

MHT CET 2025 Memory Based Question Paper PDF (April 15, 2025) (Shift 2)

1. A sound wave travels through air with a frequency of 500 Hz and a wavelength of 0.68 m. Calculate the speed of sound in air.

(1) 340 m/s
(2) 500 m/s
(3) 200 m/s
(4) 680 m/s
2. In a silicon semiconductor at room temperature, the intrinsic carrier concentration is $1.5 \times 10^{16} \text{ m}^{-3}$. Calculate the energy band gap of the silicon if the intrinsic carrier concentration is given by:

$$n_i = \sqrt{N_c N_v} e^{-E_g/2kT}$$

Where: - $N_c = 2.8 \times 10^{25} \text{ m}^{-3}$ is the effective density of states in the conduction band, - $N_v = 1.04 \times 10^{25} \text{ m}^{-3}$ is the effective density of states in the valence band, - $k = 1.38 \times 10^{-23} \text{ J/K}$ is the Boltzmann constant, - $T = 300 \text{ K}$ is the temperature.

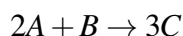
- (1) 1.1 eV
(2) 0.9 eV
(3) 2.0 eV
(4) 0.7 eV
3. An ideal gas is contained in a cylinder with a movable piston. The gas undergoes an isothermal expansion from a volume of 2 liters to 8 liters at a temperature of 300 K. If the initial pressure of the gas is $2 \times 10^5 \text{ Pa}$, calculate the work done by the gas during this expansion. (Use $R = 8.31 \text{ J/mol} \cdot \text{K}$)

(1) 7200 J
(2) 3600 J
(3) 1800 J
(4) 14400 J
4. A concave mirror has a focal length of 20 cm. An object is placed 60 cm in front of the mirror. Find the image distance.

- (1) 30 cm
(2) 40 cm
(3) 60 cm
(4) 80 cm
5. A projectile is fired with an initial speed of 20 m/s at an angle of 30° above the horizontal. Find the maximum height reached by the projectile.
- (1) 10 m
(2) 20 m
(3) 5 m
(4) 15 m
6. The gravitational potential energy of an object of mass 5 kg at a height of 10 m above the surface of the Earth is:
- (1) 490 J
(2) 500 J
(3) 450 J
(4) 550 J
7. A car of mass 1000 kg is moving in a circular path of radius 50 m with a speed of 20 m/s. Calculate the centripetal force acting on the car.
- (1) 4000 N
(2) 2000 N
(3) 5000 N
(4) 10000 N
8. Two charges, $q_1 = +3 \mu\text{C}$ and $q_2 = -4 \mu\text{C}$, are placed 20 cm apart. Calculate the force between the charges. (Use Coulomb's constant $k = 9 \times 10^9 \text{ N} \cdot \text{m}^2/\text{C}^2$)
- (1) 1.35 N
(2) 2.45 N
(3) 3.5 N
(4) 4.2 N
9. A fluid of density 800 kg/m^3 is flowing through a pipe of varying cross-sectional area. The velocity of the fluid at point A is 2 m/s, and the velocity at point B is 4 m/s. If the cross-sectional area at point A is 1 m^2 , find the cross-sectional area at point B.

- (1) 0.5 m^2
- (2) 1.5 m^2
- (3) 2.0 m^2
- (4) 4.0 m^2

10. For the reaction:



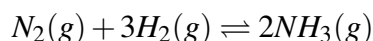
The rate law is given as:

$$\text{Rate} = k[A]^2[B]$$

If the concentration of A is doubled and the concentration of B is halved, how does the rate of the reaction change?

- (1) It remains the same.
 - (2) It doubles.
 - (3) It increases by a factor of 4.
 - (4) It decreases by a factor of 2.
11. The enthalpy of formation of hydrogen chloride (HCl) is -92.3 kJ/mol . If 2 moles of HCl are formed from hydrogen and chlorine gas, calculate the total heat released.
- (1) -184.6 kJ
 - (2) -92.3 kJ
 - (3) 92.3 kJ
 - (4) 184.6 kJ

12. For the equilibrium reaction:



At a certain temperature, the equilibrium constant K_c is 4.0. If the concentrations of N_2 , H_2 , and NH_3 are 0.2 M, 0.6 M, and 0.4 M, respectively, calculate the reaction quotient Q_c and determine whether the reaction is at equilibrium.

- (1) $Q_c = 1.2$, the reaction will shift to the left.
 - (2) $Q_c = 4.0$, the reaction is at equilibrium.
 - (3) $Q_c = 2.0$, the reaction will shift to the right.
 - (4) $Q_c = 0.5$, the reaction will shift to the left.
13. The freezing point depression constant (K_f) for water is $1.86^\circ\text{C} \cdot \text{kg/mol}$. If 0.5 moles of a non-volatile solute is dissolved in 1 kg of water, calculate the freezing point depression.

- (1) 0.93 °C
- (2) 1.86 °C
- (3) 3.72 °C
- (4) 2.79 °C

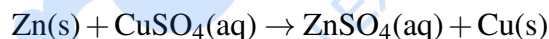
14. The energy of the nth orbit of the hydrogen atom is given by:

$$E_n = -\frac{13.6}{n^2} \text{ eV}$$

What is the energy of the second orbit ($n = 2$) of the hydrogen atom?

- (1) -3.4 eV
- (2) -13.6 eV
- (3) -6.8 eV
- (4) -1.36 eV

15. In the reaction:



Which of the following is the correct oxidation half-reaction?

- (1) $\text{Zn} \rightarrow \text{Zn}^{2+} + 2e^-$
- (2) $\text{Cu}^{2+} + 2e^- \rightarrow \text{Cu}$
- (3) $\text{Zn}^{2+} + 2e^- \rightarrow \text{Zn}$
- (4) $\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-$

16. Which of the following is the primary function of the human respiratory system?

- (1) To transport oxygen to tissues and carbon dioxide to the lungs.
- (2) To remove waste products from the body.
- (3) To facilitate digestion and absorption of nutrients.
- (4) To maintain homeostasis by regulating blood pH.

17. In a monohybrid cross between two heterozygous pea plants ($\text{Pp} \times \text{Pp}$), what is the expected phenotypic ratio of the offspring?

- (1) 3:1
- (2) 1:2:1
- (3) 1:1

- (4) 4:0
- 18.** Which of the following is an example of a primary consumer in an ecosystem?
- (1) Grasshopper
 - (2) Snake
 - (3) Fox
 - (4) Deer
- 19.** Which part of the human brain is primarily responsible for regulating basic life functions, such as heart rate and breathing?
- (1) Cerebrum
 - (2) Cerebellum
 - (3) Medulla Oblongata
 - (4) Hypothalamus
- 20.** Which of the following is the correct equation for photosynthesis?
- (1) $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$
 - (2) $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{energy}$
 - (3) $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 + \text{light energy}$
 - (4) $\text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2 \rightarrow 6\text{CO}_2 + 6\text{H}_2\text{O} + \text{light energy}$
- 21.** Which organelle is primarily responsible for producing ATP in a cell?
- (1) Nucleus
 - (2) Mitochondria
 - (3) Endoplasmic Reticulum
 - (4) Golgi Apparatus
- 22.** In a DNA molecule, which of the following base-pairings is correct?
- (1) Adenine pairs with Cytosine.
 - (2) Thymine pairs with Guanine.
 - (3) Adenine pairs with Thymine.
 - (4) Cytosine pairs with Uracil.
- 23.** Which of the following processes occurs during the second meiotic division (Meiosis II)?

- (1) Homologous chromosomes are separated.
- (2) Sister chromatids are separated.
- (3) DNA replication occurs.
- (4) Crossing over occurs.

24. Which of the following factors does NOT affect the rate of an enzyme-catalyzed reaction?

- (1) Temperature
- (2) pH
- (3) Substrate concentration
- (4) Color of the enzyme

