MHT CET 2026 April 15 Shift 2

Question Paper with Solutions

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:** 50 Multiple Choice Questions (Mathematics)

(iv) **Compulsory Questions:** All 150 questions are compulsory.

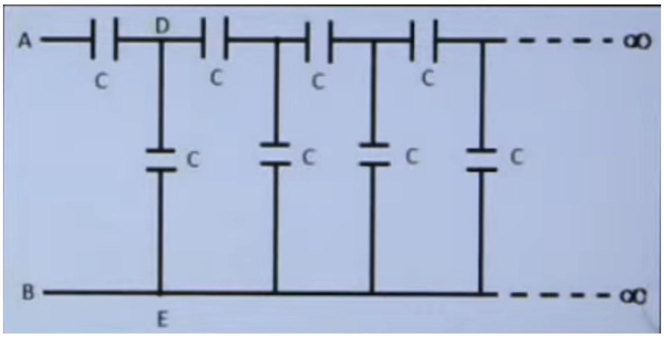
(v) Each question has four options. Only **one** option is correct.

(vi) **Right Answer:** Physics (+1 marks), Chemistry (+1 marks) and Mathematics (+2 marks).

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

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

1. The capacitance of an infinite circuit formed by the repetition of the same link consisting of two identical capacitors, each with capacitance C, as shown in the figure is:



(A) Zero

(B) $\dfrac{(\sqrt{5}-1)C}{2}$

(C) $\dfrac{(\sqrt{5}+1)C}{2}$

(D) Infinite

Correct Answer: (2) $\dfrac{(\sqrt{5}-1)C}{2}$

Solution:

Concept:

For an **infinite repeating network**, the equivalent capacitance of the entire circuit remains the same even after removing the first repeating section. This self-similarity allows us to form an equation for the equivalent capacitance.

Let the equivalent capacitance between points A and B be C_{eq}.

Step 1: Represent the infinite network using self-similarity.

After the first section, the remaining infinite network still has equivalent capacitance C_{eq}.

The first section consists of:

- One capacitor C in series along the top branch
- A vertical capacitor C connected to the remaining network

Step 2: Combine the vertical capacitor with the remaining network.

The vertical capacitor C is in **parallel** with the equivalent capacitance of the remaining infinite network.

Thus,

$$C' = C + C_{eq}$$

Step 3: Find equivalent capacitance of the series combination.

The series combination of C and C' is

$$C_{eq} = \frac{C \cdot C'}{C + C'}$$

Substitute $C' = C + C_{eq}$:

$$C_{eq} = \frac{C(C + C_{eq})}{2C + C_{eq}}$$

Step 4: Solve the equation.

$$C_{eq}(2C + C_{eq}) = C(C + C_{eq})$$

$$2CC_{eq} + C_{eq}^2 = C^2 + CC_{eq}$$

$$C_{eq}^2 + CC_{eq} - C^2 = 0$$

Dividing by C^2:

$$\left(\frac{C_{eq}}{C}\right)^2 + \left(\frac{C_{eq}}{C}\right) - 1 = 0$$

Step 5: Solve the quadratic equation.

$$\frac{C_{eq}}{C} = \frac{-1 + \sqrt{5}}{2}$$

Thus,

$$C_{eq} = \frac{(\sqrt{5} - 1)C}{2}$$

Hence, the correct option is (B).

Quick Tip: In infinite electrical networks:

- The remaining circuit after removing the first block has the same equivalent value.
- This self-similarity leads to a quadratic equation for the equivalent resistance or capacitance.

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2. Evaluate the integral:

$$\int_3^5 |x - 4| \, dx$$

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (1) 1

Solution:

Concept:

The absolute value function is defined as

$$|x-a| = \begin{cases} a-x, & x < a \\ x-a, & x \geq a \end{cases}$$

Thus, the interval must be split at the point where the expression inside the modulus becomes zero.

Step 1: Find where the expression inside modulus becomes zero.

$$x - 4 = 0$$

$$x = 4$$

Since 4 lies between 3 and 5, split the integral at $x = 4$.

Step 2: Rewrite the integral.

For $3 \leq x < 4$,

$$|x-4| = 4-x$$

For $4 \leq x \leq 5$,

$$|x-4| = x-4$$

Thus,

$$\int_3^5 |x-4|dx = \int_3^4 (4-x)dx + \int_4^5 (x-4)dx$$

Step 3: Evaluate both integrals.

First integral:

$$\int_3^4 (4-x)dx = \left[4x - \frac{x^2}{2}\right]_3^4$$

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

Second integral:

$$\int_4^5 (x-4)dx = \left[\frac{x^2}{2} - 4x\right]_4^5$$

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

Step 4: Add the results.

$$\frac{1}{2} + \frac{1}{2} = 1$$

Thus,

$$\int_3^5 |x-4|dx = 1$$

Hence, the correct option is **(A)**.

Quick Tip: For integrals involving modulus:

$$\int |f(x)|dx$$

first find the points where $f(x) = 0$ and split the interval there. Then remove the modulus by considering the sign of $f(x)$ in each interval.

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3. A $1.5\,$kg block is attached to a spring with spring constant $k = 100\,\mathrm{N\,m^{-1}}$ and displaced by $0.2\,$m. Calculate the potential energy stored in the spring.

(A) $1\,$J

(B) 2 J

(C) 3 J

(D) 4 J

Correct Answer: (2) 2 J

Solution:

Concept:

The potential energy stored in a spring is given by the formula

$$U = \frac{1}{2}kx^2$$

where

- k = spring constant
- x = displacement from equilibrium position

Step 1: Write the given values.

$$k = 100\,\text{N m}^{-1}, \qquad x = 0.2\,\text{m}$$

Step 2: Substitute values into the formula.

$$U = \frac{1}{2} \times 100 \times (0.2)^2$$

Step 3: Calculate the value.

$$(0.2)^2 = 0.04$$

$$U = 50 \times 0.04$$

$$U = 2\,\text{J}$$

Thus, the potential energy stored in the spring is 2 J.

Hence, the correct option is (B).

Quick Tip: Potential energy stored in a spring depends only on displacement and spring constant:

$$U = \frac{1}{2}kx^2$$

The mass of the block does **not affect** the elastic potential energy.

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4. What product is formed when a ketone reacts with hydrazine (NH_2-NH_2)**?**

(A) Alcohol

(B) Hydrazone

(C) Amide

(D) Ester

Correct Answer: (2) Hydrazone

Solution:

Concept:

Ketones react with hydrazine (NH_2-NH_2) in a condensation reaction to form **hydrazones**. This reaction involves nucleophilic attack of hydrazine on the carbonyl carbon followed by elimination of water.

General reaction:

$$R_2C=O+NH_2NH_2 \rightarrow R_2C=NNH_2+H_2O$$

The product $R_2C=NNH_2$ is called a **hydrazone**.

Step 1: Identify the functional group in ketones.

Ketones contain the carbonyl group:

$$R_2C = O$$

Step 2: Reaction with hydrazine.

Hydrazine acts as a nucleophile and attacks the carbonyl carbon, forming an intermediate which eliminates water.

Step 3: Formation of final product.

The final product contains the functional group

$$C = NNH_2$$

which is known as a **hydrazone**.

Hence, the correct option is (B).

Quick Tip: Reactions of aldehydes and ketones with nitrogen nucleophiles:

- $NH_2OH \rightarrow$ Oxime
- $NH_2NH_2 \rightarrow$ Hydrazone
- $NH_2NHCONH_2 \rightarrow$ Semicarbazone

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5. Evaluate the definite integral:

$$\int_0^{\frac{\pi}{2}} \sin^2 x \, dx$$

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{4}$

(C) $\frac{\pi}{8}$

(D) π

Correct Answer: (2) $\frac{\pi}{4}$

Solution:

Concept:

Use the trigonometric identity

$$\sin^2 x = \frac{1 - \cos 2x}{2}$$

This identity simplifies the integration.

Step 1: Substitute the identity into the integral.

$$\int_0^{\frac{\pi}{2}} \sin^2 x\, dx = \int_0^{\frac{\pi}{2}} \frac{1 - \cos 2x}{2}\, dx$$

Step 2: Split the integral.

$$= \frac{1}{2}\int_0^{\frac{\pi}{2}} 1\, dx - \frac{1}{2}\int_0^{\frac{\pi}{2}} \cos 2x\, dx$$

Step 3: Evaluate both integrals.

$$\frac{1}{2}\int_0^{\frac{\pi}{2}} 1\, dx = \frac{1}{2}\left[\frac{\pi}{2}\right] = \frac{\pi}{4}$$

$$\int_0^{\frac{\pi}{2}} \cos 2x\, dx = \left[\frac{\sin 2x}{2}\right]_0^{\frac{\pi}{2}} = 0$$

Step 4: Final result.

$$\int_0^{\frac{\pi}{2}} \sin^2 x\, dx = \frac{\pi}{4}$$

Thus, the correct option is (B).

Quick Tip: Useful definite integrals:

$$\int_0^{\frac{\pi}{2}} \sin^2 x\, dx = \int_0^{\frac{\pi}{2}} \cos^2 x\, dx = \frac{\pi}{4}$$