

MHT CET 2023 Mathematics Memory Based Question Paper PDF

Mathematics

Question 1

The value of c for the function $f(x) = \log x$ on $[1, e]$ if LMVT can be applied, is

Options:

- A. $e - 2$
- B. $e + 1$
- C. $e - 1$
- D. e

Question 2

The three ships namely A, B and C sail from India to Africa. If the odds in favour of the ships reaching safely are $2 : 5$, $3 : 7$ and $6 : 11$ respectively, then probability of all of them arriving safely is

Options:

- A. $\frac{18}{595}$
- B. $\frac{11}{34}$
- C. $\frac{196}{217}$
- D. $\frac{1}{595}$

Question 3

If p and q are true statements and r and s are false statements, then the truth values of the statement patterns $(p \wedge q) \vee r$ and $(p \vee s) \leftrightarrow (q \wedge r)$ are respectively

Options:

- A. F, T
- B. T, T
- C. F, F
- D. T, F

Question 4

If the sum of mean and variance of a Binomial Distribution is $\frac{15}{2}$ for 10 trials, then the variance is

Options:

- A. 1.5
- B. 2.5
- C. 4.5
- D. 3.5

Question 5

If $(\bar{a} \times \bar{b}) \times \bar{c} = -5\bar{a} + 4\bar{b}$ and $\bar{a} \cdot \bar{b} = 3$, then the value of $\bar{a} \times (\bar{b} \times \bar{c})$ is

Options:

- A. $3\bar{b} - 4\bar{c}$
- B. $4\bar{a} - 3\bar{b}$
- C. $4\bar{b} - 3\bar{c}$
- D. $3\bar{a} - 4\bar{c}$

Question 6

The plane through the intersection of planes $x + y + z = 1$ and $2x + 3y - z + 4 = 0$ and parallel to Y-axis also passes through the point

Options:

- A. $(3, 3, -1)$
- B. $(-3, 0, 1)$
- C. $(3, 2, 1)$
- D. $(-3, 0, -1)$

Question 7

Let $f(x) = e^x - x$ and $g(x) = x^2 - x, \forall x \in R$, then the set of all $x \in R$, where the function $h(x) = (f \circ g)(x)$ is increasing is

Options:

- A. $[0, \frac{1}{2}] \cup [1, \infty)$
- B. $[-1, -\frac{1}{2}] \cup [\frac{1}{2}, \infty)$
- C. $[0, \infty)$
- D. $[-\frac{1}{2}, 0] \cup [1, \infty)$

Question 8

Let f be a differentiable function such that $f(1) = 2$ and $f'(x) = f(x)$, for all $x \in R$. If $h(x) = f(f(x))$, then $h'(1)$ is equal to

Options:

- A. $4e^2$
- B. $4e$
- C. $2e$
- D. $2e^2$

Question 9

The joint equation of a pair of lines passing through the origin and making an angle of $\frac{\pi}{4}$ with the line $3x + 2y - 8 = 0$ is

Options:

- A. $5x^2 + 24xy - 5y^2 = 0$
- B. $5x^2 - 24xy + 5y^2 = 0$
- C. $5x^2 - 24xy - 5y^2 = 0$

D. $5x^2 + 24xy + 5y^2 = 0$

Question 10

Two sides of a square are along the lines $5x - 12y + 39 = 0$ and $5x - 12y + 78 = 0$, then area of the square is

Options:

- A. 9 sq. units.
- B. $\frac{1}{3}$ sq. units.
- C. 18 sq. units.
- D. 3 sq. units.

Question 11

The value of $\int \frac{dx}{x^2(x^4+1)^{\frac{3}{4}}}$ is

Options:

- A. $(\frac{x^4+1}{x^4})^{\frac{1}{4}} + c$
- B. $(x^4 + 1)^{\frac{1}{4}} + c$
- C. $-(\frac{x^4+1}{x^4})^{\frac{1}{4}} + c$
- D. $-(\frac{x^4+1}{x^4})^{\frac{1}{4}} + c$

Question 12

$\int \frac{5 \tan x}{\tan x - 2} dx = x + a \log |\sin x - 2 \cos x| + c$, (where c is a constant of integration), then the value of a is

Options:

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

Question 13

Let $S = \{t \in R / f(x) = |x - \pi|(e^{|x|} - 1) \sin |x| \text{ is not differentiable at } t\}$, then S is

Options:

- A. ϕ (an empty set)
- B. $\{0\}$
- C. $\{\pi\}$
- D. $\{0, \pi\}$

Question 14

The domain of the function $f(x) = \sin^{-1}(\frac{|x|+5}{x^2+1})$ is $(-\infty, -a] \cup [a, \infty)$. Then a is equal to

Options:

- A. $\frac{\sqrt{17}}{2} + 1$
- B. $\frac{\sqrt{17}-1}{2}$
- C. $\frac{1+\sqrt{17}}{2}$

D. $\frac{\sqrt{17}}{2} - 1$

Question 15

The perpendicular distance of the origin from the plane $x - 3y + 4z - 6 = 0$ is

Options:

- A. 6
- B. $\frac{6}{\sqrt{26}}$
- C. $\frac{1}{\sqrt{26}}$
- D. $\frac{3}{\sqrt{26}}$

Question 16

The area bounded by the X-axis and the curve $y = x(x - 2)(x + 1)$ is

Options:

- A. $\frac{37}{12}$ sq. units
- B. $\frac{27}{12}$ sq. units
- C. $\frac{37}{4}$ sq. units
- D. $\frac{27}{13}$ sq. units

Question 17

Let $f : R \rightarrow R$ and $g : R \rightarrow R$ be continuous functions. Then the value of the integral

$$\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} [f(x) + f(-x)][g(x) - g(-x)]dx$$
 is

Options:

- A. π
- B. 1
- C. -1
- D. 0

Question 18

If $\vec{p} = \hat{i} + \hat{j} + \hat{k}$ and $\vec{q} = \hat{i} - 2\hat{j} + \hat{k}$. Then a vector of magnitude $5\sqrt{3}$ units perpendicular to the vector $\vec{q}$ and coplanar with $\vec{p}$ and $\vec{q}$ is

Options:

- A. $5(\hat{i} - \hat{j} + \hat{k})$
- B. $5(\hat{i} + \hat{j} - \hat{k})$
- C. $5(\hat{i} - \hat{j} - \hat{k})$
- D. $5(\hat{i} + \hat{j} + \hat{k})$

Question 19

The value of $\frac{{}^{10}C_r}{{}^{11}C_r}$, when both the numerator and denominator are at their greatest values, is

Options:

- A. $\frac{6}{11}$
- B. $\frac{1}{11}$
- C. $\frac{4}{11}$

D. $\frac{3}{11}$

Question 20

The general solution of the differential equation $\frac{dy}{dx} + \left(\frac{3x^2}{1+x^3}\right)y = \frac{1}{x^3+1}$ is

Options:

A. $y(1+x^3) = x^3 + c$

B. $y(1+x^3) = x + c$

C. $y(1+x^3) = x^2 + c$

D. $y(1+x^3) = 2x + c$

Question 21

If y is a function of x and $\log(x+y) = 2xy$, then $\frac{dy}{dx}$ at $x = 0$ is

Options:

A. 0

B. -1

C. 1

D. 2

Question 22

The displacement 'S' of a moving particle at a time t is given by $S = 5 + \frac{48}{t} + t^3$. Then its acceleration when the velocity is zero, is

Options:

A. 12

B. 20

C. 16

D. 24

Question 23

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. $\frac{\pi}{3}$

B. $\frac{\pi}{6}$

C. $\frac{\pi}{4}$

D. $\frac{2\pi}{3}$

Question 24

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

Options:

A. $\frac{5\pi}{6}$

B. $\frac{\pi}{2}$

C. $\frac{3\pi}{4}$

D. $\frac{3\pi}{4}$

Question 25

$$\int_0^{\pi} \frac{x \tan x}{\sec x + \cos x} dx =$$

Options:

- A. $\frac{\pi}{8}$
B. $-\frac{\pi^2}{8}$
C. $\frac{\pi^2}{4}$
D. $-\frac{\pi^2}{4}$

Question 26

If $\tan^{-1} a + \tan^{-1} b + \tan^{-1} c = \pi$, then which of the following statement is true?

Options:

- A. $a + b - c = abc$
B. $a + b + c = 2abc$
C. $abc = 1$
D. $a + b + c = abc$

Question 27

If $f(x) = \frac{4}{x^4} [1 - \cos \frac{x}{2} - \cos \frac{x}{4} + \cos \frac{x}{2} \cdot \cos \frac{x}{4}]$ is continuous at $x = 0$, then $f(0)$ is

Options:

- A. $\frac{1}{32}$
B. $\frac{1}{16}$
C. $\frac{1}{8}$
D. $\frac{1}{64}$

Question 28

Two lines $\frac{x-3}{1} = \frac{y+1}{3} = \frac{z-6}{-1}$ and $\frac{x+5}{7} = \frac{y-2}{-6} = \frac{z-3}{4}$ intersect at the point R. Then reflection of R in the xy -plane has co-ordinates

Options:

- A. $(2, -4, -7)$
B. $(2, -4, 7)$
C. $(-2, 4, 7)$
D. $(2, 4, 7)$

Question 29

The value of $\int \frac{(x^2-1)dx}{x^3\sqrt{2x^4-2x^2+1}}$ is

Options:

- A. $2\sqrt{2 - \frac{2}{x^2} + \frac{1}{x^4}} + c$
B. $2\sqrt{2 + \frac{2}{x^2} + \frac{1}{x^4}} + c$
C. $\frac{1}{2}\sqrt{2 - \frac{2}{x^2} + \frac{1}{x^4}} + c$

D. $2\sqrt{2 - \frac{2}{x^2} - \frac{1}{x^4}} + c$

Question 30

The shaded area in the figure given below is a solution set of a system of inequations. The minimum value of objective function $3x + 5y$, subject to the linear constraints given by this system of inequations is

Options:

- A. 19.5
- B. 21
- C. 15
- D. 19.8

Question 31

If $\bar{a} = m\bar{b} + n\bar{c}$, where $\bar{a} = 4\hat{i} + 13\hat{j} - 18\hat{k}$, $\bar{b} = \hat{i} - 2\hat{j} + 3\hat{k}$, $\bar{c} = 2\hat{i} + 3\hat{j} - 4\hat{k}$, then $m + n =$

Options:

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

Question 32

In a game, 3 coins are tossed. A person is paid 7 /-, if he gets all heads or all tails; and he is supposed to pay 3 /-, if he gets one head or two heads. The amount he can expect to win on an average per game is

Options:

- A. -0.5
- B. 0.5
- C. 1
- D. -1

Question 33

$$\int e^x(1 - \cot x + \cot^2 x)dx =$$

Options:

- A. $e^x \cdot \cot x + c$
- B. $e^x \cdot \operatorname{cosec} x + c$
- C. $-e^x \cdot \cot x + c$
- D. $-e^x \cdot \operatorname{cosec} x + c$

Question 34

The parametric equations of the circle $x^2 + y^2 + 2x - 4y - 4 = 0$ are

Options:

- A. $x = -1 + 3 \cos \theta, y = 2 + 3 \sin \theta$
- B. $x = 1 + 3 \cos \theta, y = -2 + 3 \sin \theta$
- C. $x = -1 + 3 \sin \theta, y = -2 + 3 \cos \theta$
- D. $x = 1 + 3 \sin \theta, y = 2 + 3 \cos \theta$

Question 35

In a triangle ABC, with usual notations, if $c = 4$, then value of $(a - b)^2 \cos^2 \frac{C}{2} + (a + b)^2 \sin^2 \frac{C}{2}$ is

Options:

- A. 4
- B. 16
- C. 9
- D. 25

Question 36

$$\lim_{x \rightarrow a} \frac{\sqrt{a+2x} - \sqrt{3x}}{\sqrt{3a+x} - 2\sqrt{x}} =$$

Options:

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

Question 37

If $B = \begin{bmatrix} 3 & \alpha & -1 \\ 1 & 3 & 1 \\ -1 & 1 & 3 \end{bmatrix}$ is the adjoint of a 3×3 matrix A and $|A| = 4$, then α is equal to

Options:

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

Question 38

If $x = 3 \tan t$ and $y = 3 \sec t$, then the value of $\frac{d^2y}{dx^2}$ at $t = \frac{\pi}{4}$ is

Options:

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

Question 39

A fair die is tossed twice in succession. If X denotes the number of sixes in two tosses, then the probability distribution of X is given by

Options:

- A. 0: 25/36, 1: 1/36, 2: 5/18
 B. 0: 5/18, 1: 1/36, 2: 25/36
 C. 0: 25/36, 1: 10/36, 2: 1/36
 D. 0: 5/18, 1: 25/36, 2: 1/36

Question 40

The negation of the statement pattern $\sim s \vee (\sim r \wedge s)$ is equivalent to

Options:

- A. $s \wedge r$
 B. $s \wedge (r \wedge \sim s)$
 C. $s \wedge \sim r$
 D. $s \vee (r \vee \sim s)$

Question 41

If the volume of tetrahedron, whose vertices are with position vectors $\hat{i} - 6\hat{j} + 10\hat{k}$, $-\hat{i} - 3\hat{j} + 7\hat{k}$, $5\hat{i} - \hat{j} + \lambda\hat{k}$ and $7\hat{i} - 4\hat{j} + 7\hat{k}$ is 11 cubic units, then value of λ is

Options:

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

Question 42

The argument of $\frac{1+i\sqrt{3}}{\sqrt{3}+i}$, $i = \sqrt{-1}$ is

Options:

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

Question 43

If $y = \tan^{-1}\left(\frac{\log(\frac{e}{x^2})}{\log(ex^2)}\right) + \tan^{-1}\left(\frac{4+2\log x}{1-8\log x}\right)$, then $\frac{dy}{dx}$ is

Options:

- A. 0
- B. $\frac{1}{x}$
- C. $\frac{1}{4}$
- D. 1

Question 44

If the surface area of a spherical balloon of radius 6 cm is increasing at the rate $2 \text{ cm}^2/\text{sec}$, then the rate of increase in its volume in cm^3/sec is

Options:

- A. 16
- B. 6
- C. 12
- D. 8

Question 45

The value of α , so that the volume of parallelopiped formed by $\hat{i} + \alpha\hat{j} + \hat{k}$, $\hat{j} + \alpha\hat{k}$ and $\alpha\hat{i} + \hat{k}$ becomes minimum, is

Options:

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

Question 46

In a certain culture of bacteria, the rate of increase is proportional to the number of bacteria present at that instant. It is found that there are 10,000 bacteria at the end of 3 hours and 40,000 bacteria at the end of 5 hours, then the number of bacteria present in the beginning are

Options:

- A. 1250
- B. 1200
- C. 1350
- D. 1300

Question 47

If x, y, z are in A.P. and $\tan^{-1} x, \tan^{-1} y$ and $\tan^{-1} z$ are also in A.P., then

Options:

- A. $x = y = z$
- B. $2x = 3y = 6z$
- C. $6x = 3y = 2z$
- D. $6x = 4y = 3z$

Question 48

Mean and variance of six observations are 8 and 16 respectively. If each observation is multiplied by 3, then new variance of the resulting observations is

Options:

- A. 16
- B. 48
- C. 24
- D. 144

Question 49

The differential equation of all circles, passing through the origin and having their centres on the X-axis, is

Options:

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

Question 50

$$\int_0^1 \cos^{-1} x dx =$$

Options:

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

Chemistry

Question 51

What is the calculated value of spin only magnetic moment in terms of BM if only one unpaired electron is present in a species?

Options:

- A. 2.76
- B. 2.84
- C. 2.2
- D. 1.73

Question 52

Which of the following is tertiary allylic alcohol?

Options:

- A. Prop-2-en-1-ol
- B. But-3-en-2-ol
- C. 2-Methylprop-2-en-ol
- D. 2-Methylbut-3-en-2-ol

Question 53

Identify the solvent used in bromination of phenol to obtain 2,4,6-tribromophenol.

Options:

- A. Chloroform
- B. Water
- C. Carbon tetrachloride
- D. Carbon disulphide

Question 54

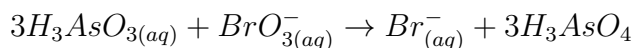
How many moles of nitrogen atoms are present in 8 g of ammonium nitrate? (Molar mass of ammonium nitrate = 80)

Options:

- A. 0.1 mol
- B. 0.2 mol
- C. 0.4 mol
- D. 0.8 mol

Question 55

Identify the elements undergoing reduction and oxidation respectively in the following redox reaction.

**Options:**

- A. As and O
- B. Br and As
- C. As and Br
- D. Br and O

Question 56

Which of the following is tricarboxylic acid?

Options:

- A. Propionic acid
- B. Oxalic acid
- C. Malonic acid
- D. Citric acid

Question 57

Find the radius of an atom in fcc unit cell having edge length 393pm.

Options:

- A. 196.51 pm
- B. 170.22 pm
- C. 78.63 pm
- D. 138.93 pm

Question 58

Which from following is a CORRECT decreasing order of ionization enthalpies of different elements?

Options:

- A. S > Se > Te > Po
- B. Te > Po > S > Se
- C. S > Te > Po > Se
- D. Te > Po > Se > S

Question 59

A gas absorbs 200 J heat and expands by 500 cm^3 against a constant external pressure $2 \times 10^5 \text{ N m}^{-2}$. What is the change in internal energy?

Options:

- A. 800 J
- B. -750 J
- C. 100 J
- D. -150 J

Question 60

Identify a copolymer from following.

Options:

- A. Natural rubber
- B. Polypropene
- C. PVC
- D. Terylene

Question 61

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



$$\left[-\frac{\Delta[N_2O_5]}{\Delta t}\right] = x \text{ mol dm}^{-3} \text{ s}^{-1}$$

Options:

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

Question 62

Calculate the rate constant for the first order reaction, $A \rightarrow B$ if the rate of reaction is $5.4 \times 10^{-6} \text{ mol dm}^{-3} \text{ s}^{-1}$ and $[A] = 0.3M$.

Options:

- A. $1.8 \times 10^{-5} \text{ s}^{-1}$
- B. $1.5 \times 10^{-5} \text{ s}^{-1}$
- C. $2.1 \times 10^{-5} \text{ s}^{-1}$
- D. $2.4 \times 10^{-5} \text{ s}^{-1}$

Question 63

Identify the product obtained when benzonitrile is reduced by stannous chloride in presence of hydrochloric acid followed by acid hydrolysis.

Options:

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

Question 64

Find solubility in terms of mol L^{-1} if solubility product of silver bromide is 6.4×10^{-13} .

Options:

- A. $4.0 \times 10^{-5} \text{ mol L}^{-1}$
- B. $8.0 \times 10^{-7} \text{ mol L}^{-1}$
- C. $7.5 \times 10^{-5} \text{ mol L}^{-1}$
- D. $6.4 \times 10^{-4} \text{ mol L}^{-1}$

Question 65

What happens when solution of an electrolyte is diluted?

Options:

- A. Both Λ and k increases
- B. Both Λ and k decreases
- C. Λ increases and k decreases
- D. Λ decreases and k increases

Question 66

The solubility of a gas in a liquid is directly proportional to the pressure of the gas over the solution. Identify the law for this statement.

Options:

- A. Henry's law
- B. Raoult's law
- C. Dalton's law
- D. Avogadro's law

Question 67

Weak acid HX has dissociation constant 1×10^{-5} . Calculate the percent dissociation in its 0.1M solution.

Options:

- A. 2.2%
- B. 3.5%
- C. 4.2%
- D. 1.0%

Question 68

Calculate the pH of a buffer solution containing 0.01 M salt and 0.004 M weak acid. ($pK_a = 4.762$)

Options:

- A. 4.36
- B. 4.76
- C. 5.16
- D. 5.36

Question 69

Which among the following is vinylic halide?

Options:

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

Question 70

Which from following compounds is obtained when carbon dioxide gas bubbled through slaked lime solution?

Options:

- A. $CaCO_{3(s)}$
- B. $CaCl_{2(aq)}$
- C. $CaSO_{4(s)}$

D. $\text{NaCl}_{(aq)}$

Question 71

Calculate the number of atoms present in unit cell of an element having molar mass 190 g mol^{-1} and density 20 g cm^{-3} . [$a^3 \cdot N_A = 38 \text{ cm}^3 \text{ mol}^{-1}$]

Options:

- A. 1
- B. 2
- C. 6
- D. 4

Question 72

What is the solubility of a gas in water at 25°C if partial pressure is 0.18 atm ? ($K_H = 0.16 \text{ mol dm}^{-3} \text{ atm}^{-1}$)

Options:

- A. $0.029 \text{ mol dm}^{-3}$
- B. $0.022 \text{ mol dm}^{-3}$
- C. $0.032 \text{ mol dm}^{-3}$
- D. $0.038 \text{ mol dm}^{-3}$

Question 73

What is the radius of fourth orbit of Be^{+++} ?

Options:

- A. 211.6 pm
- B. 158.7 pm
- C. 52.9 pm
- D. 13.2 pm

Question 74

What is the number of unpaired electrons in NO molecule?

Options:

- A. 0
- B. 1
- C. 2
- D. 3

Question 75

Identify the glycosidic linkage present in lactose.

Options:

- A. $\beta - 1,4$
- B. $\alpha - 1,6$
- C. $\beta - 1,6$

D. $\alpha - 1, 4$

Question 76

Which from following statements is TRUE about $CH_3CH(NH_2)CH_2COOH$ molecule?

Options:

- A. It is an example of amino acids.
- B. Its IUPAC name is 3-carboxy-2-amine.
- C. The amino group is located at C - 2.
- D. $-NH_2$ group is considered as principal functional group for IUPAC naming.

Question 77

Which of the following is obtained as product when ethylene reacts with oxygen in presence of Pd/Al_2O_3 ?

Options:

- A. Acetaldehyde
- B. Acetic acid
- C. Methane
- D. Methyl alcohol

Question 78

What is the position of transition elements from Sc to Zn in long form of periodic table?

Options:

- A. Group 4 to 13, period-3
- B. Group 3 to 12, period-4
- C. Group 5 to 14, period-4
- D. Group 3 to 12, period-5

Question 79

Which from following elements is most abundant on earth?

Options:

- A. N
- B. C
- C. O
- D. H

Question 80

What is the volume of 1 mole real gas at STP ($V_0 = 22.4 \text{ dm}^3$), if compressibility factor of real gas is 1.1 at STP?

Options:

- A. 22.40 dm^3
- B. 23.64 dm^3
- C. 24.64 dm^3

D. 23.50 dm^3

Question 81

Identify the product obtained when isopropyl bromide is reacted with metallic sodium in dry ether.

Options:

- A. Isobutane
- B. Isohexane
- C. 2,3-Dimethylbutane
- D. 2,3-Dimethylhexane

Question 82

Which of the following is general representation of Grignard reagent?

Options:

- A. $\text{R} - \text{O} - \text{Na}$
- B. $\text{R} - \text{COO} - \text{Ag}$
- C. $\text{R} - \text{Mg} - \text{X}$
- D. $\text{R} - \text{COOK}$

Question 83

Which among the following statements is NOT true about high density polythene?

Options:

- A. It is obtained from ethene.
- B. It needs high pressure (1000-2000 atm) for synthesis.
- C. Polymerization occurs in presence of Ziegler-Natta catalyst.
- D. Melting point is higher than LDP.

Question 84

What is osmotic pressure of solution of 1.7 g CaCl_2 in 1.25 dm^3 water at 300 K if van't Hoff factor and molar mass of CaCl_2 are 2.47 and 111 g mol^{-1} respectively? [$R = 0.082 \text{ dm}^3 \text{ atm mol}^{-1} \text{ K}^{-1}$]

Options:

- A. 0.625 atm
- B. 0.744 atm
- C. 0.827 atm
- D. 0.936 atm

Question 85

Which among the following pair of properties is intensive?

Options:

- A. Mass and heat capacity
- B. Heat capacity and pressure
- C. Specific heat and pressure

D. Internal energy and boiling point

Question 86

Identify the molecular formula of an alkane that exhibits only two different structural isomers.

Options:

- A. C_2H_6
- B. C_3H_8
- C. C_4H_{10}
- D. C_6H_{12}

Question 87

An organic compound 'A' on reaction with PCl_3 gives an alkyl chloride having formula C_3H_7Cl . 'A' on oxidation with PCC forms an aldehyde having formula C_3H_6O . Identify 'A'.

Options:

- A. Propan-1-ol
- B. Propan-2-ol
- C. Propanoic acid
- D. Propanone

Question 88

Identify tetrasaccharide from following.

Options:

- A. Glycogen
- B. Cellulose
- C. Ribose
- D. Stachyose

Question 89

What type of ligand does the ethylenediamine is?

Options:

- A. Monodentate
- B. Bidentate
- C. Tetradentate
- D. Hexadentate

Question 90

What is angular momentum of an electron in fourth orbit of hydrogen atom?

Options:

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

Question 91

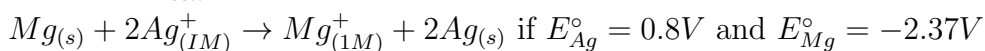
Which from following complexes is heteroleptic?

Options:

- A. $K_3[Al(C_2O_4)_3]$
- B. $[Co(C_2O_4)_3]^{3-}$
- C. $Na_3[AlF_6]$
- D. $[Co(H_2O)(NH_3)_5]_3$

Question 92

Calculate E_{cell}° in which following reaction occurs.



Options:

- A. -3.17 V
- B. 3.17 V
- C. -1.57 V
- D. 1.57 V

Question 93

Identify CORRECT decreasing order of solubilities of alcohols, alkanes and amines in water having comparable molar mass.

Options:

- A. Alcohol > amine > alkane
- B. Alkane > amine > alcohol
- C. Amine > alcohol > alkane
- D. Alkane > alcohol > amine

Question 94

Which of the following characteristic properties is NOT true for crystalline solid?

Options:

- A. These substances have sharp melting point,
- B. These have different values of refractive index in different directions.
- C. The constituent particles are orderly arranged.
- D. These are isotropic.

Question 95

Time required for 90% completion of a first order reaction is 'x' minute. Calculate the time required to complete 99.9% of the reaction at same temperature.

Options:

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

Question 96

Identify 'A' in the following reaction: $A \xrightarrow[\text{ether}]{LiAlH_4} \text{Ethanamine}$

Options:

- A. C_2H_5CN
- B. CH_3CONH_2
- C. $C_2H_5CONH_2$
- D. CH_3NO_2

Question 97

Which of the following reagents is used in Gatterman-Koch formylation of arene?

Options:

- A. CrO_3
- B. $CO, HCl/AlCl_3$ (anhydr.)
- C. CrO_2Cl_2, CS_2
- D. $Cl_2h\nu, H_3O^+$

Question 98

Identify the last step in wet chemical synthesis of nanomaterial.

Options:

- A. Formation of oxide or alcohol-bridged network
- B. Dehydration
- C. Aging of the gel
- D. Drying of the gel

Question 99

Calculate the conductivity of 0.02 M electrolyte solution if its molar conductivity $407.2\Omega^{-1} \text{ cm}^2 \text{ mol}^{-1}$?

Options:

- A. $8.144 \times 10^{-3}\Omega^{-1} \text{ cm}^{-1}$
- B. $4.072 \times 10^{-3}\Omega^{-1} \text{ cm}^{-1}$
- C. $7.15 \times 10^{-3}\Omega^{-1} \text{ cm}^{-1}$
- D. $6.055 \times 10^{-3}\Omega^{-1} \text{ cm}^{-1}$

Question 100

If 8.84 kJ heat is liberated for formation of 3 g ethane, calculate its $\Delta_f H^\circ$.

Options:

- A. -8.00 kJ
- B. 15.0 kJ
- C. 30.0 kJ
- D. -84.4 kJ

Physics

Question 101

Two trains, each 30 m long are travelling in opposite directions with velocities 5 m/s and 10 m/s. They will cross after

Options:

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

Question 102

The fundamental frequency of air column in pipe 'A' closed at one end is in unison with second overtone of an air column in pipe 'B' open at both ends. The ratio of length of air column in pipe 'A' to that of air column in pipe 'B' is

Options:

- A. 1 : 6
- B. 3 : 8
- C. 2 : 3
- D. 3 : 4

Question 103

In Young's double slit experiment, the two slits are 'd' distance apart. Interference pattern is observed on a screen at a distance 'D' from the slits. A dark fringe is observed on a screen directly opposite to one of the slits. The wavelength of light is

Options:

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

Question 104

A black body radiates maximum energy at wavelength ' λ ' and its emissive power is 'E' Now due to change in temperature of that body, it radiates maximum energy at wavelength $\frac{2\lambda}{3}$. At that temperature emissive power is

Options:

- A. $\frac{81}{16}$
- B. $\frac{27}{32}$
- C. $\frac{18}{10}$
- D. $\frac{9}{4}$

Question 105

In meter bridge experiment, null point was obtained at a distance 'l' from left end. The values of resistances in the left and right gap are doubled and then interchanged. The new position of the null point is

Options:

- A. $(100 - l)$
- B. $(100 - 2l)$
- C. $(100 - 3l)$
- D. $(100 - l/2)$

Question 106

The magnetic field at the centre of a circular coil of radius 'R', carrying current 2A is ' B_1 '. The magnetic field at the centre of another coil of radius ' $3R$ ' carrying current 4A is ' B_2 '. The ratio $B_1 : B_2$ is

Options:

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

Question 107

If a capacitor of capacity $900\mu F$ is charged to 100 V and its total energy is transferred to a capacitor of capacity $100\mu F$, then its potential will be

Options:

- A. 30 V
- B. 200 V
- C. 300 V
- D. 400 V

Question 108

The equation of wave is $Y = 6 \sin(12\pi t - 0.02\pi x + \frac{\pi}{3})$ where 'x' is in m and 't' in s. The velocity of the wave is

Options:

- A. 200 m/s
- B. 300 m/s
- C. 400 m/s
- D. 600 m/s

Question 109

With an alternating voltage source of frequency 'f', inductor 'L', capacitor 'C' and resistance 'R' are connected in series. The voltage leads the current by 45° . The value of 'L' is ($\tan 45^\circ = 1$)

Options:

- A. $(\frac{1+2\pi fCR}{4\pi^2 f^2 C})$

- B. $\left(\frac{1-2\pi fCR}{4\pi^2 f^2 C}\right)$
 C. $\left(\frac{4\pi^2 f^2 C}{1+2\pi fCR}\right)$
 D. $\left(\frac{4\pi^2 f^2 C}{1-2\pi fCR}\right)$

Question 110

A pure Si crystal has 4×10^{28} atoms per m^3 . It is doped by 1 ppm concentration of antimony. The number of free electrons available will be

Options:

- A. $4 \times 10^{34} \text{ m}^{-3}$
 B. $4 \times 10^{28} \text{ m}^{-3}$
 C. $4 \times 10^{22} \text{ m}^{-3}$
 D. $4 \times 10^{20} \text{ m}^{-3}$

Question 111

A mass 'M' moving with velocity 'V' along X-axis collides and sticks to another mass 2M which is moving along Y-axis with velocity '3 V'. The velocity of the combination after collision is

Options:

- A. $\frac{V}{3}\hat{i} + 2V\hat{j}$
 B. $\frac{V}{2}\hat{i} + V\hat{j}$
 C. $\frac{V}{3}\hat{i} - 2V\hat{j}$
 D. $\frac{V}{2}\hat{i} - V\hat{j}$

Question 112

Which of the following graphs between pressure (P) and volume (V) correctly shows isochoric changes?

Options:

- A. D
 B. B
 C. C
 D. A

Question 113

A galvanometer has resistance 'G' and range ' V_g '. How much resistance is required to read voltage upto 'V' volt?

Options:

- A. $G(\frac{V}{V_g} - 1)$
- B. $G(\frac{V+V_g}{V})$
- C. $G(\frac{V-V_g}{V})$
- D. GV_g

Question 114

'n' number of liquid drops each of radius 'r' coalesce to form a single drop of radius 'R'. The energy released in the process is converted into the kinetic energy of the big drop so formed. The speed of the big drop is [T = surface tension of liquid, ρ = density of liquid.]

Options:

- A. $\sqrt{\frac{T}{\rho} [\frac{1}{r} - \frac{1}{R}]}$
- B. $\sqrt{\frac{2T}{\rho} [\frac{1}{r} - \frac{1}{R}]}$
- C. $\sqrt{\frac{4T}{\rho} [\frac{1}{r} - \frac{1}{R}]}$
- D. $\sqrt{\frac{6T}{\rho} [\frac{1}{r} - \frac{1}{R}]}$

Question 115

What is the moment of inertia of the electron moving in second Bohr orbit of hydrogen atom? [h = Planck's constant, m = mass of electron, ϵ_0 = permittivity of free space, e = charge on electron]

Options:

- A. $\frac{4\epsilon_0^2 h^4}{\pi^2 m e^4}$
- B. $\frac{8m\epsilon_0^2 h^4}{\pi^2 e^4}$
- C. $\frac{16\epsilon_0^2 h^4}{\pi^2 m e^4}$
- D. $\frac{\epsilon_0^2 h^4}{16\pi^2 m e^4}$

Question 116

At critical temperature, the surface tension of liquid is

Options:

- A. zero
- B. infinity
- C. unity
- D. same as that at any other temperature

Question 117

Two wires 2 mm apart supply current to a 100 V, 1 kW heater. The force per metre between the wires is ($\mu_0 = 4\pi \times 10^{-27}$ SI unit)

Options:

- A. 2×10^{-2} N
- B. 4×10^{-3} N
- C. 2×10^2 N

D. 10^{-2} N

Question 118

A solenoid of 500 turns/m is carrying a current of 3 A. Its core is made of iron which has relative permeability 5001. The magnitude of magnetization is

Options:

- A. $4.5 \times 10^6 \text{ Am}^{-1}$
- B. $6.0 \times 10^{-6} \text{ Am}^{-1}$
- C. $7.5 \times 10^6 \text{ Am}^{-1}$
- D. $9.0 \times 10^6 \text{ Am}^{-1}$

Question 119

The ratio of the velocity of the electron in the first Bohr orbit to that in the second Bohr orbit of hydrogen atom is

Options:

- A. 8 : 1
- B. 2 : 1
- C. 4 : 1
- D. 1 : 4

Question 120

The capacitive reactance of a capacitor 'C' is $X\Omega$. Both, the frequency of a.c. supply and capacitance of the above capacitor are doubled. The new capacitive reactance will be

Options:

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

Question 121

A 100 mH coil carries a current of 1 A. Energy stored in the form of magnetic field is

Options:

- A. 0.025 J
- B. 0.050 J
- C. 0.075 J
- D. 0.100 J

Question 122

A metal rod 2 m long increases in length by 1.6 mm, when heated from 0°C to 60°C . The coefficient of linear expansion of metal rod is

Options:

- A. $1.33 \times 10^{-5}/^\circ\text{C}$

- B. $1.66 \times 10^{-5}/^{\circ}C$
 C. $1.33 \times 10^{-3}/^{\circ}C$
 D. $1.66 \times 10^{-3}/^{\circ}C$

Question 123

Assume that an electric field $E = 30x^2\hat{i}$ exists in space. If ' V_0 ' is the potential at the origin and ' V_A ' is the potential at $x = 2$ m, then the potential difference ($V_A - V_0$) is

Options:

- A. -80 J
 B. -120 J
 C. 80 J
 D. 120 J

Question 124

Two dielectric slabs having dielectric constant ' K_1 ' and ' K_2 ' of thickness $\frac{d}{4}$ and $\frac{3d}{4}$ are inserted between the plates as shown in figure. The net capacitance between A and B is $[\epsilon_0$ is permittivity of free space]

Options:

- A. $\frac{2A\epsilon_0}{d} \left[\frac{K_1 K_2}{3K_1 + K_2} \right]$
 B. $\frac{3A\epsilon_0}{d} \left[\frac{K_1 + K_2}{K_1 K_2} \right]$
 C. $\frac{3A_0}{2d} \left[\frac{K_1 + K_2}{K_1 K_2} \right]$
 D. $\frac{4A\epsilon_0}{d} \left[\frac{K_1 K_2}{3K_1 + K_2} \right]$

Question 125

The output of an 'OR' gate is connected to both the inputs of a 'NAND' gate. The combination will serve as

Options:

- A. OR gate
- B. NOT gate
- C. NOR gate
- D. AND gate

Question 126

Which one of the operations of $n - p - n$ transistor differs from that of $p - n - p$ transistor?

Options:

- A. The emitter-base junction is reversed biased in $n - p - n$ transistor.
- B. The emitter injects minority carriers into the base region of the $p - n - p$ transistor.
- C. The emitter injects holes into the base of the $p - n - p$ transistor and electrons into the base region of $n - p - n$ transistor.
- D. The emitter injects holes into the base of $n - p - n$ transistor.

Question 127

A hollow metal pipe is held vertically and bar magnet is dropped through it with its length along the axis of the pipe. The acceleration of the falling magnet is (g = acceleration due to gravity)

Options:

- A. equal to g .
- B. less than g .
- C. more than g .
- D. zero.

Question 128

A metal sphere of mass ' m ' and density ' σ_1 ' falls with terminal velocity through a container containing liquid. The density of liquid is ' σ_2 '. The viscous force acting on the sphere is

Options:

- A. $mg(1 + \frac{\sigma_2}{\sigma_1})$
- B. $mg(1 - \frac{\sigma_1}{\sigma_2})$
- C. $mg(1 - \frac{\sigma_2}{\sigma_1})$
- D. $mg(1 + \frac{\sigma_1}{\sigma_2})$

Question 129

Two uniform wires of same material are vibrating under the same tension. If the first overtone of first wire is equal to the 2^{nd} overtone of 2^{nd} wire and radius of the first wire is twice the radius of the 2^{nd} wire then the ratio of length of first wire to 2^{nd} wire is

Options:

- A. 1 : 3
- B. 3 : 1
- C. 1 : 9

D. 9 : 1

Question 130

A body is projected vertically from earth's surface with velocity equal to half the escape velocity. The maximum height reached by the satellite is (R = radius of earth)

Options:

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

Question 131

A ball of mass ' m ' is dropped from a height ' s ' on a horizontal platform fixed at the top of a vertical spring. The platform is depressed by a distance ' h '. The spring constant is (g = acceleration due to gravity)

Options:

- A. $\frac{2mg(s-h)}{h^2}$
- B. $\frac{2mg(s+h)}{h^2}$
- C. $\frac{mg(s-h)}{h}$
- D. $\frac{mg(s+h)}{h}$

Question 132

In the circuit given below, the current through inductor is 0.9 A and through the capacitor is 0.6 A. The current drawn from the a.c. source is

Options:

- A. 1.5 A
- B. 0.9 A
- C. 0.6 A
- D. 0.3 A

Question 133

A body is executing a linear S.H.M. Its potential energies at the displacement ' x ' and ' y ' are ' E_1 ' and ' E_2 ' respectively. Its potential energy at displacement $(x + y)$ will be

Options:

- A. $E_1 + E_2$
- B. $(\sqrt{E_1} + \sqrt{E_2})^2$
- C. $E_1 - E_2$
- D. $(\sqrt{E_2} - \sqrt{E_1})^2$

Question 134

We have a jar filled with gas characterized by parameters P, V, T and another jar B filled with gas having parameters $2P$, $\frac{V}{4}$, $2T$, where symbols have their usual meaning. The ratio of number of molecules in jar A to those in jar B is

Options:

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

Question 135

Two spheres each of mass 'M' and radius $\frac{R}{2}$ are connected at the ends of massless rod of length '2R'. What will be the moment of inertia of the system about an axis passing through centre of one of the spheres and perpendicular to the rod?

Options:

- A. $\frac{2}{3}MR^2$
- B. $\frac{5}{2}MR^2$
- C. $\frac{5}{21}MR^2$
- D. $\frac{21}{5}MR^2$

Question 136

If the potential difference used to accelerate electrons is doubled, by what factor does the de-Broglie wavelength associated with electrons change?

Options:

- A. Wavelength in increased to $\frac{1}{\sqrt{2}}$ times.
- B. Wavelength in increased to $\frac{1}{2}$ times.
- C. Wavelength in decreased to $\frac{1}{\sqrt{2}}$ times.
- D. Wavelength in decreased to $\frac{1}{2}$ times.

Question 137

A simple harmonic progressive wave is represented by $y = A \sin(100\pi t + 3x)$. The distance between two points on the wave at a phase difference of $\frac{\pi}{3}$ radian is

Options:

- A. $\frac{\pi}{8}$ m
- B. $\frac{\pi}{9}$ m
- C. $\frac{\pi}{6}$ m
- D. $\frac{\pi}{3}$ m

Question 138

An insulated container contains a monoatomic gas of molar mass ' m '. The container is moving with velocity ' V '. If it is stopped suddenly, the change in temperature of a gas is ΔT [R is gas constant]

Options:

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

Question 139

To get three images of a single object, the angle between the two plane mirrors should be

Options:

- A. 50°
- B. 60°
- C. 72°
- D. 90°

Question 140

A parallel beam of monochromatic light falls normally on a single narrow slit. The angular width of the central maximum in the resulting diffraction pattern

Options:

- A. increases with increase of slit width.
- B. decreases with increase of slit width.
- C. decreases with decrease of slit width.
- D. may increase or decrease with decrease of slit width.

Question 141

For the diagram shown, the resistances between points A and B when ideal diode D is forward biased is ' R_1 ' and that when reverse biased is ' R_2 '. The ratio $R_1 : R_2$ is

Options:

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

D. 1 : 4

Question 142

The maximum kinetic energy of the photoelectrons varies

Options:

- A. inversely with the intensity of incident radiation and is independent of its frequency.
- B. inversely with the frequency of incident radiation and is independent on its intensity.
- C. linearly with the frequency of incident radiation and depends on its intensity
- D. linearly with the frequency of incident radiation and is independent of its intensity.

Question 143

Light waves from two coherent sources arrive at two points on a screen with path difference of zero and $\frac{\lambda'}{2}$. The ratio of intensities at the points is ($\cos 0^\circ = 1, \cos \pi = -1$)

Options:

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

Question 144

A uniform rope of length 'L' and mass ' m_1 ' hangs vertically from a rigid support. A block of mass ' m_2 ' is attached to the free end of the rope. A transverse wave of wavelength ' λ_1 ' is produced at the lower end of the rope. The wavelength of the wave when it reaches the top of the rope is ' λ_2 '. The ratio $\frac{\lambda_1}{\lambda_2}$ is

Options:

- A. $\left[\frac{m_2}{m_1+m_2}\right]^{\frac{1}{2}}$
- B. $\left[\frac{m_1+m_2}{m_2}\right]^{\frac{1}{2}}$
- C. $\left[\frac{m_1}{m_1+m_2}\right]^{\frac{1}{2}}$
- D. $\left[\frac{m_2}{m_1-m_2}\right]^{\frac{1}{2}}$

Question 145

In a vessel, the ideal gas is at a pressure P. If the mass of all the molecules is halved and their speed is doubled, then resultant pressure of the gas will be

Options:

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

Question 146

Two concentric circular coils having radii r_1 and r_2 ($r_2 \ll r_1$) are placed co-axially with centres coinciding. The mutual induction of the arrangement is (Both coils have single turn, $\mu_0 =$

permeability of free space)

Options:

- A. $\frac{\mu_0 \pi r_2^2}{2r_1}$
- B. $\frac{\mu_0 \pi r_2}{2r_1}$
- C. $\frac{\mu_0 \pi r_2^2}{r_1^2}$
- D. $\frac{\mu_0 \pi r_2}{r_1}$

Question 147

A system consists of three particles each of mass ' m_1 ' placed at the corners of an equilateral triangle of side ' $\frac{L}{3}$ ', A particle of mass ' m_2 ' is placed at the mid point of any one side of the triangle. Due to the system of particles, the force acting on m_2 is

Options:

- A. $\frac{3Gm_1m_2}{L^2}$
- B. $\frac{6Gm_1m_2}{L^2}$
- C. $\frac{9Gm_1m_2}{L^2}$
- D. $\frac{12Gm_1m_2}{L^2}$

Question 148

The moment of inertia of a uniform square plate about an axis perpendicular to its plane and passing through the centre is $\frac{Ma^2}{6}$, where 'M' is the mass and 'a' is the side of square plate. Moment of inertia of this plate about an axis perpendicular to its plane and passing through one of its corners is

Options:

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

Question 149

Two lenses of power $-15D$ and $+5D$ are in contact with each other. The focal length of the combination is

Options:

- A. -0.1 cm
- B. -10 cm
- C. -20 cm
- D. $+10$ cm

Question 150

A particle performing uniform circular motion of radius $\frac{\pi}{2}$ m makes 'x' revolutions in time 't'. Its tangential velocity is

Options:

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