CUET 2025 MAY 31 English Question Paper With Solutions

Time Allowed :1 Hours	**Maximum Marks :**250	**Total questions :**50

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 1 hour duration.
2. The question paper consists of 50 questions. The maximum marks are 250.
3. 5 marks are awarded for every correct answer, and 1 mark is deducted for every wrong answer.

1. Two point charges $+Q$ and $-4Q$ are placed 60 cm apart. Where should a third charge be placed so that it experiences zero net force?

(A) 15 cm from $+Q$

(B) 20 cm from $-4Q$

(C) 60 cm from $+Q$

(D) 45 cm from $-4Q$

Correct Answer: (C) 60 cm from $+Q$

Solution:

Let the charges $+Q$ and $-4Q$ be fixed on a line with a separation of 60 cm. We are to find a location to place a third charge (say q) such that the net electrostatic force acting on it is zero. We consider three possible regions to place the third charge: **(i) to the left of** $+Q$, **(ii) between** $+Q$ **and** $-4Q$, and **(iii) to the right of** $-4Q$.

Case (ii): Between $+Q$ **and** $-4Q$

Assume the test charge q is placed at a point between the two charges. Since both charges will exert attractive or repulsive forces in the same direction (depending on the sign of q), the forces will not cancel. So, equilibrium **cannot** occur between the charges.

Case (i): To the left of $+Q$

Let the third charge be placed at a distance x cm to the left of $+Q$. Then its distance from $-4Q$ will be $x + 60$ cm.

Using Coulomb's law, equating magnitudes of forces for net force to be zero:

$$\frac{Q}{x^2} = \frac{4Q}{(x+60)^2} \Rightarrow \frac{1}{x^2} = \frac{4}{(x+60)^2} \Rightarrow \frac{(x+60)^2}{x^2} = 4 \Rightarrow \frac{x+60}{x} = 2 \Rightarrow x+60 = 2x \Rightarrow x = 60 \text{ cm}$$

So, the third charge should be placed 60 cm to the left of $+Q$. This matches Option (C) since the point is 60 cm from $+Q$. Let's confirm directions:

- Force due to $+Q$ is repulsive.

- Force due to $-4Q$ is attractive.

Both act in opposite directions if the test charge is to the left of $+Q$, and they can cancel only in this region.

Quick Tip

Always consider direction of forces when solving electrostatics problems. For equilibrium points, test regions outside the segment first, especially when dealing with unlike charges. Use Coulomb's law and set magnitudes equal to find the exact distance.

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2. A disc of mass M and radius R is rolling without slipping with linear velocity v. What is its total kinetic energy?

(A) $\frac{1}{2}Mv^2$

(B) $\frac{3}{4}Mv^2$

(C) $\frac{1}{4}Mv^2$

(D) $\frac{5}{6}Mv^2$

Correct Answer: (B) $\frac{3}{4}Mv^2$

Solution:

When a disc rolls without slipping, it has two forms of kinetic energy:

1. **Translational Kinetic Energy:**

$$K_{\text{trans}} = \frac{1}{2}Mv^2$$

2. **Rotational Kinetic Energy:**

$$K_{\text{rot}} = \frac{1}{2}I\omega^2$$

For a solid disc, the moment of inertia about its center is:

$$I = \frac{1}{2}MR^2$$

Since the disc is rolling without slipping, we use the rolling condition:

$$v = \omega R \quad \Rightarrow \quad \omega = \frac{v}{R}$$

Substitute into rotational energy:

$$K_{\text{rot}} = \frac{1}{2} \cdot \frac{1}{2}MR^2 \cdot \left(\frac{v}{R}\right)^2 = \frac{1}{4}Mv^2$$

Now, total kinetic energy is the sum of both:

$$K_{\text{total}} = K_{\text{trans}} + K_{\text{rot}} = \frac{1}{2}Mv^2 + \frac{1}{4}Mv^2 = \frac{3}{4}Mv^2$$

Quick Tip

For rolling objects, always add both translational and rotational kinetic energy. Use the relation $v = \omega R$ when rolling without slipping. For a disc, the moment of inertia is $\frac{1}{2}MR^2$.

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3. A block is resting on a rough horizontal surface. A force is applied horizontally, but the block does not move. What can be said about the frictional force acting on it?

(A) It is zero

(B) It is equal to the limiting friction

(C) It is more than the applied force

(D) It is equal to the applied force

Correct Answer: (D) It is equal to the applied force

Solution:

When a block is placed on a rough horizontal surface and a horizontal force is applied, friction acts to oppose the applied force.

Since the block **does not move**, it is in equilibrium. This means the net force on it is zero.

Therefore, the frictional force must exactly balance the applied force:

$$f_{\text{friction}} = F_{\text{applied}}$$

This friction is called **static friction**. It is a self-adjusting force, meaning it increases or decreases to match the applied force—up to a maximum value called **limiting friction**.

The limiting friction is given by:

$$f_{\text{limiting}} = \mu_s N$$

where μ_s is the coefficient of static friction and N is the normal force.

If the applied force is less than the limiting friction, the static friction equals the applied force and the object remains at rest.

In this case, since the block does not move, we conclude:

$$f_{\text{friction}} = F_{\text{applied}}$$

So, the frictional force acting on the block is equal to the applied force.

Quick Tip

Static friction adjusts to match the applied force until it reaches the limiting value. If the object is at rest, static friction equals the applied force, not the maximum possible friction.

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4. If the temperature of an ideal gas is doubled at constant pressure, what happens to its volume?

(A) It becomes half

(B) It doubles

(C) It becomes one-fourth

(D) It remains unchanged

Correct Answer: (B) It doubles

Solution:

This is a direct application of the **ideal gas law**:

$$PV = nRT$$

If pressure P and number of moles n are constant, then the equation simplifies to:

$$V \propto T$$

This means that volume is directly proportional to temperature (in Kelvin).

So, if the temperature is doubled:

$$T_2 = 2T_1 \quad \Rightarrow \quad V_2 = 2V_1$$

Hence, the volume also doubles.

Let’s say the initial temperature is $300\,K$, and volume is V. After doubling the temperature to $600\,K$, the volume becomes $2V$.

Quick Tip

At constant pressure, volume and temperature of an ideal gas are directly proportional. This is known as **Charles’s Law**. If temperature increases, volume increases proportionally.

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5. A 10-ohm resistor carries a current of 2 A. What is the power dissipated?

(A) 5 W

(B) 10 W

(C) 20 W

(D) 40 W

Correct Answer: (D) 40 W

Solution:

To find the power dissipated in a resistor, we use one of the standard formulas from electric power concepts. The three most common formulas for power P are:

1. $P = I^2R$

2. $P = V^2/R$

3. $P = VI$

Here, we are given:

Current $I = 2\,\mathrm{A}$

Resistance $R = 10\,\Omega$

We are not given the voltage, so the most convenient formula to use is:

$$P = I^2R$$

Step 1: Square the current

$$I^2 = (2\,\mathrm{A})^2 = 4\,\mathrm{A}^2$$

Step 2: Multiply by resistance

$$P = 4 \times 10 = 40\,\text{W}$$

Interpretation: The resistor converts 40 joules of electrical energy into heat every second. That's what we mean by "dissipated power" — energy that's lost (usually as heat) due to resistance.

Alternative Check (Optional):

We can also find the voltage across the resistor using Ohm's law:

$$V = IR = 2 \times 10 = 20\,\text{V}$$

Now, apply $P = VI$:

$$P = 20 \times 2 = 40\,\text{W}$$

This confirms the same result.

> **Quick Tip**
>
> When calculating power in resistors:
>
> - Use $P = I^2R$ when current and resistance are known.
>
> - Use $P = \frac{V^2}{R}$ when voltage and resistance are known.
>
> - Use $P = VI$ when voltage and current are known.
>
> Always double-check units and remember that power is measured in watts (W).

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6. A wave travels along a string with a frequency of 50 Hz and wavelength of 2 m. What is its speed?

(A) 25 m/s

(B) 50 m/s

(C) 100 m/s

(D) 200 m/s

Correct Answer: (C) 100 m/s

Solution:

To find the speed of a wave, we use the basic wave speed formula:

$$v = f\lambda$$

where:

v = speed of the wave

f = frequency of the wave

λ = wavelength of the wave

Step 1: Write down the given values

Frequency $f = 50\,\text{Hz}$

Wavelength $\lambda = 2\,\text{m}$

Step 2: Substitute into the formula

$$v = 50 \times 2 = 100\,\text{m/s}$$

Step 3: Interpretation

The wave moves along the string at a speed of 100 meters per second. This means each wave crest (or any point on the wave) travels 100 meters in one second.

Quick Tip

Use the wave speed formula $v = f\lambda$ for all types of waves. Always ensure frequency is in hertz (Hz) and wavelength is in meters (m) to get speed in meters per second (m/s).

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7. An object is placed 10 cm in front of a concave mirror of focal length 15 cm. The image formed is:

(A) Virtual and enlarged

(B) Real and enlarged

(C) Virtual and diminished

(D) Real and diminished

Correct Answer: (A) Virtual and enlarged

Solution:

We are given:

- Object distance $u = -10\,\text{cm}$ (object is in front of mirror, so it's negative)

- Focal length of concave mirror $f = -15\,\text{cm}$ (concave mirrors have negative focal length)

We use the mirror equation:

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

Substitute the known values:

$$\frac{1}{-15} = \frac{1}{v} + \frac{1}{-10} \Rightarrow \frac{1}{v} = \frac{1}{-15} + \frac{1}{10}$$

Take LCM of 30:

$$\frac{1}{v} = \frac{-2+3}{30} = \frac{1}{30} \Rightarrow v = 30\,\text{cm}$$

Interpretation: The image distance $v = +30\,\text{cm}$, which means the image is on the same side as the object (behind the mirror), indicating a **virtual** image.

To understand the size, calculate magnification:

$$m = -\frac{v}{u} = -\frac{30}{-10} = +3$$

So, the image is **enlarged** (magnification > 1) and **upright** (positive sign).

Conclusion: A concave mirror forms a **virtual and enlarged** image when the object is placed between the pole and the focus (which is the case here since object is at 10 cm and focus is at 15 cm).

Quick Tip

For concave mirrors:

- Object beyond center $\rightarrow$ real, inverted, diminished

- Object at center $\rightarrow$ real, inverted, same size

- Object between center and focus $\rightarrow$ real, inverted, enlarged

- Object at focus $\rightarrow$ image at infinity

- Object between focus and pole $\rightarrow$ **virtual, erect, enlarged**

8. A current-carrying straight conductor produces a magnetic field. The direction of the field is given by:

(A) Ampere’s law

(B) Lenz’s law

(C) Right-hand thumb rule

(D) Faraday’s law

Correct Answer: (C) Right-hand thumb rule

Solution:

When current flows through a straight conductor, it generates a magnetic field around it. The direction of this magnetic field is determined using the **Right-hand thumb rule**.

Right-hand thumb rule:

Imagine holding the current-carrying conductor in your right hand such that your thumb points in the direction of the current. Then, the curl of your fingers around the conductor gives the direction of the magnetic field lines.

This rule tells us that the magnetic field lines form concentric circles around the conductor, and their direction depends on the direction of current flow.

Let’s look at why the other options are incorrect:

- **Ampere’s law** relates the magnetic field in space to the current producing it but does not give a directional rule.
- **Lenz’s law** deals with the direction of induced current due to changing magnetic flux, not the direction of magnetic fields around conductors.
- **Faraday’s law** describes how a changing magnetic field induces an electromotive force (emf), but not the direction of magnetic fields from current.

Hence, only the **right-hand thumb rule** directly provides the magnetic field direction for a current-carrying straight conductor.

Quick Tip

To quickly find the direction of magnetic field lines around a straight wire, use your right hand: thumb = current direction, curled fingers = magnetic field direction. This is the **Right-hand thumb rule**.

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9. A body of mass 2 kg is raised to a height of 5 m. What is the potential energy gained? (Take $g = 10\,\mathbf{m/s^2}$)

(A) 10 J

(B) 50 J

(C) 100 J

(D) 150 J

Correct Answer: (C) 100 J

Solution:

The potential energy gained by a body raised to a certain height is given by the formula:

$$PE = mgh$$

Where:

m = mass of the body = 2 kg

g = acceleration due to gravity = 10 m/s^2

h = height = 5 m

Step 1: Substitute the values into the formula

$$PE = 2 \times 10 \times 5 = 100\,\text{J}$$

Step 2: Interpretation

The body has gained 100 joules of gravitational potential energy as a result of being raised. This energy is stored due to its position above the ground and can be converted into kinetic energy if it falls.

Why not the other options?

- 10 J and 50 J are too low, based on the formula.

- 150 J would require a greater height or mass.

Quick Tip

Gravitational potential energy is given by $PE = mgh$. Always use consistent units: mass in kg, height in meters, and $g = 9.8$ or 10 m/s^2 as approximated. This formula tells you how much energy is stored due to elevation.

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10. If the velocity–time graph of a body is a straight line inclined to the time axis, the motion has:

(A) Uniform velocity

(B) Uniform acceleration

(C) Variable acceleration

(D) Zero acceleration

Correct Answer: (B) Uniform acceleration

Solution:

To understand this, we need to recall what the slope of a velocity-time (v–t) graph represents.

Slope of v–t graph = acceleration

Now consider the given condition:

- The velocity-time graph is a **straight line** inclined to the time axis.

- A straight line means the slope is constant.

So if the slope (i.e., acceleration) is constant, this implies:

$$\text{Acceleration is uniform (constant)}$$

Let's analyze the options:

- (A) Uniform velocity: would mean the v–t graph is a horizontal straight line (slope = 0).

- (C) Variable acceleration: would require the v–t graph to be curved.

- (D) Zero acceleration: would again correspond to a horizontal line (zero slope).

Only option (B) correctly matches a straight-line v–t graph with non-zero slope.

Quick Tip

In a velocity-time graph:

- Slope = acceleration

- Straight line with constant slope = uniform acceleration

- Curved line = variable acceleration

- Horizontal line = zero acceleration (uniform velocity)

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11. The value of acceleration due to gravity on the Moon is about $\frac{1}{6}$ that on Earth. If an object weighs 60 N on Earth, its weight on the Moon is:

(A) 10 N

(B) 20 N

(C) 30 N

(D) 60 N

Correct Answer: (A) 10 N

Solution:

Weight is the force due to gravity, calculated using the formula:

$$W = mg$$

The object's weight on the Moon is less because gravity on the Moon is $\frac{1}{6}$th of Earth's gravity.

Step 1: Given weight on Earth = 60 N

This means:

$$W_{\text{Earth}} = mg = 60\,\text{N}$$

Step 2: On the Moon, gravity is reduced to $\frac{1}{6}$:

$$W_{\text{Moon}} = \frac{1}{6} \times 60 = 10\,\text{N}$$

So, the object would weigh 10 N on the Moon.

Quick Tip

Weight depends on gravitational field strength. On the Moon, gravity is $\frac{1}{6}$th of Earth's, so an object weighs only one-sixth of its weight on Earth.

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12. What is the amount of heat required to raise the temperature of 100 g of water from 30°C to 80°C? (Specific heat of water = 4.2 J/g°C)

(A) 2,100 J

(B) 12,600 J

(C) 21,000 J

(D) 42,000 J

Correct Answer: (C) 21,000 J

Solution:

To calculate the amount of heat required to raise the temperature of a substance, we use the formula:

$$Q = mc\Delta T$$

Where:

Q = heat energy (in joules)

m = mass of the substance (in grams)

c = specific heat capacity

ΔT = change in temperature

Step 1: Write down the known values

$m = 100\,\text{g}$

$c = 4.2\,\text{J/g°C}$

$\Delta T = 80°C - 30°C = 50°C$

Step 2: Substitute the values into the formula

$$Q = 100 \times 4.2 \times 50 = 21,000\,\text{J}$$

So, the heat required is 21,000 joules.

Quick Tip

Use $Q = mc\Delta T$ for heat calculations. Make sure mass is in grams, specific heat is in J/g°C, and temperature change is calculated correctly as final minus initial.

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13. Two like charges are placed 1 m apart in air. If the force between them is 9 N, and one charge is 1 C, what is the other charge? (Use $k = 9 \times 10^9$ Nm^2/C^2)

(A) 1 C

(B) 0.1 C

(C) 0.01 C

(D) 10^{-9} C

Correct Answer: (D) 10^{-9} C

Solution:

To solve this, we use **Coulomb's Law**, which gives the force between two point charges:

$$F = k \cdot \frac{q_1 q_2}{r^2}$$

Where:

$F = 9\,\text{N}$ (given force)

$k = 9 \times 10^9\,\text{Nm}^2/\text{C}^2$ (Coulomb's constant)

$r = 1\,\text{m}$ (distance between charges)

$q_1 = 1\,\text{C}$ (one of the charges)

$q_2 =?$ (the other charge we need to find)

Step 1: Rearranging the formula to solve for q_2:

$$q_2 = \frac{F \cdot r^2}{k \cdot q_1}$$

Step 2: Substituting the known values

$$q_2 = \frac{9 \cdot (1)^2}{9 \times 10^9 \cdot 1} = \frac{9}{9 \times 10^9} = \frac{1}{10^9} = 10^{-9}\,\text{C}$$

Final Answer: $q_2 = 10^{-9}\,\text{C}$

Quick Tip

In Coulomb's law, if you're given force, one charge, and distance, isolate the unknown charge using:

$$q = \frac{Fr^2}{kq_{\text{known}}}$$

Keep track of units and exponents carefully!

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14. Two capacitors of 4 μF and 6 μF are connected in series. Their equivalent capacitance is:

(A) 10 μF

(B) 5 μF

(C) 2.4 μF

(D) 1.6 μF

Correct Answer: (C) 2.4 μF

Solution:

For capacitors in series, the equivalent capacitance C_{eq} is given by the formula:

$$\frac{1}{C_{\text{eq}}} = \frac{1}{C_1} + \frac{1}{C_2}$$

Given:

$C_1 = 4\,\mu\text{F}$, $C_2 = 6\,\mu\text{F}$

Step 1: Substitute the values

$$\frac{1}{C_{\text{eq}}} = \frac{1}{4} + \frac{1}{6} = \frac{3+2}{12} = \frac{5}{12}$$

Step 2: Invert to find C_{eq}

$$C_{\text{eq}} = \frac{12}{5} = 2.4\,\mu\text{F}$$

Quick Tip

For capacitors in series, always use the reciprocal rule:

$$\frac{1}{C_{\text{eq}}} = \frac{1}{C_1} + \frac{1}{C_2} + \cdots$$

The result is always less than the smallest individual capacitor.

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15. In the Bohr model of hydrogen atom, the angular momentum of the electron is:

(A) Quantized as multiples of h

(B) Continuous

(C) Quantized as multiples of $\frac{h}{2\pi}$

(D) Equal to zero

Correct Answer: (C) Quantized as multiples of $\frac{h}{2\pi}$

Solution:

According to **Bohr's quantization rule**, the angular momentum of an electron in a hydrogen atom is quantized. This means the electron can only occupy certain allowed energy levels.

Bohr's postulate:

$$L = n \cdot \frac{h}{2\pi} \quad \text{where } n = 1, 2, 3, \ldots$$

So, the angular momentum is not just any value — it is a whole number multiple of $\frac{h}{2\pi}$, not of h.

Why not the other options?

- (A) Quantized as multiples of h: incorrect — should be $\frac{h}{2\pi}$.

- (B) Continuous: Bohr's theory explicitly proposed quantization.

- (D) Equal to zero: This is not true; lowest level still has non-zero angular momentum.

Quick Tip

In Bohr's model, angular momentum is quantized:

$$L = n \cdot \frac{h}{2\pi} = n\hbar$$

This was key in explaining the discrete energy levels in atoms.

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16. Which of the following statements is true regarding static friction?

(A) It always equals the maximum static friction.

(B) It is always less than kinetic friction.

(C) It adjusts up to a maximum value to prevent motion.

(D) It acts only when the body is moving.

Correct Answer: (C) It adjusts up to a maximum value to prevent motion.

Solution:

Static friction is the frictional force that resists the initiation of motion between two surfaces in contact. Unlike kinetic friction (which acts when there is motion), static friction varies depending on the external force applied.

Key property:

Static friction is **self-adjusting**. This means it increases as the applied force increases, but only up to a limit — the **maximum static friction** given by:

$$f_{\text{max}} = \mu_s N$$

where μ_s is the coefficient of static friction and N is the normal force.

Let's analyze the options:

- (A) **It always equals the maximum static friction:** Incorrect — it only equals the maximum when motion is about to occur. Otherwise, it's less.

- (B) **It is always less than kinetic friction:** Incorrect — static friction is usually greater than kinetic friction.

- (C) **It adjusts up to a maximum value to prevent motion:** Correct — this is the defining feature of static friction.

- (D) **It acts only when the body is moving:** Incorrect — that's kinetic friction, not static.

Quick Tip

Static friction prevents motion and adjusts its value to match the applied force up to a limit:

$$f_s \le \mu_s N$$

It acts only when the body is at rest relative to the surface.
