so that the mass is separated from the piston, is (acceleration due to gravity, $g = 10 \text{ ms}^{-2}$, $\pi^2 = 10$)

Options:

- A. 0.25 m
- B. 0.5 m
- C. 1 m
- D. ∞

Question 138

A machine gun fires bullets of mass 30 g with velocity of 1000 m/s. The man holding the gun can exert a maximum force of 300 N on it. How many bullets can he fire per second at most?

Options:

- A. 3
- B. 6
- C. 10
- D. 9

Question 139

The temperature of a gas is measure of

Options:

- A. the average kinetic energy of gas molecules.
- B. the average potential energy of gas molecules.
- C. the average distance between the molecules of a gas
- D. the size of the molecules of a gas

Question 140

A body (mass m) starts its motion from rest from a point distant R_0 ($R_0 > R$) from the centre of the earth. The velocity acquired by the body when it reaches the surface of earth will be (G = universal constant of gravitation, M = mass of earth, R = radius of earth)

Options:

- A. $2GM \left(\frac{1}{R} - \frac{1}{R_0} \right)$
- B. $\left[2GM \left(\frac{1}{R} - \frac{1}{R_0} \right) \right]^{\frac{1}{2}}$
- C. $GM \left(\frac{1}{R} - \frac{1}{R_0} \right)$
- D. $2GM \left[\left(\frac{1}{R} - \frac{1}{R_0} \right) \right]^{\frac{1}{2}}$

Question 141

An ideal refrigerator has freezer at a temperature of -13°C . The coefficient of performance of the engine is 5. The temperature of the air (to which heat is rejected) is

Options:

- A. 320°C
- B. 39°C
- C. 325 K
- D. 325°C

Question 142

1000 small water drops of equal size combine to form a big drop. The ratio of final surface energy to the total initial surface energy is

Options:

- A. 10 : 1
- B. 1 : 10
- C. 1000 : 1
- D. 1 : 1000

Question 143

It is easier to spray water to which soap is added because addition of soap to water

Options:

- A. decreases surface tension of water
- B. increases surface tension of water.
- C. makes surface tension of water zero.
- D. increases its density.

Question 144

What will be the phase difference between virtual voltage and virtual current when current in the circuit is wattless?

Options:

- A. 60°
- B. 45°
- C. 90°
- D. 180°

Question 145

Two wavelengths of sodium light 590 nm and 596 nm are used one after another to study diffraction due to single slit of aperture 2×10^{-6} m. The distance between the slit and the screen is 1.5 m. The separation between the positions of first maximum of the diffraction pattern obtained in the two cases is

Options:

- A. 5.5 mm
- B. 5.75 mm
- C. 6.25 mm
- D. 6.75 mm

Question 146

A coil having an inductance of $\frac{1}{\pi}$ H is connected in series with a resistance of 300Ω . If 20 V from a 200 Hz source are impressed across the combination, the value of the phase angle between the voltage and the current is

Options:

- A. $\tan^{-1}\left(\frac{5}{4}\right)$
- B. $\tan^{-1}\left(\frac{4}{5}\right)$
- C. $\tan^{-1}\left(\frac{3}{4}\right)$
- D. $\tan^{-1}\left(\frac{4}{3}\right)$

Question 147

The pressure and density of a diatomic gas ($\gamma = \frac{7}{5}$) changes adiabatically from (P, ρ) to (P', ρ') . If $\frac{\rho'}{\rho} = 32$ then $\frac{P'}{P}$ should be

Options:

- A. $\frac{1}{128}$
- B. 128
- C. 32
- D. 64

Question 148

A source of sound is moving towards a stationary observer with $\left(\frac{1}{10}\right)^{\text{th}}$ the of the speed of sound. The ratio of apparent to real frequency is

Options:

- A. 10 : 9
- B. 11 : 10
- C. $(11)^2 : (10)^2$
- D. $(9)^2 : (10)^2$

Question 149

If E_a and E_q represent the electric field intensity due to a short dipole at a point on its axial line and on the equatorial line at the same distance 'r' from the centre of the dipole, then

Options:

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

Question 150

In potentiometer experiment, the balancing length is 8 m when two cells E_1 and E_2 are joined in series. When two cells are connected in opposition the balancing length is 4 m. The ratio of the e.m.f. of the two cells $\left(\frac{E_1}{E_2}\right)$ is

Options:

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

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