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MHT CET 2025 April 17 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 200 questions. The maximum marks are 200.
3. 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: - $n_{i0} = 1.5 \times 10^{10}$ cm^{-3}, - $T_0 = 300$ K, - $E_g = 1.1$ eV, - $k = 8.617 \times 10^{-5}$ eV/K, - $T = 500$ K.

(1) 3.0×10^{12} cm^{-3}

(2) 6.2×10^{12} cm^{-3}

(3) 8.5×10^{13} cm^{-3}

(4) 1.2×10^{14} cm^{-3}

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2. A 1.0 kg sample of water at $80°C$ is placed in thermal contact with a 2.0 kg sample of water at $20°C$. 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 J/g°C.

(1) $40°C$

(2) $45°C$

(3) $50°C$

(4) $60°C$

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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

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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

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5. A photon has an energy of 5.0 eV. What is its wavelength? (Planck's constant $h = 6.626 \times 10^{-34}$ J · s, speed of light $c = 3.0 \times 10^8$ m/s)

(1) 400 nm

(2) 500 nm

(3) 600 nm

(4) 700 nm

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

(1) 2.25×10^3 J/K

(2) 2.25×10^6 J/K

(3) 2.25×10^9 J/K

(4) 2.25×10^7 J/K

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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

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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 m

(2) 1.0 m

(3) 2.0 m

(4) 3.0 m

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9. A radioactive substance has a half-life of 10 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

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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

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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 M

(2) $0.50\,\mathrm{M}$

(3) $1.0\,\mathrm{M}$

(4) $2.0\,\mathrm{M}$

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

(1) $22.4\,\mathrm{L}$

(2) $24.0\,\mathrm{L}$

(3) $20.0\,\mathrm{L}$

(4) $25.0\,\mathrm{L}$

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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

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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

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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) $0.10\,\mathrm{M}$

(3) $0.20\,\mathrm{M}$

(4) $0.25\,\mathrm{M}$

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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 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.

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