MHT CET 2025 April 17 Shift 2 Question Paper

Time Allowed :3 HourMaximum Marks :200Total 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 200 questions. The maximum marks are 200.
- There are three parts in the question paper consisting of Physics, Chemistry and Biology (Botany and Zoology) having 50 questions in each part of equal weightage.

1. In a semiconductor, the intrinsic carrier concentration is 1.5×10^{10} cm⁻³ at room temperature. If the energy band gap of the semiconductor is 1.1 eV, calculate the intrinsic carrier concentration at a temperature of 500 K. The intrinsic carrier concentration at room temperature (300 K) is known to vary with temperature according to the relation:

$$n_i(T) = n_{i0} \left(\frac{T}{T_0}\right)^{3/2} \exp\left(-\frac{E_g}{2k} \left(\frac{1}{T} - \frac{1}{T_0}\right)\right)$$

Where: $n_{i0} = 1.5 \times 10^{10} \text{ cm}^{-3}$, $T_0 = 300 \text{ K}$, $E_g = 1.1 \text{ eV}$, $k = 8.617 \times 10^{-5} \text{ eV/K}$, T = 500 K. (1) $3.0 \times 10^{12} \text{ cm}^{-3}$ (2) $6.2 \times 10^{12} \text{ cm}^{-3}$ (3) $8.5 \times 10^{13} \text{ cm}^{-3}$ (4) $1.2 \times 10^{14} \text{ cm}^{-3}$

2. A 1.0 kg sample of water at $80^{\circ}C$ is placed in thermal contact with a 2.0 kg sample of water at $20^{\circ}C$. If the system is insulated, what will be the final equilibrium temperature of the system? Assume no heat loss to the surroundings, and the specific heat capacity of water is $4.18 \text{ J/g}^{\circ}\text{C}$.

- (1) 40°C
 (2) 45°C
 (3) 50°C
- (4) $60^{\circ}C$

3. In an electromagnetic wave traveling in a vacuum, the electric field amplitude is 3.0×10^3 V/m. What is the magnetic field amplitude of the wave? Assume the speed of light in vacuum is $c = 3.0 \times 10^8$ m/s. (1) 1.0×10^{-5} T (2) 1.0×10^{-3} T (3) 1.0×10^{-6} T (4) 1.0×10^{-4} T

4. A capacitor of capacitance $10 \,\mu$ F is charged to a potential difference of 100 V. What is the energy stored in the capacitor?

- (1) 0.5 J
- (2) 5.0 J
- (3) 50.0 J
- (4) 0.05 J

5. A photon has an energy of 5.0 eV. What is its wavelength? (Planck's constant

 $h = 6.626 \times 10^{-34} \,\text{J} \cdot \text{s}$, speed of light $c = 3.0 \times 10^8 \,\text{m/s}$)

- (1) 400 nm
- (2) 500 nm
- $(3) 600 \, \text{nm}$
- (4) 700 nm

6. What is the entropy change when 1.0 kg of water at $100^{\circ}C$ is converted to steam at the same temperature? The latent heat of vaporization of water is 2.25×10^{6} J/kg.

- (1) $2.25 \times 10^3 \,\text{J/K}$
- (2) $2.25 \times 10^6 \,\text{J/K}$
- (3) $2.25 \times 10^9 \,\text{J/K}$

7. A current of 2.0 A is passed through a conductor for 10 minutes. How much charge passes through the conductor?

(1) 1.2×10^{3} C (2) 1.0×10^{3} C (3) 2.0×10^{3} C (4) 3.0×10^{3} C

8. What is the wavelength of a sound wave that has a frequency of 500 Hz and travels at a speed of 343 m/s?

 $(1) 0.5 \,\mathrm{m}$

(2) 1.0 m

(3) 2.0 m

(4) 3.0 m

9. A radioactive substance has a half-life of $10\,\mathrm{hours.}$ If the initial amount of the

substance is 200 g, how much of the substance remains after 30 hours?

(1) 25 g

(2) 50 g

- (3) 100 g
- (4) 12.5 g

10. What is the pH of a solution with a hydrogen ion concentration of 3.0×10^{-4} mol/L?

- (1) 3.52
- (2) 3.00
- (3) 4.52
- (4) 2.52

11. What is the molarity of a solution prepared by dissolving 5.0 g of sodium chloride

(NaCl) in 250 mL of water? (Molar mass of NaCl = 58.5 g/mol)

 $(1) 0.34 \,\mathrm{M}$

(2) 0.	50 M
(3) 1.	0 M
(4) 2.	0 M

12. What is the volume of 1.0 mol of an ideal gas at standard temperature and pressure (STP)? (STP is $0^{\circ}C$ and 1.0 atm, and the ideal gas constant R = 0.0821 L·atm/mol·K)

- (1) 22.4 L
- (2) 24.0 L
- (3) 20.0 L
- (4) 25.0 L

13. What is the molar mass of a gas if 2.5 g of the gas occupies 1.0 L at 300 K and a pressure of 1.0 atm? (Use the ideal gas law, R = 0.0821 L·atm/mol·K)

- (1) 32 g/mol
- (2) 28 g/mol
- (3) 36 g/mol
- (4) 44 g/mol

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

- (1) 1.0
- (2) 2.0
- (3) 0.5
- (4) 3.0

15. What is the concentration of NaOH in a solution if 25.0 mL of 0.100 M HCl is neutralized by 50.0 mL of NaOH?

- $(1) 0.05 \,\mathrm{M}$
- (2) 0.10 M
- (3) 0.20 M
- (4) 0.25 M

16. What is the molarity of a solution made by dissolving 2.5 g of potassium chloride

(KCl) in 500 mL of water? (Molar mass of KCl = 74.5 g/mol)

(1) 0.10 M

(2) $0.25 \,\mathrm{M}$

(3) 0.50 M

(4) 1.00 M

17.

In a population of rabbits, the brown fur color (B) is dominant to the white fur color (b). If a heterozygous brown rabbit is crossed with a homozygous white rabbit, what is the probability of their offspring having brown fur?

(1) 50%

(2) 25%

(3) 75%

(4) 100%

18.

What is the role of mitochondria in the cell, and how does their structure relate to their function?

(1) Mitochondria are the site of photosynthesis and have a large surface area for light absorption.

(2) Mitochondria are the site of cellular respiration and have a double membrane structure

for ATP production.

(3) Mitochondria are involved in protein synthesis and have a single membrane.

(4) Mitochondria are the storage site for genetic material and have a large central vacuole.

19.

In a plant cell, which organelle is primarily responsible for photosynthesis?

(1) Mitochondrion

(2) Nucleus

(3) Chloroplast

(4) Ribosome

20.

What is the role of the ribosomes in the cell?

- (1) They store genetic information.
- (2) They synthesize proteins.
- (3) They regulate cellular respiration.
- (4) They control the movement of substances in and out of the cell.

21.

What is the function of the Golgi apparatus in the cell?

- (1) Synthesizes proteins and lipids.
- (2) Packages and modifies proteins for secretion.
- (3) Contains digestive enzymes to break down waste.
- (4) Regulates cell division and growth.