MHT CET 2026 April 25 Shift 2

Question Paper with Solutions (memory based)

Conducted by CET Cell, Maharashtra

General Instructions

(i) **Duration:** The total duration of the examination is 3 hours (180 minutes).

(ii) **Total Marks:** The complete paper carries a maximum of 200 marks.

(iii) **Structure:** The paper has 3 Sections:

- **Section A:** 50 Multiple Choice Questions (Physics).
- **Section B:** 50 Multiple Choice Questions (Chemistry).
- **Section B:** 100 Multiple Choice Questions (Biology).

(iv) **Compulsory Questions:** All 200 questions are compulsory.

(v) Each question has four options. Only **one** option is correct.

(vi) Correct Answer: +1 marks.

(vii) **Incorrect Answer:** (No Negative marking).

(viii) **Unanswered/Marked for Review:** 0 marks.

1. The moment of inertia of a thin uniform rod of mass M and length L about an axis passing through its centre and perpendicular to its length is:

(A) $ML^2/3$
(B) $ML^2/12$
(C) $ML^2/6$
(D) $ML^2/2$

Correct Answer: (B) $ML^2/12$

Solution:

Step 1: Understanding the Concept:

The moment of inertia of a rigid body depends on its mass distribution relative to the axis of rotation.

For a thin uniform rod, the axis passing through its centre and perpendicular to its length is the perpendicular bisector.

Step 2: Key Formula or Approach:

The moment of inertia I can be derived using the integral:

$$I = \int_{-L/2}^{L/2} x^2 dm$$

Step 3: Detailed Explanation:

Let the mass of the rod be M and its length be L.

The linear mass density of the rod is $\lambda = \frac{M}{L}$.

Consider a small element of length dx at a distance x from the centre.

The mass of this element is $dm = \lambda dx = \frac{M}{L} dx$.

The moment of inertia of the entire rod is:

$$I = \int_{-L/2}^{L/2} x^2 \left(\frac{M}{L}\right) dx$$

$$I = \frac{M}{L}\left[\frac{x^3}{3}\right]_{-L/2}^{L/2}$$

$$I = \frac{M}{3L}\left(\left(\frac{L}{2}\right)^3 - \left(-\frac{L}{2}\right)^3\right)$$

$$I = \frac{M}{3L}\left(\frac{L^3}{8} + \frac{L^3}{8}\right)$$

$$I = \frac{M}{3L}\left(\frac{2L^3}{8}\right) = \frac{ML^2}{12}$$

Step 4: Final Answer:

The correct moment of inertia is $ML^2/12$.

Quick Tip: Remember standard moment of inertia formulas: For a rod about its center, it is $ML^2/12$, and about its end, it is $ML^2/3$ (using the parallel axis theorem).

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2. If the temperature of a hot reservoir is 600K and the cold reservoir is 300K, the efficiency of the Carnot engine is:

(A) 25%

(B) 75%

(C) 50%

(D) 100%

Correct Answer: (C) 50%

Solution:

Step 1: Understanding the Concept:

A Carnot engine is an idealized heat engine that operates on the Carnot cycle.

Its efficiency is solely determined by the temperatures of the hot and cold reservoirs.

Step 2: Key Formula or Approach:

The efficiency η of a Carnot engine is given by the formula:

$$\eta = 1 - \frac{T_C}{T_H}$$

To express the efficiency as a percentage, we multiply by 100%:

$$\eta(\%) = \left(1 - \frac{T_C}{T_H}\right) \times 100\%$$

Step 3: Detailed Explanation:

Given the temperature of the hot reservoir $T_H = 600$ K.

Given the temperature of the cold reservoir $T_C = 300$ K.

Substituting these values into the efficiency formula:

$$\eta = 1 - \frac{300}{600}$$

$$\eta = 1 - \frac{1}{2} = \frac{1}{2}$$

Converting this to a percentage:

$$\eta(\%) = \frac{1}{2} \times 100\% = 50\%$$

Step 4: Final Answer:

The efficiency of the Carnot engine is 50%.

Quick Tip: Always ensure that temperatures are in Kelvin before applying the Carnot efficiency formula.
If given in Celsius, convert by adding 273.15.

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3. The SI unit of Magnetic Induction is:

(A) Weber
(B) Tesla
(C) Henry
(D) Gauss

Correct Answer: (B) Tesla

Solution:

Step 1: Understanding the Concept:
Magnetic induction, also known as magnetic flux density, measures the strength of the magnetic field in a given region.
It represents the amount of magnetic flux through a unit area perpendicular to the direction of the magnetic field.

Step 2: Key Formula or Approach:
The relationship between magnetic flux (Φ), magnetic induction (B), and area (A) is:

$$\Phi = B \cdot A$$

Therefore, $B = \frac{\Phi}{A}$.

Step 3: Detailed Explanation:
The SI unit of magnetic flux Φ is Weber (Wb).
The SI unit of area A is square meters (m^2).

Thus, the SI unit of magnetic induction is Weber per square meter (Wb/m^2).

This unit is named Tesla (T) in honor of Nikola Tesla.

Let us review the other options:

(A) Weber is the SI unit of magnetic flux.

(C) Henry is the SI unit of inductance.

(D) Gauss is the CGS unit of magnetic induction ($1\ T = 10^4\ G$).

Step 4: Final Answer:

The SI unit of magnetic induction is Tesla.

Quick Tip: Do not confuse Magnetic Flux (Weber) with Magnetic Flux Density or Magnetic Induction (Tesla).

Remember the conversion factor: $1\ \text{Tesla} = 10^4\ \text{Gauss}$.

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4. In a stationary wave, the distance between a node and an adjacent antinode is:

(A) $\lambda/2$

(B) λ

(C) $\lambda/4$

(D) 2λ

Correct Answer: (C) $\lambda/4$

Solution:

Step 1: Understanding the Concept:

Stationary waves (or standing waves) are formed by the superposition of two identical waves traveling in opposite directions.

A node is a point of minimum (zero) amplitude, while an antinode is a point of maximum amplitude.

Step 2: Detailed Explanation:

In a full wavelength λ of a stationary wave, there are two identical loops.

The distance between two consecutive nodes is $\lambda/2$.

The distance between two consecutive antinodes is also $\lambda/2$.

An antinode is located exactly halfway between two consecutive nodes.

Therefore, the distance between a node and its immediately adjacent antinode is exactly half of $\lambda/2$.

$$\text{Distance} = \frac{\lambda/2}{2} = \frac{\lambda}{4}$$

Step 3: Final Answer:

The distance between a node and an adjacent antinode is $\lambda/4$.

Quick Tip: Visualize the standing wave pattern: Node-to-Node is $\lambda/2$, Node-to-Antinode is $\lambda/4$, and a full wave cycle is λ.

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5. The maximum kinetic energy of photoelectrons depends on:

(A) Intensity of light

(B) Frequency of light

(C) Time of exposure

(D) Distance from source

Correct Answer: (B) Frequency of light

Solution:

Step 1: Understanding the Concept:

The photoelectric effect is the emission of electrons when light hits a material.
According to Einstein's photoelectric theory, light consists of discrete energy packets called photons.

Step 2: Key Formula or Approach:
Einstein's photoelectric equation is given by:

$$K_{\text{max}} = h\nu - \Phi$$

Where K_{max} is the maximum kinetic energy of the emitted photoelectrons, h is Planck's constant, ν is the frequency of the incident light, and Φ is the work function of the material.

Step 3: Detailed Explanation:
From the equation, K_{max} is directly proportional to the frequency ν of the incident light, provided ν is greater than the threshold frequency.
The intensity of light only increases the number of emitted photoelectrons per second, but does not affect their individual maximum kinetic energy.
Time of exposure and distance from the source also only affect the total number of photons hitting the surface, not the energy per photon.

Step 4: Final Answer:
The maximum kinetic energy of photoelectrons depends strictly on the frequency of the incident light.

Quick Tip: Remember the golden rule of the photoelectric effect: Intensity determines the photocurrent (number of electrons), while frequency determines the maximum kinetic energy.

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6. Which of the following is a monomer of Nylon 6,6?

(A) Caprolactam

(B) Adipic acid

(C) Glycine

(D) Vinyl chloride

Correct Answer: (B) Adipic acid

Solution:

Step 1: Understanding the Concept:

Nylon 6,6 is a synthetic polymer belonging to the class of polyamides.

It is formed via a condensation polymerization reaction between a diamine and a dicarboxylic acid.

Step 2: Detailed Explanation:

The "6,6" in Nylon 6,6 refers to the fact that both monomers contain exactly 6 carbon atoms.

The two monomers used to synthesize Nylon 6,6 are Hexamethylenediamine ($H_2N-(CH_2)_6-NH_2$) and Adipic acid ($HOOC-(CH_2)_4-COOH$).

Looking at the options provided:

(A) Caprolactam is the monomer for Nylon 6.

(B) Adipic acid is one of the correct monomers for Nylon 6,6.

(C) Glycine is an amino acid, a monomer for proteins.

(D) Vinyl chloride is the monomer for Polyvinyl chloride (PVC).

Step 3: Final Answer:

The correct monomer from the given choices is Adipic acid.

Quick Tip: The numbers in polyamides like Nylon 6,6 indicate the number of carbon atoms in the respective monomers.

Hexamethylenediamine has 6 carbons, and adipic acid also has 6 carbons.

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7. Ozonolysis of 2-Methylbut-2-ene followed by reaction with Zn/H_2O gives:

(A) Propanone and Ethanal

(B) Propanal and Ethanal

(C) Two moles of Propanone

(D) Butanone and Methanal

Correct Answer: (A) Propanone and Ethanal

Solution:

Step 1: Understanding the Concept:

Reductive ozonolysis of an alkene is a chemical reaction that cleaves the carbon-carbon double bond (C=C).

The reagents used are ozone (O_3) followed by a reducing agent like zinc dust and water (Zn/H_2O).

Step 2: Key Formula or Approach:

In reductive ozonolysis, the C=C double bond is broken completely, and an oxygen atom is added to each of the two carbon atoms to form carbonyl compounds (aldehydes or ketones).

The general approach is to "cut" the double bond and attach an =O to each side.

Step 3: Detailed Explanation:

The given reactant is 2-Methylbut-2-ene.

Its chemical structure is: $CH_3 - C(CH_3) = CH - CH_3$.

When we cleave the C=C double bond:

Left fragment: $CH_3 - C(CH_3) =$ becomes $CH_3 - C(= O) - CH_3$, which is Propanone (Acetone).

Right fragment: $= CH - CH_3$ becomes O=CH $- CH_3$, which is Ethanal (Acetaldehyde).

Therefore, the products formed are Propanone and Ethanal.

Step 4: Final Answer:

The reaction yields Propanone and Ethanal.

Quick Tip: To predict ozonolysis products quickly, literally erase the double bond and place a double-bonded oxygen (=O) on each of the carbon atoms that were originally double-bonded.

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8. The EAN (Effective Atomic Number) of Iron in $[Fe(CN)_6]^{4-}$ is:

(A) 34
(B) 35
(C) 36
(D) 38

Correct Answer: (C) 36

Solution:

Step 1: Understanding the Concept:
The Effective Atomic Number (EAN) rule states that in many coordination complexes, the central metal atom tends to surround itself with enough ligands so that the total number of electrons around it matches the atomic number of the nearest noble gas.

Step 2: Key Formula or Approach:
The formula to calculate EAN is:

$$\text{EAN} = Z - X + Y$$

Where Z is the atomic number of the central metal atom, X is the number of electrons lost in forming the ion (oxidation state), and Y is the number of electrons gained from the ligands (usually $2 \times$ Coordination Number).

Step 3: Detailed Explanation:
For the complex ion $[Fe(CN)_6]^{4-}$:
The atomic number of Iron (Fe) is $Z = 26$.

Let the oxidation state of Fe be x.

The cyanide ligand (CN^-) has a charge of -1.

Since the overall charge of the complex is -4, we have:

$$x + 6(-1) = -4 \implies x = +2$$

Thus, Fe is in the +2 oxidation state, meaning it has lost 2 electrons ($X = 2$).

There are 6 CN^- ligands, and each ligand donates a pair of electrons.

Electrons from ligands $Y = 6 \times 2 = 12$.

Now, calculate the EAN:

$$\text{EAN} = 26 - 2 + 12 = 36$$

This matches the atomic number of the noble gas Krypton (Kr).

Step 4: Final Answer:

The Effective Atomic Number of Iron is 36.

Quick Tip: Always ensure you have the correct oxidation state of the central metal before calculating the EAN.

A neutral ligand contributes 0 to the charge but still donates 2 electrons.

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9. Which element has the highest electronegativity?

(A) Lithium

(B) Sodium

(C) Potassium

(D) Fluorine

Correct Answer: (D) Fluorine

Solution:

Step 1: Understanding the Concept:
Electronegativity is the tendency of an atom to attract a shared pair of electrons towards itself in a covalent bond.

Step 2: Detailed Explanation:
In the periodic table, electronegativity generally increases as we move from left to right across a period because the nuclear charge increases, pulling the electron cloud closer.
It decreases as we move down a group because the atomic radius increases, making the nucleus's pull on the valence electrons weaker.
Lithium, Sodium, and Potassium are all Group 1 elements (alkali metals) and have very low electronegativities, as they tend to lose an electron to form cations.
Fluorine is a Group 17 element (halogen) situated at the top right of the periodic table (excluding noble gases).
Because of its small atomic radius and high effective nuclear charge, Fluorine has the strongest tendency to attract shared electrons.
On the Pauling scale, Fluorine is assigned the highest electronegativity value of 4.0.

Step 3: Final Answer:
Fluorine is the most electronegative element among the given options, and in the entire periodic table.

Quick Tip: Remember the trend: Electronegativity increases across a period and decreases down a group.
The order of the most electronegative elements is $F > O > N \approx Cl$.

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10. The catalyst used in the manufacture of Ammonia by Haber's process is:

(A) V_2O_5

(B) Finely divided Iron

(C) Platinum

(D) Nickel

Correct Answer: (B) Finely divided Iron

Solution:

Step 1: Understanding the Concept:

Haber's process is the primary industrial method for the large-scale production of ammonia (NH_3) from nitrogen (N_2) and hydrogen (H_2).

The chemical reaction is given by: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$.

Step 2: Detailed Explanation:

This reaction is exothermic, reversible, and occurs at high pressure (around 200 atm) and moderate temperature (about 450-500 °C).

To speed up the rate of reaction to reach equilibrium faster at these temperatures, a solid catalyst is used.

Historically and industrially, finely divided Iron (Fe) is employed as the main catalyst, often with molybdenum (Mo) or metal oxides like K_2O and Al_2O_3 as promoters to increase its efficiency.

Let us evaluate the other options:

(A) V_2O_5 (Vanadium pentoxide) is used in the Contact process for sulfuric acid production.

(C) Platinum (Pt) is used in the Ostwald process for nitric acid production.

(D) Nickel (Ni) is widely used in the hydrogenation of oils.

Step 3: Final Answer:

The catalyst used in Haber's process is finely divided Iron.

Quick Tip: Memorize the key industrial catalysts: Iron for Haber's process (NH_3), V_2O_5 for Contact process (H_2SO_4), and Platinum/Rhodium for Ostwald process (HNO_3).