MHT CET 2025 Apr 19 Shift 1 Question Paper

Time Allowed :3 Hour	Maximum Marks :200	Total Questions :200

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 150 questions. The maximum marks are 200.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 50 questions in each part of equal weightage.

1. The ratio of areas bounded by curves $y = \cos x$ and $y = 0$ between $x = 0$ to $x = \frac{\pi}{3}$ and $x = \frac{\pi}{3}$ to $x = \frac{2\pi}{3}$, with the x-axis is:

(1) $2 : 1$

(2) $\sqrt{2} : 1$

(3) $1 : 1$

(4) $1 : 3$

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2. If

$$A = \begin{bmatrix} \cos\theta & \sin\theta & 0 \\ -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

and A_{11}, A_{12}, A_{13} are the cofactors of a_{11}, a_{12}, a_{13} respectively, then the value of $a_{11}A_{11} + a_{12}A_{12} + a_{13}A_{13}$ is:

(1) -1

(2) 1

(3) 0

(4) 2

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3. If

$$f(x) = 2\,(\cos x + i \sin x)\,(\cos 3x + i \sin 3x) \cdots (\cos(2n-1)x + i \sin(2n-1)x)$$

where $n \in \mathbb{N}$, **then what is the value of** $f''(x)$?

(1) $-n^2 f(x)$

(2) $n^2 f(x)$

(3) $-n^4 f(x)$

(4) $n^4 f(x)$

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4. Smallest angle of a triangle whose sides are $6 + \sqrt{12}, \sqrt{48}, \sqrt{54}$ **is:**

(1) $\frac{\pi}{4}$

(2) $\frac{\pi}{2}$

(3) $\frac{\pi}{6}$

(4) $\frac{\pi}{3}$

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5. A box contains 9 tickets numbered from 1 to 9 inclusive. 3 tickets are drawn from the box one at a time. What is the probability that they are alternatively either (odd, even, odd) or (even, odd, even)?

(1) $\frac{5}{16}$

(2) $\frac{5}{17}$

(3) $\frac{4}{17}$

(4) $\frac{5}{16}$

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6. A plane passes through the point $(1, -2, 1)$ **and is perpendicular to both the planes**

$$2x - 2y - 2z = 5 \quad \text{and} \quad x - y + 2z = 24$$

Then, the distance of the point $(1, 2, 2)$ **from this plane is:**

(1) $2\sqrt{2}$

(2) 1

(3) $\sqrt{2}$

(4) 2

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7. Solve the equation:

$$x + \log_{15}(5 + 3x) = x \log_{15} 5 + \log_{15} 24$$

(1) 2

(2) 1

(3) 5

(4) 8

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8. An ellipse has OB as the semi-minor axis, and S, S' as the foci. If $\angle SBS'$ is a right angle, then the eccentricity e of the ellipse is:

(1) $\sqrt{2}$

(2) $\frac{1}{2}$

(3) $\frac{1}{\sqrt{2}}$

(4) $\frac{1}{3}$

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9. The value of

$$\int_1^4 \log(\lfloor x \rfloor)\, dx$$

where $\lfloor x \rfloor$ is the greatest integer less than or equal to x, is:

(1) $\log 2$

(2) $\log 5$

(3) $\log 6$

(4) $\log 3$

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10. In a triangle ABC, with usual notation, if

$$\frac{b+c}{11} = \frac{c+a}{12} = \frac{a+b}{13}$$

then the ratio $\cos A : \cos B : \cos C$ is:

(1) $19 : 7 : 25$

(2) $7 : 19 : 25$

(3) $12 : 14 : 20$

(4) $19 : 25 : 7$

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11. The value of

$$\int_1^4 \log(\lfloor x \rfloor)\, dx$$

where $\lfloor x \rfloor$ is the greatest integer less than or equal to x, is equal to:

(1) $\log 6$

(2) $\log 5$

(3) $\log 2$

(4) $\log 3$

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12. A population $P(t)$ of 1000 bacteria introduced to a nutrient medium grows according to the relation

$$P(t) = \frac{1000t + 1000t}{100 + t^2}$$

The maximum size of this bacterial population is:

(1) 1250

(2) 1100

(3) 1050

(4) 950

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13. If the angle θ between the line

$$\frac{2t+1}{1} = \frac{y-1}{2} = \frac{z}{2}$$

and the plane $2x - y\sqrt{7} + z + 4 = 0$ is such that $\sin\theta = \frac{8}{\sqrt{3}}$, then the value of the expression is:

(1) $-\frac{5}{\sqrt{3}}$

(2) $\frac{5}{\sqrt{3}}$

(3) $\frac{8}{\sqrt{3}}$

(4) $-\frac{8}{\sqrt{3}}$

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14. The distance of the point $(-3, 2, 3)$ from the line passing through $(4, 6, -2)$ and having direction ratios $-1, 2, 3$ is:

(1) $4\sqrt{17}$

(2) $2\sqrt{17}$

(3) $2\sqrt{19}$

(4) $4\sqrt{19}$

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15. If $y = y(x)$ satisfies

$$\left(\frac{2+\sin x}{1+y}\right)\frac{dy}{dx} = -\cos x,$$

such that $y(0) = 2$, then the value of $y\left(\frac{\pi}{2}\right)$ is:

(1) 3

(2) 4

(3) 2

(4) 1

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16. Let

$$f(x) = (\cos x + \sin x)\cdot\cos(3x + i\sin x)\cdot\left[(2n-1)x + i\sin((2n-1)x)\right],$$

where $n \in \mathbb{N}$, and $i = \sqrt{-1}$. Then:

$$f''(x) = ?$$

(1) $-n^4 f(x)$

(2) $n^2 f(x)$

(3) $-n^2 f(x)$

(4) $n^4 f(x)$

---

17. If

$$[2\vec{p} - 3\vec{q}\ \vec{q}\ \vec{s}] + [3\vec{p} + 2\vec{q}\ \vec{r}\ \vec{s}] = m[\vec{p}\ \vec{r}\ \vec{s}] + n[\vec{q}\ \vec{r}\ \vec{s}] + l[\vec{p}\ \vec{q}\ \vec{s}],$$

then the values of m, n, l respectively are:

(1) $3, 4, 5$

(2) $2, 3, 3$

(3) $1, 2, 3$

(4) $3, 5, 2$

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18. Given:

$$\vec{a} = \hat{j} - \hat{k}, \quad \vec{c} = \hat{i} - \hat{j} - \hat{k}$$

The vector $\vec{b}$ satisfies:

$$\vec{a} \times \vec{b} + \vec{c} = \vec{0} \quad \text{and} \quad \vec{a} \cdot \vec{b} = 3$$

Find the vector $\vec{b}$.

(1) $\vec{b} = -\hat{i} + \hat{j} - 2\hat{k}$

(2) $\vec{b} = \hat{i} + \hat{j} + 2\hat{k}$

(3) $\vec{b} = \hat{i} - \hat{j} + 2\hat{k}$

(4) $\vec{b} = -\hat{i} + \hat{j} + \hat{k}$

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19. Evaluate the integral:

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

(1) $2\log\left(\frac{1}{2}\right)$

(2) $\log\left(\frac{3}{4}\right)$

(3) 0

(4) $\log 2$

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20. Find the area bounded between the parabola $y^2 = 4x$ and the line $y = 2x - 3$.

(1) $\displaystyle\int_{1-\sqrt{7}}^{1+\sqrt{7}} \left(\frac{y+3}{2} - \frac{y^2}{4}\right) dy$

(2) $\displaystyle\int_{1-\sqrt{7}}^{1+\sqrt{7}} \left(\frac{y^2}{4} - \frac{y+3}{2}\right) dy$

(3) $\displaystyle\int_{-2}^{2} \left(\frac{y^2}{4} - y\right) dy$

(4) $\displaystyle\int_{1-\sqrt{7}}^{1+\sqrt{7}} \left(\frac{y^2+y+3}{2}\right) dy$

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21. The magnetic moment of a sample of mass 2 g is 8×10^{-7} A $\cdot$ m^2. If density $\rho = 4$ g/cm^3, then the magnetisation M of the sample is: ?

(1) 0.4 A/m

(2) 1.6 A/m

(3) 4.0 A/m

(4) 6.4 A/m

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22. Which of the following statements is *correct* regarding the coordination compound $[Fe(CN)_6]^{4-}$ and fructose structure?

(1) The EAN of iron in $[Fe(CN)_6]^{4-}$ is 36 and fructose forms a pyranose ring.

(2) The EAN of iron in $[Fe(CN)_6]^{4-}$ is 36 and fructose forms a furanose ring.

(3) The compound exhibits ionisation isomerism and fructose is a non-reducing sugar.

(4) The EAN of Fe is 30 and fructose forms a pyranose ring.

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23. The EAN of cobalt in the complex $[Co(NH_3)_6]^{3+}$ is:

(1) 27

(2) 30

(3) 33

(4) 36

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24. A cube of edge 4 cm has mass 256 g. The density of the material in SI unit is:

(1) $4\,\text{kg/m}^3$

(2) $1600\,\text{kg/m}^3$

(3) $4000\,\text{kg/m}^3$

(4) $1000\,\text{kg/m}^3$

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25. A force $F = 5x$ N acts on a body and displaces it from $x = 0$ to $x = 2$ m. The work done by the force is:

(1) 10 J

(2) 20 J

(3) 5 J

(4) 15 J

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26. The van't Hoff factor for a solution of K_2SO_4 in water is:

(1) 1

(2) 2

(3) 3

(4) 4

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27. Rosenmund reduction is used to convert acyl chlorides into:

(1) Alcohols

(2) Carboxylic acids

(3) Aldehydes

(4) Ketones

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28. In the electrolysis of molten NaCl, the product obtained at the cathode is:

(1) Cl_2 gas

(2) Na metal

(3) NaOH

(4) H_2 gas

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29. Which of the following is an example of physisorption?

(1) Adsorption of NH_3 on charcoal

(2) Adsorption of H_2 on Ni

(3) Adsorption of noble gases on solid surface

(4) Adsorption of O_2 on heated metal

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30. For a first-order reaction, the time required to reduce the concentration of the reactant to half its initial value is:

(1) $\frac{0.3010}{k}$

(2) $\frac{1}{k}$

(3) $\frac{0.693}{k}$

(4) $\frac{2.303}{k}$
