

MHT CET 23 April Shift 2 PCM Question Paper

Time Allowed :1 Hour 30 Mins	Maximum Marks :120	Total Questions :120
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General Instructions

1. The question paper consists of three sections: Mathematics, Physics, and Chemistry. You must attempt all sections. No section can be skipped.
2. All questions are Multiple Choice Questions (MCQs). Each question has four answer options, of which only one is correct.
3. Marking Scheme:
Mathematics: 2 marks for each correct answer
Physics & Chemistry: 1 mark for each correct answer
No negative marking for wrong or unattempted answers.
4. The medium of the question paper is English. Questions will appear only in the language selected during application.
5. The total duration of the examination is 90 minutes. The timer will start once you click on "Start Test".
6. You may navigate between questions and sections at any time. Use the Next, Previous, and Question Palette options to move through the paper.
7. A question can be marked for review. Questions marked for review will be saved but not considered final unless a response is selected.
8. You must click Save & Next after selecting an answer. Answers not saved will not be recorded.
9. Rough sheets are provided for calculations. They must be returned to the invigilator before leaving.
10. Do not attempt to use any prohibited items. Calculators, mobile phones, smart-watches, written notes, or communication devices are strictly not allowed.
11. You must remain seated until the invigilator announces the end of the session. Leaving the hall before the scheduled time is not permitted.
12. In case of any technical issue, raise your hand immediately. Do not attempt to fix the system yourself.
13. The test will automatically submit when the time ends. You may also submit earlier by clicking the Submit button, after which no changes can be made.

1. Given that: $x = a \sin(2t)(1 + \cos(2t))$, $y = a \cos(2t)(1 - \cos(2t))$

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

- (1) $\frac{a \tan(t)}{b}$
 - (2) $\frac{a \tan(t)}{b}$
 - (3) $\frac{b \tan(t)}{a}$
 - (4) $\frac{a}{b \tan(t)}$
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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
-

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) $\frac{10}{11}$
-

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) $\frac{5}{6}$
-

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 $a \cdot b$ is positive?

- (1) $\frac{1}{2}$
 - (2) $\frac{1}{3}$
 - (3) $\frac{2}{3}$
 - (4) $\frac{1}{4}$
-

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
-

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
-

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

10. For the reaction $\text{N}_2(g) + 3\text{H}_2(g) \rightleftharpoons 2\text{NH}_3(g)$, the equilibrium constant K_c at a certain temperature is 1.5. If the concentration of N_2 is 0.5 M, H_2 is 1.0 M, and NH_3 is 0.2 M, what is the reaction quotient Q_c ?

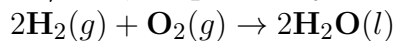
- (1) 1.0
 - (2) 1.5
 - (3) 0.5
 - (4) 2.0
-

11. In the reaction $2\text{Al}(s) + 3\text{Cl}_2(g) \rightleftharpoons 2\text{AlCl}_3(s)$, 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 $\text{H}_2(g)$, $\text{O}_2(g)$, and $\text{H}_2\text{O}(l)$ are 0, 0, and -285.8 kJ/mol, respectively. What is the enthalpy change for the following reaction:



- (1) -571.6 kJ/mol
 - (2) -285.8 kJ/mol
 - (3) 0 kJ/mol
 - (4) 571.6 kJ/mol
-

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
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