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MHT CET 2025 Apr 23 Shift 2 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. Given that:

$$x = a\sin(2t)(1+\cos(2t)), \quad y = a\cos(2t)(1-\cos(2t))$$

Find $\frac{dy}{dx}$.

(1) $\frac{a\tan(t)}{b}$

(2) $\frac{a\tan(t)}{b}$

(3) $\frac{b\tan(t)}{a}$

(4) $\frac{b}{a\tan(t)}$

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2. Find the value of the following expression:

$$\tan^2(\sec^{-1}4) + \cot(\csc^{-1}3)$$

(1) 1

(2) 2

(3) 3

(4) 4

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3. In the word "UNIVERSITY", find the probability that the two "I"s do not come together.

(1) $\frac{7}{11}$

(2) $\frac{8}{11}$

(3) $\frac{9}{11}$

(4) $\frac{10}{11}$

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4. A die is rolled once. What is the probability of rolling a number greater than 4?

(1) $\frac{1}{6}$

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

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

(4) $\frac{5}{6}$

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5. If a and b are two non-zero vectors such that the angle between them is 60°, what is the probability that the dot product $\mathrm{a} \cdot \mathrm{b}$ is positive?

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

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

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

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

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6. In a dataset of 50 values, the mean is 40 and the variance is 25. What is the probability that a randomly selected value from this dataset is between 35 and 45?

(1) 0.68

(2) 0.95

(3) 0.34

(4) 0.99

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7. A radioactive substance has a half-life of 5 years. What is the probability that a single atom of this substance will decay within 5 years?

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

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

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

(4) $\frac{1}{8}$

8. In the case of a particle in a one-dimensional infinite potential well (box), what is the probability of finding the particle in the first half of the box for the ground state?

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

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

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

(4) 1

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9. For a system of particles in thermal equilibrium, what is the probability that a particle will have energy greater than E_0 according to the Boltzmann distribution?

(1) $e^{-\frac{E_0}{kT}}$

(2) $1 - e^{-\frac{E_0}{kT}}$

(3) $e^{\frac{E_0}{kT}}$

(4) $1 + e^{\frac{E_0}{kT}}$

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10. For the reaction $\mathbf{N}_2(g) + 3\mathbf{H}_2(g) \rightleftharpoons 2\mathbf{NH}_3(g)$, the equilibrium constant K_c at a certain temperature is 1.5. If the concentration of $\mathbf{N}_2$ is 0.5 M, $\mathbf{H}_2$ is 1.0 M, and $\mathbf{NH}_3$ is 0.2 M, what is the reaction quotient Q_c?

(1) 1.0

(2) 1.5

(3) 0.5

(4) 2.0

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11. In the reaction $\mathbf{2Al(s)} + \mathbf{3Cl}_2(g) \rightleftharpoons 2\mathbf{AlCl}_3(s)$, if 4.0 g of aluminum reacts with 6.0 g of chlorine gas, what is the limiting reactant?

(1) Al

(2) Cl_2

(3) $AlCl_3$

(4) None

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12. The enthalpy of formation for $\mathbf{H}_2(g)$, $\mathbf{O}_2(g)$, and $\mathbf{H}_2O(l)$ are 0, 0, and -285.8 kJ/mol,

respectively. What is the enthalpy change for the following reaction:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$$

(1) -571.6 kJ/mol

(2) -285.8 kJ/mol

(3) 0 kJ/mol

(4) 571.6 kJ/mol

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13. What is the pH of a 0.01 M solution of hydrochloric acid (HCl)?

(1) 1

(2) 2

(3) 3

(4) 4

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14. A gas occupies a volume of 10.0 L at a pressure of 2.0 atm and a temperature of 300 K. What will the volume be if the pressure is increased to 4.0 atm and the temperature is increased to 600 K? (Assume the amount of gas remains constant.)

(1) 5.0 L

(2) 10.0 L

(3) 20.0 L

(4) 2.5 L
