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 C:** 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) **Right Answer:** Physics (+1 marks), Chemistry (+1 marks) and Biology(+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 measures an object's resistance to rotational acceleration about a specific axis.

For a continuous mass distribution, it is calculated using the integral $I = \int r^2 dm$.

Step 2: Key Formula or Approach:

The approach involves taking an elemental mass dm at a distance x from the axis and integrating over the entire length of the rod.

The relevant formula is $I = \int x^2 dm$, where the limits of integration are from $-L/2$ to $L/2$.

Step 3: Detailed Explanation:

Consider a thin uniform rod of mass M and length L.

Let the axis of rotation pass through its center and be perpendicular to its length.

We take an elemental mass dm of length dx at a distance x from the center.

The linear mass density is $\lambda = M/L$, so the mass of the element is $dm = (M/L)dx$.

The moment of inertia of this elemental mass is $dI = dm \cdot x^2$.

Integrating from $x = -L/2$ to $x = L/2$ gives the total moment of inertia:

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

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

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

$$I = \frac{M}{3L}\left(\frac{2L^3}{8}\right) = \frac{M}{3L}\left(\frac{L^3}{4}\right) = \frac{ML^2}{12}$$

Step 4: Final Answer:

The correct option is (B) as the calculated moment of inertia is $ML^2/12$.

Quick Tip: Memorize standard moments of inertia for common shapes.
For a rod about its center, it is $ML^2/12$, and about its end, it is $ML^2/3$.

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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 a theoretical thermodynamic cycle that determines the maximum possible efficiency any heat engine can achieve.
The efficiency depends exclusively on the absolute temperatures of the hot and cold reservoirs.

Step 2: Key Formula or Approach:
The formula for the efficiency of a Carnot engine is $\eta = 1 - \frac{T_C}{T_H}$.
Here, T_C is the absolute temperature of the cold reservoir and T_H is the absolute temperature of the hot reservoir.

Step 3: Detailed Explanation:
From the given question, the temperature of the hot reservoir is $T_H = 600$ K.
The temperature of the cold reservoir is $T_C = 300$ K.
Substitute these temperature values into the efficiency formula:

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

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

$$\eta = 0.5$$

To convert this decimal to a percentage, multiply by 100:

$$\text{Efficiency } \% = 0.5 \times 100\% = 50\%$$

Step 4: Final Answer:

The efficiency of the Carnot engine is 50%, which corresponds to option (C).

Quick Tip: Always verify that the given temperatures are in Kelvin (K) before using the Carnot efficiency formula.

If they are provided in Celsius, you must convert them 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 or magnetic field B, represents the strength of a magnetic field.

It defines the force experienced by a moving charge or a current-carrying wire in the field.

Step 2: Key Formula or Approach:

The approach is to identify the standard International System of Units (SI) for various electromagnetic quantities.

We will evaluate each option against standard physical definitions.

Step 3: Detailed Explanation:

Let us analyze each given option systematically.

Option (A) is Weber (Wb), which is the SI unit for magnetic flux (Φ).

Option (B) is Tesla (T), which is the internationally accepted SI unit for magnetic induction or magnetic flux density.

Option (C) is Henry (H), which is the SI unit for electrical inductance (L).

Option (D) is Gauss (G), which is indeed a unit of magnetic induction, but it belongs to the older CGS system, not the SI system.

Therefore, Tesla is the only correct SI unit among the choices.

Step 4: Final Answer:

The SI unit of Magnetic Induction is Tesla.

Quick Tip: Remember the relationship between units: $1\ \text{Tesla} = 1\ \text{Weber/m}^2$.

Also, note the conversion factor for CGS units: $1\ \text{Tesla} = 10^4\ \text{Gauss}$.

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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:

A stationary wave, or standing wave, forms when two identical waves travel in opposite directions and superimpose.

This creates points of zero displacement called nodes and points of maximum displacement called antinodes.

Step 2: Key Formula or Approach:

The approach is to use the standard geometric properties of a standing wave pattern.

We know that the distance between two consecutive nodes is $\lambda/2$, where λ is the wavelength.

Step 3: Detailed Explanation:

In a standing wave, a full wavelength λ covers two complete vibrating loops.

Nodes occur at positions where the waves destructively interfere completely.

The distance separating two consecutive nodes is exactly half of a wavelength, or $\lambda/2$.

Antinodes occur exactly halfway between two consecutive nodes, where constructive interference is maximum.

Therefore, the distance from a node to the very next adjacent antinode is half of the distance between two nodes.

This distance is calculated as $\frac{1}{2} \times \left(\frac{\lambda}{2}\right) = \frac{\lambda}{4}$.

Step 4: Final Answer:

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

Quick Tip: Visualizing the sine wave helps greatly: nodes are at $0, \lambda/2, \lambda$ and antinodes are at the peaks $\lambda/4, 3\lambda/4$.

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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 from a material when light shines upon it.

The properties of these emitted electrons (photoelectrons) are governed by the quantum nature of light.

Step 2: Key Formula or Approach:

Einstein's photoelectric equation is the key to solving this: $K_{max} = h\nu - \Phi$.

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

Step 3: Detailed Explanation:

According to the photoelectric equation, K_{max} is directly dependent on the frequency ν of the incident light.

If the frequency of the light increases, the energy of the incident photons increases, resulting in a higher maximum kinetic energy for the emitted electrons.

The intensity of light determines the number of photons striking the surface per unit time.

Increasing intensity increases the number of emitted photoelectrons but does not change the maximum kinetic energy of an individual electron.

Time of exposure and distance from the source only affect the total number of photons arriving over time, not their individual energy.

Step 4: Final Answer:

The maximum kinetic energy of photoelectrons depends entirely on the frequency of light.

Quick Tip: Keep these distinct: Intensity controls the 'amount' (photoelectric current). Frequency controls the 'energy' (maximum kinetic energy and stopping potential).

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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 type of polyamide, which is a synthetic polymer formed by step-growth condensation polymerization.

The numbers "6,6" in its name refer to the number of carbon atoms present in its two constituent monomers.

Step 2: Key Formula or Approach:

The approach is to identify the specific chemical monomers required to synthesize the Nylon 6,6 polymer chain.

We need to evaluate the given options to find either the diamine or the dicarboxylic acid used in this synthesis.

Step 3: Detailed Explanation:

Nylon 6,6 is manufactured by the polycondensation of two specific monomers.

The first monomer is a six-carbon diamine known as hexamethylenediamine ($H_2N\text{-}(CH_2)_6\text{-}NH_2$).

The second monomer is a six-carbon dicarboxylic acid known as adipic acid ($HOOC\text{-}(CH_2)_4\text{-}COOH$).

Let us briefly review the incorrect options provided.

Option (A) Caprolactam is the single monomer used for producing Nylon 6, not Nylon 6,6.

Option (C) Glycine is a natural amino acid and is not utilized in the production of commercial nylon polymers.

Option (D) Vinyl chloride is the monomer used to manufacture polyvinyl chloride (PVC) via addition polymerization.

Therefore, Adipic acid is the correct monomer from the given list.

Step 4: Final Answer:

Adipic acid is a monomer of Nylon 6,6.

Quick Tip: The naming convention for polyamides is very helpful.

For Nylon x, y, the first number x represents the number of carbons in the amine, and y represents the number of carbons in the acid.

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:

Ozonolysis is an organic reaction used to break double or triple bonds using ozone (O_3).

When followed by Zn/H_2O, it undergoes reductive cleavage, converting the alkene into respective aldehydes or ketones without further oxidizing them to carboxylic acids.

Step 2: Key Formula or Approach:

The simplest approach to predict products of reductive ozonolysis is to formally break the carbon-carbon double bond.

Then, cap both ends of the broken bond with a doubly-bonded oxygen atom (=O).

Step 3: Detailed Explanation:

First, we must write down the structural formula for the starting material, 2-Methylbut-2-ene.

The structure is CH_3-C(CH_3)=CH-CH_3.

Next, we identify the exact location of the C=C double bond to perform the cleavage.

We split the molecule into two fragments at the double bond.

The left fragment is CH_3-C(CH_3)=.

The right fragment is =CH-CH_3.

Now, we attach an oxygen atom to the double bond of each fragment.

The left fragment becomes CH_3-C(=O)-CH_3, which is a ketone known as Propanone (or acetone).

The right fragment becomes O=CH-CH_3, which is an aldehyde known as Ethanal (or acetaldehyde).

Therefore, the final mixture of products consists of Propanone and Ethanal.

Step 4: Final Answer:

The reaction gives Propanone and Ethanal.

Quick Tip: A quick shortcut for reductive ozonolysis: mentally erase the double bond = and write =O facing O= in its place.

This instantly gives you the structures of the final carbonyl compounds.

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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 was proposed by Sidgwick to explain the stability of coordination complexes.

It represents the total number of electrons present around the central metal ion after coordination.

Step 2: Key Formula or Approach:

The EAN is calculated using the established formula: $\text{EAN} = Z - \text{O.S.} + 2 \times (\text{C.N.})$.

Here, Z is the atomic number of the central metal, O.S. is its oxidation state, and C.N. is the coordination number.

Step 3: Detailed Explanation:

Let's analyze the given complex ion, $[\text{Fe(CN)}_6]^{4-}$.

The central metal atom is Iron (Fe), which has an atomic number of $Z = 26$.

Next, we calculate the oxidation state (O.S.) of Iron, let's call it x.

The cyanide ligand (CN^-) is a unidentate ligand with a charge of -1.

The sum of the charges of the metal and ligands equals the overall charge of the complex.

$$x + 6(-1) = -4$$

$$x - 6 = -4$$

$$x = +2$$

Thus, the oxidation state of Iron is 2.

The coordination number (C.N.) is the total number of coordinate bonds formed, which is 6 since there are six CN^- ligands.

Now, we substitute these values into the EAN formula:

$$\text{EAN} = 26 - 2 + 2 \times 6$$

$$\text{EAN} = 24 + 12$$

$$\text{EAN} = 36$$

Step 4: Final Answer:

The EAN of Iron in the given complex is 36.

Quick Tip: A complex whose EAN equals the atomic number of the next noble gas (like 36 for Krypton) is generally considered very stable.

This is known as following the EAN rule.

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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 defined as the tendency of an atom to attract a shared pair of electrons towards itself in a covalent bond.

It is a relative property and depends on the atom's effective nuclear charge and atomic radius.

Step 2: Key Formula or Approach:

The approach requires applying the general periodic trends of electronegativity across periods and down groups in the periodic table.

Electronegativity increases across a period (left to right) and decreases down a group (top to bottom).

Step 3: Detailed Explanation:

Let us evaluate the positions of the given elements in the periodic table.

Options (A) Lithium, (B) Sodium, and (C) Potassium are all alkali metals situated in Group 1.

They are located on the far left side of the periodic table, meaning they have very large atomic radii and low effective nuclear charges.

Consequently, these metals have very low electronegativity values, as they tend to easily lose electrons rather than attract them.

Option (D) Fluorine is a halogen located in Group 17 and Period 2.

It is positioned at the top right of the periodic table, excluding the relatively inert noble gases.

Due to its small atomic size and high effective nuclear charge, it exhibits an extremely strong pull on shared electrons.

Therefore, Fluorine is universally recognized as the most electronegative element, assigned a maximum value of 4.0 on the Pauling scale.

Step 4: Final Answer:

Fluorine has the highest electronegativity among the given elements.

Quick Tip: A good mnemonic for the most electronegative elements is "FONClBrISCH". It stands for Fluorine, Oxygen, Nitrogen/Chlorine, Bromine, Iodine, Sulfur, Carbon, Hydrogen in decreasing order.

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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:

The Haber process is a crucial industrial chemical process used to synthesize ammonia (NH_3) directly from nitrogen (N_2) and hydrogen (H_2) gases.

Because the reaction requires breaking the exceptionally strong triple bond of the nitrogen molecule, a catalyst is essential to provide an alternative pathway with a lower activation energy.

Step 2: Key Formula or Approach:

The approach involves recalling factual knowledge about standard industrial manufacturing processes and their specifically optimized catalysts.

We will match each given chemical species with its most famous industrial application.

Step 3: Detailed Explanation:

The chemical reaction for the Haber process is: $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$.

To achieve a practical rate of reaction at economically feasible temperatures, a solid catalyst is utilized.

The historically established and currently used catalyst for this specific process is finely divided iron.

This iron catalyst is typically promoted with small amounts of potassium oxide (K_2O) and aluminum oxide (Al_2O_3) to enhance its performance.

Let us briefly review the other options provided.

Option (A) Vanadium pentoxide (V_2O_5) is the characteristic catalyst used in the Contact process to produce sulfuric acid.

Option (C) Platinum (Pt) mesh is widely used as a catalyst in the Ostwald process for manufacturing nitric acid.

Option (D) Nickel (Ni) is the standard catalyst employed in the industrial hydrogenation of vegetable oils to form solid fats.

Therefore, finely divided iron is the correct answer.

Step 4: Final Answer:

The catalyst used in the manufacture of Ammonia by Haber's process is finely divided Iron.

Quick Tip: Matching industrial processes with their catalysts is a highly recurring question format. Remember: Haber = Iron (Fe), Contact = Vanadium pentoxide (V_2O_5), Ostwald = Platinum (Pt).
