

MHT CET 2023 Mathematics Memory Based Question Paper PDF

Mathematics

Question 1

$$\int_0^{\pi} \frac{dx}{4+3\cos x} =$$

Options:

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

Question 2

If $y = \log_{\sin x} \tan x$, then $\left(\frac{dy}{dx}\right)_{x=\frac{\pi}{4}}$ has the value

Options:

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

Question 3

$\lim_{x \rightarrow 2} \left[\frac{1}{x-2} - \frac{2}{x^3-3x^2+2x} \right]$ is equal to

Options:

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

Question 4

From a lot of 20 baskets, which includes 6 defective baskets, a sample of 2 baskets is drawn at random one by one without replacement. The expected value of number of defective basket is

Options:

- A. 0.6
- B. 0.06
- C. 0.006
- D. 1.07

Question 5

If the angle between the lines represented by the equation $x^2 + \lambda xy - y^2 \tan^2 \theta = 0$ is 2θ , then the value of λ is

Options:

- A. 0
- B. 1
- C. $\tan \theta$
- D. 2

Question 6

Number of common tangents to the circles $x^2 + y^2 - 6x - 14y + 48 = 0$ and $x^2 + y^2 - 6x = 0$ are

Options:

- A. 0
- B. 1
- C. 4
- D. 2

Question 7

The left-hand derivative of $f(x) = [x] \sin(\pi x)$, at $x = k$, k is an integer and $[.]$ is the greatest integer function, is

Options:

- A. $(-1)^k (k - 1)\pi$
- B. $(-1)^{k-1} (k - 1)\pi$
- C. $(-1)^k k\pi$
- D. $(-1)^{k-1} k\pi$

Question 8

Let $f(x) = \int \frac{\sqrt{x}}{(1+x)^2} dx, x \geq 0$, then $f(3) - f(1)$ is equal to

Options:

- A. $-\frac{\pi}{6} + \frac{1}{2} + \frac{\sqrt{3}}{4}$
- B. $-\frac{\pi}{12} + \frac{1}{2} + \frac{\sqrt{3}}{4}$
- C. $\frac{\pi}{6} + \frac{1}{2} - \frac{\sqrt{3}}{4}$
- D. $\frac{\pi}{12} + \frac{1}{2} - \frac{\sqrt{3}}{4}$

Question 9

Value of c satisfying the conditions and conclusions of Rolle's theorem for the function $f(x) = x\sqrt{x+6}, x \in [-6, 0]$ is

Options:

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

Question 10

Three of six vertices of a regular hexagon are chosen at random. The probability that the triangle with these three vertices is equilateral, equals

Options:

- A. $\frac{1}{2}$
- B. $\frac{1}{5}$
- C. $\frac{1}{10}$
- D. $\frac{1}{20}$

Question 11

If the direction cosines l, m, n of two lines are connected by relations $l - 5m + 3n = 0$ and $7l^2 + 5m^2 - 3n^2 = 0$, then value of $l + m + n$ is

Options:

- A. $\frac{2}{\sqrt{6}}$ or $\frac{6}{\sqrt{14}}$
- B. $\frac{1}{\sqrt{6}}$ or $\frac{5}{\sqrt{14}}$
- C. $\frac{2}{\sqrt{6}}$ or $\frac{5}{\sqrt{14}}$
- D. $\frac{1}{\sqrt{6}}$ or $\frac{6}{\sqrt{14}}$

Question 12

Let $f(x) = \log(\sin x)$, $0 < x < \pi$ and $g(x) = \sin^{-1}(e^{-x})$, $x \geq 0$. If α is a positive real number such that $a = (f \circ g)'(\alpha)$ and $b = (f \circ g)(\alpha)$, then

Options:

- A. $a\alpha^2 - b\alpha - a = 0$
- B. $a\alpha^2 - b\alpha - a = 1$
- C. $a\alpha^2 + b\alpha - a = -2\alpha^2$
- D. $a\alpha^2 + b\alpha + a = 0$

Question 13

Five students are to be arranged on a platform such that the boy B_1 occupies the second position and such that the girl G_1 is always adjacent to the girl G_2 . Then, the number of such possible arrangements is

Options:

- A. 4

- B. 7
- C. 8
- D. 6

Question 14

If the volume of the parallelopiped is 158 cu. units whose coterminous edges are given by the vectors $\vec{a} = (\hat{i} + \hat{j} + n\hat{k})$, $\vec{b} = 2\hat{i} + 4\hat{j} - n\hat{k}$ and $\vec{c} = \hat{i} + n\hat{j} + 3\hat{k}$, where $n \geq 0$, then the value of n is

Options:

- A. 8
- B. $\frac{19}{3}$
- C. 7
- D. 19

Question 15

Let $f(x)$ be positive for all real x . If $I_1 = \int_{1-h}^h xf(x(1-x))dx$ and $I_2 = \int_{1-h}^h f(x(1-x))dx$, where $(2h-1) > 0$, then $\frac{I_1}{I_2}$ is

Options:

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

Question 16

The mirror image of the point $(1, 2, 3)$ in a plane is $(-\frac{7}{3}, -\frac{4}{3}, -\frac{1}{3})$. Thus, the point _____ lies on this plane.

Options:

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

Question 17

If $\alpha = 3 \sin^{-1} \frac{6}{11}$ and $\beta = 3 \cos^{-1} \left(\frac{4}{9} \right)$, where the inverse trigonometric functions take only the principal values, then the correct option is

Options:

- A. $\cos \beta > 0$
- B. $\sin \beta < 0$
- C. $\cos(\alpha + \beta) > 0$
- D. $\cos \alpha < 0$

Question 18

The value of $\sec^2(\tan^{-1} 2) + \csc^2(\cot^{-1} 3)$ is

Options:

- A. 4
- B. 9
- C. 2
- D. 15

Question 19

The value of $\tan \left(\frac{\pi}{8} \right)$ is

Options:

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

Question 20

A plane is parallel to two lines, whose direction ratios are $1, 0, -1$ and $-1, 1, 0$ and it contains the point $(1, 1, 1)$. If it cuts co-ordinate axes (X, Y, Z - axes resp.) at A, B, C, then the volume of the tetrahedron OABC is cu. units.

Options:

- A. 9
- B. $\frac{9}{4}$
- C. $\frac{9}{2}$
- D. 27

Question 21

The domain of the function given by $2^x + 2^y = 2$ is

Options:

- A. $0 < x \leq 1$
- B. $0 \leq x \leq 1$
- C. $-\infty < x \leq 0$
- D. $-\infty < x < 1$

Question 22

If $f(x) = xe^{x(1-x)}$, $x \in \mathbb{R}$, then $f(x)$ is

Options:

- A. increasing in $[-\frac{1}{2}, 1]$
- B. decreasing $\mathbb{R}$
- C. increasing in $\mathbb{R}$
- D. decreasing in $[-\frac{1}{2}, 1]$

Question 23

The solution of the differential equation $\frac{dy}{dx} = \frac{1+y^2}{1+x^2}$ is

Options:

- A. $x + y = c$, where c is a constant of integration.
- B. $x - y = c(xy)$, where c is a constant of integration.
- C. $x + y = c(1 + xy)$, where c is a constant of integration.
- D. $y - x = c(1 + xy)$, where c is a constant of integration.

Question 24

If $\bar{a}, \bar{b}, \bar{c}$ are three vectors such that $\bar{a} \cdot (\bar{b} + \bar{c}) + \bar{b} \cdot (\bar{c} + \bar{a}) + \bar{c} \cdot (\bar{a} + \bar{b}) = 0$ and $|\bar{a}| = 1, |\bar{b}| = 8$ and $|\bar{c}| = 4$, then $|\bar{a} + \bar{b} + \bar{c}|$ has the value -----.

Options:

- A. 81
- B. 9
- C. 5
- D. 4

Question 25

Let $\bar{a} = 2\hat{i} + \hat{j} - 2\hat{k}$ and $\bar{b} = \hat{i} + \hat{j}$. If $\bar{c}$ is a vector such that $\bar{a} \cdot \bar{c} = |\bar{c}|$, $|\bar{c} - \bar{a}| = 2\sqrt{2}$ and the angle between $(\bar{a} \times \bar{b})$ and $\bar{c}$ is $\frac{\pi}{6}$, then $|(\bar{a} \times \bar{b}) \times \bar{c}|$ is

Options:

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

Question 26

$$\int_{-1}^3 \left(\cot^{-1} \left(\frac{x}{x^2+1} \right) + \cot^{-1} \left(\frac{x^2+1}{x} \right) \right) dx =$$

Options:

- A. $(\frac{\pi}{4})$
- B. π
- C. $(\frac{\pi}{2})$
- D. (2π)

Question 27

If $P = \begin{bmatrix} 1 & \alpha & 3 \\ 1 & 3 & 3 \\ 2 & 4 & 4 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A| = 4$, then value of α is

Options:

- A. 4
- B. 11
- C. 5
- D. 0

Question 28

If $f(x) = \begin{cases} \frac{\sqrt{1+mx}-\sqrt{1-mx}}{x}, & -1 \leq x < 0 \\ \frac{2x+1}{x-2}, & 0 \leq x \leq 1 \end{cases}$ is continuous in the interval $[-1, 1]$, then m is equal to

Options:

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

Question 29

The area of the region bounded by the parabola $y = x^2$ and the curve $y = |x|$ is

Options:

- A. $\frac{1}{2}$ sq. units
- B. $\frac{1}{3}$ sq. units

- C. $\frac{1}{4}$ sq. units
D. $\frac{1}{6}$ sq. units

Question 30

Derivative of $\tan^{-1} \left(\frac{\sqrt{1+x^2}-\sqrt{1-x^2}}{\sqrt{1+x^2}+\sqrt{1-x^2}} \right)$ w.r.t. $\cos^{-1} x^2$ is

Options:

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

Question 31

A binomial random variable X satisfies $9.p(X = 4) = p(X = 2)$ when $n = 6$. Then p is equal to

Options:

- A. $\frac{1}{4}$
B. $\frac{1}{2}$
C. $\frac{1}{8}$
D. $\frac{1}{5}$

Question 32

If in $\triangle ABC$, with usual notations, $a \cdot \cos^2 \frac{C}{2} + c \cos^2 \frac{A}{2} = \frac{3b}{2}$, then

Options:

- A. a, b, c are in G.P.
B. a, b, c are in H.P.
C. a, b, c are in A.P.
D. a, b, c are in Arithmetico Geometric Progression

Question 33

The lines $\frac{x-1}{3} = \frac{y+1}{2} = \frac{z-1}{5}$ and $\frac{x+2}{4} = \frac{y-1}{3} = \frac{z+1}{2}$

Options:

- A. intersect each other and point of intersection is $(2, 1, 3)$
B. intersect each other and point of intersection is $(3, 2, 4)$
C. intersect each other and point of intersection is $(-2, 3, 3)$
D. do not intersect.

Question 34

A curve passes through the point $(1, \frac{\pi}{6})$. Let the slope of the curve at each point (x, y) be $\frac{y}{x} + \sec \left(\frac{y}{x} \right)$, $x > 0$, then, the equation of the curve is

Options:

- A. $\sin\left(\frac{y}{x}\right) = \log(x) + \frac{1}{2}$
- B. $\csc\left(\frac{y}{x}\right) = \log(x) + 2$
- C. $\sec\left(\frac{2y}{x}\right) = \log(x) + 2$
- D. $\cos\left(\frac{2y}{x}\right) = \log(x) + \frac{1}{2}$

Question 35

For the following shaded area, the linear constraints except $x, y \geq 0$ are

Options:

- A. $2x + y \leq 2, x - y \leq 1, x + 2y \leq 8$
- B. $2x + y \geq 2, x - y \leq 1, x + 2y \leq 8$
- C. $2x + y \geq 2, x - y \geq 1, x + 2y \leq 8$
- D. $2x + y \geq 2, x - y \geq 1, x + 2y \geq 8$

Question 36

Let $\omega \neq 1$ be a cube root of unity and S be the set of all non-singular matrices of the form

$\begin{bmatrix} 1 & a & b \\ \omega & 1 & c \\ \omega^2 & \omega & 1 \end{bmatrix}$ where each of a, b and c is either ω or ω^2 , then the number of distinct matrices in the set S is

Options:

- A. 2
- B. 6
- C. 4
- D. 8

Question 37

The value of $2 \tan^{-1} \frac{1}{2} + \tan^{-1} \frac{1}{7}$

Options:

- A. $\tan^{-1}\left(\frac{17}{31}\right)$
- B. $\tan^{-1}\left(\frac{19}{31}\right)$
- C. $\tan^{-1}\left(\frac{31}{17}\right)$

D. $\tan^{-1}\left(\frac{31}{19}\right)$

Question 38

$$\int \frac{e^x(1+x)}{\cos^2(e^x \cdot x)} dx =$$

Options:

- A. $-\cot(e^x) + c$, where c is a constant of integration.
- B. $\tan(x \cdot e^x) + c$, where c is a constant of integration.
- C. $\tan(e^x) + c$, where c is a constant of integration.
- D. $-\cot(x \cdot e^x) + c$, where c is a constant of integration.

Question 39

In a triangle ABC, with usual notations, if $m\angle A = 60^\circ$, $b = 8$, $a = 6$ and $B = \sin^{-1} x$, then x has the value

Options:

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

Question 40

If variance of $x_1, x_2, \dots, x_n$ is σ_x^2 , then the variance of $\lambda x_1, \lambda x_2, \dots, \lambda x_n$ ($\lambda \neq 0$) is

Options:

- A. $\lambda \cdot \sigma_x$
- B. $\lambda \cdot \sigma_x^2$
- C. $\lambda^2 \cdot \sigma_x$
- D. $\lambda^2 \cdot \sigma_x^2$

Question 41

If $\bar{a} = \hat{i} + \hat{j}$, $\bar{b} = 2\hat{j} - \hat{k}$ and $\bar{r} \times \bar{a} = \bar{b} \times \bar{a}$, $\bar{r} \times \bar{b} = \bar{a} \times \bar{b}$, then the value $\frac{\bar{r}}{|\bar{r}|}$ is

Options:

- A. $\frac{\hat{i}+3\hat{j}+\hat{k}}{\sqrt{11}}$
- B. $\frac{\hat{i}-3\hat{j}+\hat{k}}{\sqrt{11}}$
- C. $\frac{\hat{i}-3\hat{j}-\hat{k}}{\sqrt{11}}$
- D. $\frac{\hat{i}+3\hat{j}-\hat{k}}{\sqrt{11}}$

Question 42

If $z = x + iy$ and $z^{1/3} = p + iq$, where $x, y, p, q \in \mathbb{R}$ and $i = \sqrt{-1}$, then value of $\left(\frac{x}{p} + \frac{y}{q}\right)$ is

Options:

- A. $p^2 - q^2$
- B. $4(p^2 - q^2)$
- C. $p^2 + q^2$
- D. $4(p^2 + q^2)$

Question 43

If $\int \frac{dx}{x\sqrt{1-x^3}} = k \log \left| \frac{\sqrt{1-x^3}-1}{\sqrt{1-x^3}+1} \right| + c$, (where c is a constant of integration), then value of k is

Options:

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

Question 44

The statement pattern $p \rightarrow \sim (p \wedge \sim q)$ is equivalent to

Options:

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

Question 45

a and b are the intercepts made by a line on the co-ordinate axes. If $3a = b$ and the line passes through $(1, 3)$, then the equation of the line is

Options:

- A. $x + 3y = 10$
- B. $3x + y = 6$
- C. $x - 3y + 8 = 0$
- D. $3x - 2y + 3 = 0$

Question 46

Let $\bar{a}$, $\bar{b}$ and $\bar{c}$ be three unit vectors such that $\bar{a} \times (\bar{b} \times \bar{c}) = \frac{\sqrt{3}}{2}(\bar{b} + \bar{c})$. If $\bar{b}$ is not parallel to $\bar{c}$, then the angle between $\bar{a}$ and $\bar{b}$ is

Options:

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

Question 47

The vector equation of the line $2x + 4 = 3y + 1 = 6z - 3$ is

Options:

- A. $\vec{r} = (2\hat{i} + \frac{1}{3}\hat{j} + \frac{1}{2}\hat{k}) + \lambda(3\hat{i} + 2\hat{j} + \hat{k})$
 B. $\vec{r} = (-2\hat{i} - \frac{1}{3}\hat{j} + \frac{1}{2}\hat{k}) + \lambda(3\hat{i} + 2\hat{j} + \hat{k})$
 C. $\vec{r} = (2\hat{i} + \hat{j} + \hat{k}) + \lambda(3\hat{i} + 2\hat{j} + \hat{k})$
 D. $\vec{r} = (-2\hat{i} - \hat{j} + \hat{k}) + \lambda(3\hat{i} + 2\hat{j} + \hat{k})$

Question 48

If $\vec{a}$ and $\vec{b}$ are two unit vectors such that $\vec{a} + 2\vec{b}$ and $5\vec{a} - 4\vec{b}$ are perpendicular to each other, then the angle between $\vec{a}$ and $\vec{b}$ is

Options:

- A. $(\frac{\pi}{4})$
 B. $(\frac{\pi}{3})$
 C. $\cos^{-1}(\frac{1}{3})$
 D. $\cos^{-1}(\frac{2}{7})$

Question 49

$$\int \frac{\log(\cot x)}{\sin 2x} dx =$$

Options:

- A. $-\log(\cot x)^2 + c$, where c is a constant of integration.
 B. $2(\log(\cot x))^2 + c$, where c is a constant of integration.
 C. $-\frac{1}{4}(\log(\sin x))^2 + c$, where c is a constant of integration.
 D. $-\frac{1}{4}(\log(\cot x))^2 + c$, where c is a constant of integration.

Question 50

If $y = \sqrt{\frac{1 - \sin^{-1}(x)}{1 + \sin^{-1}(x)}}$, then $\frac{dy}{dx}$ at $x = 0$ and $y = 1$ is

Options:

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

Chemistry

Question 51

Name the accelerator used to introduce network of crosslink in elastomer.

Options:

- A. Zinc butyl xanthate
- B. Zinc ethyl xanthate
- C. Zinc butyl stearate
- D. Zinc propyl xanthate

Question 52

Which of the following is a property of alkali metals?

Options:

- A. High density
- B. Compounds are paramagnetic
- C. Form dipositive ions only
- D. Most electropositive elements

Question 53

The IUPAC name of following compound is:

Options:

- A. 1-Bromo-1,3,4-trimethylhex-2-ene
- B. 2-Bromo-4,5-dimethylhept-3-ene
- C. 2-Bromo-5-ethyl-4-methylhex-3-ene
- D. 1-Bromo-4-ethyl-1,3-dimethylpent-2-ene

Question 54

If K_b denote molal elevation constant of water, then boiling point of an aqueous solution containing 36 g glucose (molar mass = 180) per dm^3 is:

Options:

- A. $(100 + K_b)^\circ C$
- B. $(100 + 2K_b)^\circ C$
- C. $(100 + \frac{K_b}{10})^\circ C$
- D. $(100 + \frac{2K_b}{10})^\circ C$

Question 55

Which metal halide from following has lowest ionic character (M = metal atom)?

Options:

- A. MF
- B. MCl
- C. MBr
- D. MI

Question 56

Which among the following reagents is called as Hinsberg's reagent?

Options:

- A. Benzenesulphonyl chloride
- B. Sodium nitroprusside
- C. Chromyl chloride
- D. Hydrazine

Question 57

Which among the following amines has highest value of pK_b ?

Options:

- A. $(CH_3)_2NH$
- B. $(CH_3)_3N$
- C. CH_3NH_2
- D. $C_6H_5NH_2$

Question 58

What is vapour pressure of a solution containing 1 mol of a nonvolatile solute in 36 g of water ($P_1^0 = 32$ mm Hg)?

Options:

- A. 8.14 mm Hg
- B. 12.31 mm Hg
- C. 16.08 mm Hg
- D. 21.44 mm Hg

Question 59

Identify the product obtained when phenol is reacted with dilute nitric acid at low temperature.

Options:

- A. ortho-Nitrophenol
- B. para-Nitrophenol
- C. Mixture of ortho and para-nitrophenols

D. 2,4,6-Trinitrophenol

Question 60

For an elementary reaction



rate of appearance of C is $1.3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$, the rate of disappearance of A is:

Options:

- A. $1.3 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
- B. $2.6 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
- C. $5.2 \times 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$
- D. $8.66 \times 10^{-5} \text{ mol L}^{-1} \text{ s}^{-1}$

Question 61

Which among the following alkenes is most stable?

Options:

- A. $R_2C = CH_2$
- B. $H_2C = CH_2$
- C. $RCH = CHR$
- D. $R_2C = CR_2$

Question 62

Identify a CORRECT formula for spin only magnetic moment.

Options:

- A. $\mu = (n^2 + 2)BM$
- B. $\mu = \sqrt{n^2 + 2}BM$
- C. $\mu = \sqrt{n(n + 2)}BM$
- D. $\mu = (n + 2)^2BM$

Question 63

Which of the following salts turns red litmus blue in its aqueous solution?

Options:

- A. NH_4NO_3
- B. NH_4Cl
- C. NH_4CN
- D. NH_4F

Question 64

What is the value of increase in internal energy when system does 8 J of work on surrounding

by supplying 40 J of heat to it?

Options:

- A. 23 J
- B. 32 J
- C. 40 J
- D. 48 J

Question 65

Benzonitrile on reduction with stannous chloride in presence of hydrochloric acid followed by acid hydrolysis forms:

Options:

- A. Benzal chloride
- B. Benzoyl chloride
- C. Benzophenone
- D. Benzaldehyde

Question 66

Which among the following is TRUE for isobaric process?

Options:

- A. $\Delta U = 0$
- B. $-\Delta U = -W$
- C. $\Delta U = Q$
- D. $Q_p = \Delta U + P_{ext}\Delta V$

Question 67

Which among the following statements is TRUE about gammexane?

Options:

- A. It is an isomer of BHC.
- B. It is one of the herbicides.
- C. It is obtained from benzene by bromination.
- D. It is monochloro derivative of benzene.

Question 68

Which of the following is primary allylic alcohol?

Options:

- A.

B. $H_2C = CH - CH_2OH$

C.

D.

Question 69

Which of the following is NOT correct about fructose?

Options:

- A. It is ketohexose.
- B. It is reducing sugar.
- C. It is laevorotatory.
- D. Its ring structure is hemiacetal.

Question 70

Which among following salts shows decrease in solubility with increase in temperature?

Options:

- A. Na_2SO_4
- B. KNO_3
- C. $NaNO_3$
- D. KBr

Question 71

Find the number of faradays of electricity required to produce 45 g of Al from molten Al_2O_3 .

(At. mass of Al = 27)

Options:

- A. 1 F
- B. 3 F
- C. 5 F
- D. 7 F

Question 72

Identify the reagent that confirms the presence of five $-OH$ groups in glucose.

Options:

- A. NH_2OH
- B. HCN
- C. dil. HNO_3
- D. Acetic anhydride

Question 73

What is the concentration of OH^- ion in a solution containing $0.05\text{ M } H^+$ ions?

Options:

- A. $2.5 \times 10^{-13} M$
- B. $5.0 \times 10^{-2} M$
- C. $2.0 \times 10^{-13} M$
- D. $4.2 \times 10^{-12} M$

Question 74

Which formula is used to calculate edge length in bcc structure?

Options:

- A. $a = \frac{\sqrt{3}r}{4}$
- B. $a = \frac{4}{\sqrt{3}r}$
- C. $a = \frac{\sqrt{3}}{4r}$
- D. $a = \frac{4r}{\sqrt{3}}$

Question 75

Identify the products of following reaction:

Options:

- A. Methanoic acid and phenyl methanol
- B. Methanol and benzoic acid
- C. Methanol and phenol
- D. Methanoic acid and phenol

Question 76

What is the volume in dm^3 occupied by 3 mol of ammonia gas at STP?

Options:

- A. 2.24
- B. 22.4
- C. 56.0
- D. 67.2

Question 77

Slope of the graph between $\log \frac{[A]_0}{[A]_t}$ (y axis) and time (x axis) for first order reaction is equal to:

Options:

- A. $+\frac{k}{2.303}$
- B. k
- C. $-k$
- D. $-\frac{2.303}{k}$

Question 78

What is total number of donor atoms in $[Co(H_2O)(NH_3)_5]I_3$?

Options:

- A. 5
- B. 9
- C. 6
- D. 3

Question 79

Which from following equations is used to express the angular momentum of an electron in a stationary state?

Options:

- A. $mvr = \frac{nh}{2\pi}$
- B. $mvr = \frac{2\pi}{nh}$
- C. $r = \frac{mvh}{n2\pi}$
- D. $mv = \frac{2\pi r}{nh}$

Question 80

Which emission transition series is obtained when electron jumps from $n_2 = \infty$ to $n_1 = 1$?

Options:

- A. Balmer
- B. Lyman
- C. Paschen
- D. Bracket

Question 81

What is half life time of a first order reaction if initial conc. of reactant is 0.01 mol L^{-1} and rate of reaction is $0.00352 \text{ mol L}^{-1} \text{ minute}^{-1}$?

Options:

- A. 1.969 minute
- B. 7.75 minute
- C. 16.69 minute
- D. 19.69 minute

Question 82

Which among the following pairs of polymers contains both members as copolymers?

Options:

- A. Neoprene and Isoprene
- B. Orlon and Teflon
- C. Bakelite and Orlon
- D. SBR and PHBV

Question 83

What is atomic mass of an element with BCC structure and density 10 g cm^{-3} having edge length 300 pm ?

Options:

- A. 51.0 g mol^{-1}
- B. 60.0 g mol^{-1}
- C. 81.3 g mol^{-1}

D. 96.8 g mol^{-1}

Question 84

Oxidation state of manganese in potassium permanganate is:

Options:

- A. +3
- B. +7
- C. +5
- D. +1

Question 85

Which among following complexes is a neutral complex?

Options:

- A. $[Co(H_2O)(NH_3)_5]I_3$
- B. $[Co(NO_2)_3(NH_3)_3]$
- C. $Na[Co(NO_2)_6]$
- D. $[Fe(H_2O)_3(NCS)]Cl_2$

Question 86

Which among the following halogens combines readily with metals to form metal halides with highest ionic character?

Options:

- A. Chlorine
- B. Bromine
- C. Iodine
- D. Fluorine

Question 87

Which of the following compounds has the highest boiling point?

Options:

- A. Chloromethane

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

Question 88

Identify degenerate orbitals from following for hydrogen atom.

Options:

- A. 1s and 2s
- B. 1s and 2p
- C. 2s and 2p
- D. 3s and 2p

Question 89

Identify the product P obtained in following reaction.

Options:

- A. Benzoic acid
- B. Benzaldehyde
- C. Phenol
- D. Glyoxal

Question 90

What is IUPAC name of the compound?

Options:

- A. 1-Bromo-4-hydroxybenzene

- B. 1-Hydroxy-4-bromobenzene
- C. 4-Hydroxybromobenzene
- D. 4-Bromophenol

Question 91

Calculate the pH of 1.36×10^{-2} M solution of perchloric acid.

Options:

- A. 1.43
- B. 1.86
- C. 2.43
- D. 2.86

Question 92

Which of the following formulae is used to determine compressibility factor for measurement of deviation from ideal behaviour?

Options:

- A. $Z = \frac{nRT}{PV}$
- B. $Z = \frac{PV}{nRT}$
- C. $Z = \frac{nRT}{V}$
- D. $Z = \frac{nRT}{P}$

Question 93

The molar conductivity of 0.02 M AgI at 298 K is $142.3 \Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$. What is its conductivity?

Options:

- A. $1.42 \times 10^{-3} \Omega^{-1} \text{ cm}^{-1}$
- B. $2.41 \times 10^{-3} \Omega^{-1} \text{ cm}^{-1}$
- C. $2.85 \times 10^{-3} \Omega^{-1} \text{ cm}^{-1}$
- D. $7.11 \times 10^{-3} \Omega^{-1} \text{ cm}^{-1}$

Question 94

What is IUPAC name of following compound?

Options:

- A. 2-Ethylhept-3-en-5-ol
- B. 3-Methyloct-4-en-6-ol
- C. 6-Methyloct-4-en-3-ol
- D. 6-Ethylhept-4-en-3-ol

Question 95

Identify a molecule with incomplete octet from following.

Options:

- A. SF_6
- B. PCl_5
- C. $LiCl$
- D. H_2SO_4

Question 96

What is the number of unit cells present in a cubic pack crystal lattice having 4 atoms per unit cell and weighing 0.60 g (molar mass 60 g mol^{-1}) ?

Options:

- A. 1×10^{21}
- B. 1.5×10^{21}
- C. 3.0×10^{21}
- D. 6.0×10^{21}

Question 97

Identify 'A' in the following reaction.

Options:

- A. Benzene
- B. Chlorobenzene
- C. Toluene
- D. Phenol

Question 98

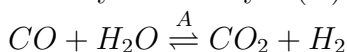
Which among the following is CORRECT formula for determination of cell constant?

Options:

- A. $\frac{l}{a} = \frac{k}{R}$
- B. $\frac{l}{a} = k \cdot R$
- C. $\frac{l}{a} = \frac{R}{k}$
- D. $\frac{l}{a} = \frac{1}{R}$

Question 99

Identify the catalyst (A) used in following reaction.

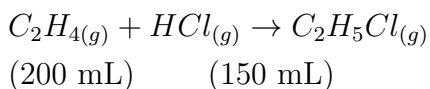


Options:

- A. Platinised asbestos
- B. MnO_2
- C. Co-Th alloy
- D. Fe - Cr

Question 100

What is value of PV type of work for following reaction at 1 bar?



Options:

- A. 3.5 J
- B. 4.5 J
- C. 9.0 J
- D. 15 J

Physics

Question 101

A coil of radius 'r' is placed on another coil (whose radius is R and current flowing through it is changing) so that their centres coincide ($R \gg r$). If both the coils are coplanar then the mutual inductance between them is (μ_0 = permeability of free space)

Options:

- A. $\frac{\mu_0 \pi R^2}{2r}$
- B. $\frac{\mu_0 \pi r^2}{2R}$
- C. $\frac{\mu_0 \pi r^2}{R}$
- D. $\mu_0 \pi R^2$

Question 102

Two capillary tubes of the same diameter are kept vertically in two different liquids whose densities are in the ratio 4 : 3. The rise of liquid in two capillaries is ' h_1 ' and ' h_2 ' respectively. If the surface tensions of liquids are in the ratio 6 : 5, the ratio of heights $\left(\frac{h_1}{h_2}\right)$ is (Assume that their angles of contact are same)

Options:

- A. 0.4
- B. 0.5
- C. 0.8
- D. 0.9

Question 103

Two spherical black bodies of radii ' r_1 ' and ' r_2 ' at temperature ' T_1 ' and ' T_2 ' respectively radiate power in the ratio 1 : 2 Then $r_1 : r_2$ is

Options:

- A. $\frac{1}{2} \left(\frac{T_2}{T_1}\right)^4$
- B. $\frac{1}{\sqrt{2}} \left(\frac{T_2}{T_1}\right)^2$
- C. $2 \left(\frac{T_1}{T_2}\right)^4$
- D. $2 \left(\frac{T_1}{T_2}\right)^2$

Question 104

For a particle executing S.H.M., its potential energy is 8 times its kinetic energy at certain displacement ' x ' from the mean position. If ' A ' is the amplitude of S.H.M the value of ' x ' is

Options:

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

Question 105

The maximum kinetic energies of photoelectrons emitted are K_1 and K_2 when lights of wavelengths λ_1 and λ_2 are incident on a metallic surface. If $\lambda_1 = 3\lambda_2$ then

Options:

- A. $K_1 = \frac{K_2}{3}$
- B. $K_1 < \frac{K_2}{3}$
- C. $K_1 = 3K_2$
- D. $3K_1 = 2K_2$

Question 106

A particle moves along a circular path with decreasing speed. Hence

Options:

- A. its resultant acceleration is towards the centre.
- B. it moves in a spiral path with decreasing radius.
- C. the direction of angular momentum remains constant.
- D. its angular momentum remains constant

Question 107

Identify the correct circuit diagrams for the normal operation from the following.

Options:

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

Question 108

With the gradual increase in frequency of an a. c. source, the impedance of an LCR series circuit

Options:

- A. first decreases, becomes minimum and then increases.
- B. increases.
- C. decreases.
- D. remains constant.

Question 109

In energy band diagram of insulators, a band gap and the conduction band is respectively

Options:

- A. very low and partially filled.
- B. very high and completely filled.
- C. very high and empty.
- D. very low and empty.

Question 110

Two positively charged identical spheres separated by a distance 'd' exert some force (F) on each other when they are kept in air. If both the spheres are immersed in a liquid of dielectric constant 5, the force experienced by each is (All other parameters are unchanged.)

Options:

- A. 5 F
- B. $\frac{F}{3}$
- C. $\frac{F}{4}$
- D. $\frac{F}{5}$

Question 111

A string fixed at both the ends forms standing wave with node separation of 5 cm. If the velocity of the wave on the string is 2 m/s, then the frequency of vibration of the string is

Options:

- A. 0.2 Hz
- B. 10 Hz
- C. 20 Hz
- D. 40 Hz

Question 112

A ball of mass 'm' is attached to the free end of a string of length 'l'. The ball is moving in horizontal circular path about the vertical axis as shown in the diagram. The angular velocity ' ω ' of the ball will be [T = Tension in the string.]

Options:

- A. $\sqrt{\frac{Tl}{m}}$
- B. $\sqrt{\frac{Tm}{l}}$
- C. $\sqrt{\frac{ml}{T}}$
- D. $\sqrt{\frac{T}{ml}}$

Question 113

Radius of gyration of a thin uniform circular disc about the axis passing through its centre and

perpendicular to its plane is K_c . Radius of gyration of the same disc about a diameter of the disc is K_d . The ratio $K_c : K_d$ is

Options:

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

Question 114

When a current of 1 A is passed through a coil of 100 turns, the flux associated with it is 2.5×10^{-5} Wb/ turn. The self inductance of the coil in millihenry is

Options:

- A. 40
- B. 25
- C. 4
- D. 2.5

Question 115

A spherical liquid drop of radius R is divided into 8 equal droplets. If surface tension is S, then the work done in this process will be

Options:

- A. $2\pi R^2 S$
- B. $3\pi R^2 S$
- C. $4\pi R^2 S$
- D. $2\pi R S^2$

Question 116

The rate of flow of heat through a metal rod with temperature difference 40°C is 1600 cal/s. The thermal resistance of metal rod in $^\circ\text{C s/cal}$ is

Options:

- A. 0.025
- B. 0.25
- C. 2.5
- D. 40

Question 117

Two charges of equal magnitude 'q' are placed in air at a distance '2r' apart and third charge ' $-2q$ ' is placed at mid point. The potential energy of the system is (ϵ_0 = permittivity of free

space)

Options:

- A. $-\frac{q^2}{8\pi\epsilon_0 r}$
- B. $-\frac{3q^2}{8\pi\epsilon_0 r}$
- C. $-\frac{5q^2}{8\pi\epsilon_0 r}$
- D. $-\frac{7q^2}{8\pi\epsilon_0 r}$

Question 118

The size of the real image produced by a convex lens of focal length F is ' m ' times the size of the object. The image distance from the lens is

Options:

- A. $\frac{F}{(m-1)}$
- B. $\frac{(m-1)}{F}$
- C. $F(m+1)$
- D. $F(m-1)$

Question 119

A double slit experiment is immersed in water of refractive index 1.33. The slit separation is 1 mm, distance between slit and screen is 1.33 m. The slits are illuminated by a light of wavelength $6300\text{\AA}$. The fringe width is

Options:

- A. $4.9 \times 10^{-4} \text{ m}$
- B. $5.8 \times 10^{-4} \text{ m}$
- C. $6.3 \times 10^{-4} \text{ m}$
- D. $8.6 \times 10^{-4} \text{ m}$

Question 120

Potential difference between the points P and Q is nearly

Options:

- A. 6 V
- B. 8 V
- C. 17 V
- D. 21 V

Question 121

An electron in the hydrogen atom jumps from the first excited state to the ground state. What will be the percentage change in the speed of electron?

Options:

- A. 25%
- B. 50%
- C. 75%
- D. 100%

Question 122

In series LCR circuit, the voltage across the inductance and the capacitance are not

Options:

- A. out of phase with the voltage across the resistance by 90° .
- B. equal in magnitude at resonance.
- C. out of phase with each other by 180° .
- D. in phase with the source voltage.

Question 123

If the temperature of a hot body is increased by 50%, then the increase in the quantity of emitted heat radiation will be approximately

Options:

- A. 125%
- B. 200%
- C. 300%
- D. 400%

Question 124

The second overtone of an open pipe has the same frequency as the first overtone of a closed pipe of length ' L '. The length of the open pipe will be

Options:

- A. $\frac{L}{2}$
- B. L

- C. 2 L
- D. 4 L

Question 125

The radius of earth is 6400 km and acceleration due to gravity $g = 10 \text{ ms}^{-2}$. For the weight of body of mass 5 kg to be zero on equator, rotational velocity of the earth must be (in rad/s)

Options:

- A. $\frac{1}{80}$
- B. $\frac{1}{400}$
- C. $\frac{1}{800}$
- D. $\frac{1}{1600}$

Question 126

A car sounding a horn of frequency 1000 Hz passes a stationary observer. The ratio of frequencies of the horn noted by the observer before and after passing the car is 11 : 9. If the speed of sound is ' v ', the speed of the car is

Options:

- A. V
- B. $\frac{v}{2}$
- C. $\frac{v}{5}$
- D. $\frac{v}{10}$

Question 127

The time period of a simple pendulum inside a stationary lift is ' T '. When the lift starts accelerating upwards with an acceleration ($\frac{g}{3}$), the time period of the pendulum will be

Options:

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

Question 128

The mutual inductance of a pair of coils, each of ' N ' turns, is ' M ' henry. If a current of ' I ' ampere in one of the coils is brought to zero in ' t ' second, the e. m. f. induced per turn in the other coil in volt is

Options:

- A. $\frac{MI}{t}$
- B. $\frac{NMI}{t}$

- C. $\frac{NM}{It}$
D. $\frac{MI}{Nt}$

Question 129

To manufacture a solenoid of length 1 m and inductance 1 mH, the length of thin wire required is

(cross - sectional diameter of a solenoid is considerably less than the length)

Options:

- A. 0.10 m
B. 0.10 km
C. 1 km
D. 10 km

Question 130

In a radioactive disintegration, the ratio of initial number of atoms to the number of atoms present at time $t = \frac{1}{2\lambda}$ is [$\lambda = \text{decay constant}$]

Options:

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

Question 131

A bullet is fired on a target with velocity 'V'. Its velocity decreases from 'V' to 'V/2' when it penetrates 30 cm in a target. Through what thickness it will penetrate further in the target before coming to rest?

Options:

- A. 5 cm
B. 8 cm
C. 10 cm
D. 20 cm

Question 132

In the experiment of diffraction due to a single slit, if the slit width is decreased, the width of the central maximum

Options:

- A. becomes zero.
B. does not change.

- C. increases.
- D. decreases.

Question 133

A cylindrical magnetic rod has length 5 cm and diameter 1 cm. It has uniform magnetization $5.3 \times 10^3 \text{ A/m}^3$. Its net magnetic dipole moment is nearly

Options:

- A. $1 \times 10^{-2} \text{ J/T}$
- B. $0.5 \times 10^{-2} \text{ J/T}$
- C. $2.5 \times 10^{-2} \text{ J/T}$
- D. $2 \times 10^{-2} \text{ J/T}$

Question 134

In biprism experiment, if 5^{th} bright band with wavelength λ_1' coincides with 6^{th} dark band with wavelength λ_2' then the ratio $\left(\frac{\lambda_2}{\lambda_1}\right)$ is

Options:

- A. $\frac{9}{7}$
- B. $\frac{7}{9}$
- C. $\frac{10}{11}$
- D. $\frac{11}{10}$

Question 135

A body of mass 'm' kg starts falling from a distance 3R above earth's surface. When it reaches a distance 'R' above the surface of the earth of radius 'R' and Mass 'M', then its kinetic energy is

Options:

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

Question 136

In the case of NAND gate, if A and B are the inputs and Y is the output then

Options:

- A. $Y = A \cdot B$
- B. $Y = \overline{A - B}$
- C. $Y = \overline{A + B}$
- D. $Y = \overline{A \cdot B}$

Question 137

A monoatomic gas at pressure 'P', having volume 'V' expands isothermally to a volume '2 V' and then adiabatically to a volume '16 V'. The final pressure of the gas is (Take $\gamma = 5/3$)

Options:

- A. $P/64$
- B. $P/32$
- C. $16P$
- D. $32P$

Question 138

In potentiometer experiments, two cells of e. m. f. ' E_1 ' and ' E_2 ' are connected in series ($E_1 > E_2$), the balancing length is 64 cm of the wire. If the polarity of E_2 is reversed, the balancing length becomes 32 cm. The ratio E_1/E_2 is

Options:

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

Question 139

A diatomic gas ($\gamma = \frac{7}{5}$) is compressed adiabatically to volume $\frac{V_i}{32}$ where V_i is its initial volume. The initial temperature of the gas is T_i in Kelvin and the final temperature is ' xT_i '. The value of ' x ' is

Options:

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

Question 140

A disc has mass M and radius R . How much tangential force should be applied to the rim of the disc, so as to rotate with angular velocity ' ω ' in time t ?

Options:

- A. $\frac{MR\omega}{4t}$
- B. $\frac{MR\omega}{2t}$
- C. $\frac{MR\omega}{t}$
- D. $MR\omega t$

Question 141

An electron moving with velocity 1.6×10^7 m/s has wavelength of $0.4 \text{ \AA}$. The required accelerating voltage for the electron motion is [charge on electron = $1.6 \times 10^{-19} \text{ C}$, mass of electron = 9×10^{-31} kg]

Options:

- A. $7.2 \times 10^3 \text{ V}$
- B. $7.2 \times 10^2 \text{ V}$
- C. 7.2 V
- D. $7.2 \times 10^{-2} \text{ V}$

Question 142

The prism has refracting angle 'A'. The second refracting surface of the prism is silvered. Light ray falling on first refracting surface with angle of incidence '2 A', reaches the second surface and returns back through the same path due to reflection at the silvered surface. The refractive index of the material of the prism is

Options:

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

Question 143

Two parallel wires of equal lengths are separated by a distance of 3 m from each other. The currents flowing through 1st and 2nd wire is 3 A and 4.5 A respectively in opposite directions. The resultant magnetic field at mid point between the wires (μ_0 = permeability of free space)

Options:

- A. $\frac{\mu_0}{2\pi}$
- B. $\frac{3\mu_0}{2\pi}$
- C. $\frac{7\mu_0}{2\pi}$
- D. $\frac{5\mu_0}{2\pi}$

Question 144

Three point charges $+q$, $+2q$ and $+Q$ are placed at the three vertices of an equilateral triangle.

If the potential energy of the system of three charges is zero, the value of Q in terms of q is

Options:

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

Question 145

If a gas is compressed isothermally then the r.m.s. velocity of the molecules

Options:

- A. decreases.
- B. increases.
- C. remains the same.
- D. first decreases and then increases.

Question 146

The bob of a simple pendulum of length ' L ' has a mass ' m ' and charge ' q '. The pendulum is suspended between the plates of a charged parallel plate capacitor. The direction of electric field is shown in figure. The period of oscillations of the simple pendulum is (acceleration due to gravity $g > qE/m$)

Options:

- A. $2\pi\sqrt{\frac{L}{g}}$
- B. $2\pi\left[\frac{L}{g-\frac{qE}{m}}\right]^{\frac{1}{2}}$
- C. $2\pi\left[\frac{L}{\sqrt{g^2-\frac{qE}{m}}}\right]^{\frac{1}{2}}$
- D. $2\pi\left[\frac{L}{g+\frac{qE}{m}}\right]^{\frac{1}{2}}$

Question 147

An electron is projected along the axis of circular conductor carrying current I . Electron will experience

Options:

- A. no force.
- B. a force along the axis.
- C. a force at angle 30° with the axis.
- D. a force perpendicular to axis.

Question 148

Two identical capacitors have the same capacitance ' C '. One of them is charged to a potential V_1 and the other to V_2 . The negative ends of the capacitors are connected together. When the positive ends are also connected, the decrease in energy of the combined system is

Options:

- A. $\frac{1}{4}C(V_1^2 - V_2^2)$
- B. $\frac{1}{4}C(V_1^2 + V_2^2)$
- C. $\frac{1}{4}C(V_1 - V_2)^2$
- D. $\frac{1}{4}C(V_1 + V_2)^2$

Question 149

A transverse wave $Y = 2\sin(0.01x + 30t)$ moves on a stretched string from one end to another end in 0.5 second. If x and y are in cm and t in second, then the length of the string is

Options:

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

Question 150

A body of density ' ρ ' is dropped from rest at a height ' h ' into a lake of density ' σ ' ($\sigma > \rho$). The maximum depth to which the body sinks before returning to float on the surface is (neglect air dissipative forces)

Options:

- A. $\frac{h\rho}{(\sigma-\rho)}$
- B. $\frac{h\rho}{(\sigma+\rho)}$
- C. $\frac{h\rho}{(\rho-\sigma)}$
- D. $\frac{2h\rho}{(\sigma-\rho)}$