MHT CET 2026 April 23 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. Identify the special tissue in the epiphytic roots of orchids that absorbs atmospheric moisture.

(A) Cortex

(B) Velamen

(C) Endodermis

(D) Pericycle

Correct Answer: (B) Velamen

Solution:

Concept: Epiphytic plants grow on other plants mainly for physical support and not for nutrition. Orchids are a common example of epiphytes. Since these plants often grow on tree branches and not directly in soil, they must obtain water and nutrients from the surrounding air, rainwater, and organic debris.

To adapt to this lifestyle, orchid roots develop a specialized multilayered tissue called **velamen**. Velamen is composed of several layers of dead cells with thickened cell walls. These cells have large empty spaces that allow them to absorb and store atmospheric moisture quickly.

Key functions of velamen include:

- Rapid absorption of atmospheric moisture such as rainwater, dew, or humidity.
- Protection of the inner living root tissues from excessive water loss.
- Mechanical protection of roots from damage and sunlight exposure.
- Temporary storage of water and dissolved minerals.

This adaptation allows orchids to survive in habitats where direct soil water is unavailable.

Step 1: Understanding the habitat of epiphytic orchids.

Epiphytic orchids grow attached to tree trunks or branches. Because they do not grow in soil, they cannot absorb water through soil like most terrestrial plants.

Step 2: Identifying the specialized root structure.

The aerial roots of orchids are covered with a thick, spongy tissue known as **velamen**. This tissue efficiently absorbs moisture from the surrounding atmosphere.

Step 3: Selecting the correct option.

Among the given options:

- Cortex – general storage tissue in roots
- Velamen – specialized tissue in orchid roots
- Endodermis – regulates water entry into vascular tissues
- Pericycle – involved in lateral root formation

Therefore, the correct answer is **Velamen**.

Quick Tip: Velamen is a characteristic adaptation of **epiphytic orchids**. It is a multilayered epidermis made of dead cells that absorbs atmospheric moisture rapidly and protects aerial roots.

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2. Which organism causes typhoid fever?

(A) Escherichia coli

(B) Vibrio cholerae

(C) Salmonella typhi

(D) Staphylococcus aureus

Correct Answer: (C) Salmonella typhi

Solution:

Concept: Typhoid fever is a serious infectious disease caused by a bacterium called **Salmonella typhi**. It primarily spreads through contaminated food and drinking water and is common in areas with poor sanitation and hygiene.

Salmonella typhi is a Gram-negative, rod-shaped bacterium that infects the intestinal tract and bloodstream of humans. Humans are the only natural hosts of this bacterium. Once inside the body, the bacteria multiply in the intestines and can spread to other organs through the bloodstream.

Common symptoms of typhoid fever include:

- Prolonged high fever
- Weakness and fatigue
- Abdominal pain
- Headache
- Loss of appetite
- Sometimes a characteristic rash called *rose spots*

If untreated, typhoid fever can lead to serious complications such as intestinal perforation or severe dehydration.

Step 1: Understanding the cause of typhoid fever.

Typhoid fever is a bacterial infection that spreads through ingestion of contaminated food or

water containing the pathogen.

Step 2: Identifying the responsible microorganism.

The bacterium responsible for typhoid fever is **Salmonella typhi**, which belongs to the genus *Salmonella*.

Step 3: Comparing the given options.

- *Escherichia coli* – usually causes intestinal infections.
- *Vibrio cholerae* – causes cholera.
- *Salmonella typhi* – causes typhoid fever.
- *Staphylococcus aureus* – causes skin infections and food poisoning.

Thus, the organism responsible for typhoid fever is **Salmonella typhi**.

Quick Tip: Typhoid fever spreads mainly through the **fecal–oral route**. Proper sanitation, clean drinking water, good hygiene, and vaccination are important preventive measures.

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3. How many times does oxidation occur in the Krebs cycle?

(A) Two times

(B) Three times

(C) Four times

(D) Six times

Correct Answer: (C) Four times

Solution:

Concept: The **Krebs cycle**, also known as the **Citric Acid Cycle (TCA cycle)**, is a crucial stage of cellular respiration. It occurs in the **mitochondrial matrix** of eukaryotic cells and plays a central role in the oxidation of metabolic fuels such as carbohydrates, fats, and proteins. The primary function of this cycle is to completely oxidize the acetyl group of acetyl-CoA and produce high-energy electron carriers.

During the Krebs cycle, oxidation reactions remove electrons from intermediates. These electrons are transferred to the coenzymes **NAD^+** and **FAD**, forming **NADH** and **$FADH_2$**. These

reduced coenzymes then donate electrons to the electron transport chain to generate ATP.
In one turn of the Krebs cycle, oxidation occurs **four times**. These oxidation steps produce:

- Three molecules of **NADH**
- One molecule of **$FADH_2$**

These oxidation reactions are responsible for capturing high-energy electrons needed for ATP production.

Step 1: Entry of Acetyl-CoA into the Krebs Cycle.

Acetyl-CoA combines with oxaloacetate to form citrate, initiating the Krebs cycle.

Step 2: Identification of oxidation reactions.

During the cycle, several intermediates undergo oxidation reactions where hydrogen atoms and electrons are removed.

The oxidation steps occur during the following conversions:

- Isocitrate → α-Ketoglutarate (produces NADH)
- α-Ketoglutarate → Succinyl-CoA (produces NADH)
- Succinate → Fumarate (produces $FADH_2$)
- Malate → Oxaloacetate (produces NADH)

Step 3: Counting the oxidation events.

There are **four oxidation reactions** in one complete cycle.

Thus, the correct answer is **Four times**.

Quick Tip: For every one molecule of acetyl-CoA entering the Krebs cycle, the cycle produces **3 NADH, 1 $FADH_2$, and 1 ATP (or GTP)** along with the release of **2 molecules of CO_2**.

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4. What is the name for the movement of cytoplasm within a cell?

(A) Diffusion

(B) Osmosis

(C) Cytoplasmic streaming (Cyclosis)

(D) Active transport

Correct Answer: (C) Cytoplasmic streaming (Cyclosis)

Solution:

Concept: The movement of cytoplasm inside a living cell is known as **cytoplasmic streaming** or **cyclosis**. This process refers to the continuous flow of cytoplasm around the cell, helping to distribute nutrients, organelles, and other cellular materials.

Cytoplasmic streaming is especially prominent in large plant cells, such as those found in aquatic plants like *Elodea*. Because these cells are large, simple diffusion would be too slow to distribute materials effectively. Cytoplasmic streaming ensures efficient transport within the cell.

The movement occurs due to interactions between the cytoskeleton components, particularly **actin filaments** and motor proteins such as **myosin**. These proteins generate forces that cause the cytoplasm to circulate throughout the cell.

Functions of cytoplasmic streaming include:

- Distribution of nutrients and metabolites
- Movement of organelles such as chloroplasts
- Efficient transport of cellular materials
- Maintaining uniform conditions within the cell

Step 1: Understanding cytoplasmic movement.

Inside cells, the cytoplasm is not static. It moves continuously to transport materials.

Step 2: Identifying the biological term.

This directed movement of cytoplasm within a cell is called **cytoplasmic streaming** or **cyclosis**.

Step 3: Evaluating the options.

- Diffusion – movement of molecules from high to low concentration.
- Osmosis – movement of water across a semi-permeable membrane.
- Cytoplasmic streaming (Cyclosis) – movement of cytoplasm inside the cell.
- Active transport – movement of substances across membranes using energy.

Thus, the correct answer is **Cytoplasmic streaming (Cyclosis)**.

Quick Tip: Cytoplasmic streaming is particularly visible in **large plant cells**. It helps move chloroplasts, nutrients, and other organelles efficiently throughout the cytoplasm.

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5. What is the SI unit of magnetic induction?

(A) Weber (Wb)

(B) Tesla (T)

(C) Henry (H)

(D) Coulomb (C)

Correct Answer: (B) Tesla (T)

Solution:

Concept: Magnetic induction, also known as **magnetic flux density**, is a measure of the strength and direction of a magnetic field at a given point in space. It is usually represented by the symbol B.

Magnetic induction describes how strongly a magnetic field acts on moving electric charges, current-carrying conductors, or magnetic materials. It plays a fundamental role in electromagnetism and appears in many important laws such as the Lorentz force law and Faraday's law of electromagnetic induction.

The **SI unit of magnetic induction** is the **Tesla (T)**. One tesla is defined as the magnetic flux density that produces a force of one newton on a one-meter conductor carrying a current of one ampere placed perpendicular to the magnetic field.

Magnetic induction is also related to magnetic flux by the relation:

$$B = \frac{\Phi}{A}$$

where Φ = magnetic flux (measured in Weber) A = area perpendicular to the magnetic field

Thus, another equivalent unit form is:

$$1\,T = 1\,\frac{\text{Weber}}{m^2}$$

Step 1: Understanding magnetic induction.

Magnetic induction B represents the intensity of the magnetic field acting over a unit area.

Step 2: Identifying the SI unit.

The SI unit used to measure magnetic flux density is **Tesla (T)**.

Step 3: Using the unit relationship.

From the relation $B = \Phi/A$,

$$1\,T = 1\,\frac{Wb}{m^2}$$

Hence, the SI unit of magnetic induction is **Tesla (T)**.

Quick Tip: Magnetic flux density B is measured in **Tesla**. It can also be expressed as **Weber per square meter (Wb/m^2)**.

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6. State the formula for the safety speed of a vehicle on a curved banked road.

(A) $v = \sqrt{rg\sin\theta}$

(B) $v = \sqrt{rg\cos\theta}$

(C) $v = \sqrt{rg\tan\theta}$

(D) $v = \sqrt{\frac{g}{r\tan\theta}}$

Correct Answer: (C) $v = \sqrt{rg\tan\theta}$

Solution:

Concept: When a vehicle moves along a curved road, it requires a **centripetal force** directed towards the center of the circular path. On a **banked road**, the road is inclined at an angle θ with respect to the horizontal. This inclination helps provide the necessary centripetal force through the components of the normal reaction.

A banked road allows vehicles to move safely around curves even without relying entirely on friction. The horizontal component of the normal reaction provides the centripetal force required for circular motion.

Step 1: Forces acting on the vehicle.

Two main forces act on the vehicle:

- Weight of the vehicle mg acting vertically downward
- Normal reaction N perpendicular to the road surface

Step 2: Resolving forces.

The components of the normal reaction are:

- $N\cos\theta$ balancing the weight
- $N\sin\theta$ providing the centripetal force

Step 3: Applying circular motion condition.

Centripetal force required:

$$\frac{mv^2}{r}$$

Equating the horizontal component:

$$N\sin\theta = \frac{mv^2}{r}$$

From vertical balance:

$$N\cos\theta = mg$$

Dividing the two equations:

$$\tan\theta = \frac{v^2}{rg}$$

Therefore,

$$v = \sqrt{rg\tan\theta}$$

Thus, the safe speed of a vehicle on a banked curve is given by:

$$v = \sqrt{rg\tan\theta}$$

Quick Tip: Banked roads help reduce dependence on friction by allowing the **normal reaction to provide centripetal force**. The safe speed depends on radius r, gravitational acceleration g, and banking angle θ.

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7. What is the unit of the ratio L/R where L is inductance and R is resistance?

(A) Ampere

(B) Second

(C) Ohm

(D) Volt

Correct Answer: (B) Second (s)

Solution:

Concept: In electrical circuits, the ratio $\frac{L}{R}$ appears frequently in circuits containing inductors and resistors, such as **RL circuits**. This ratio represents a quantity known as the **time constant** of the circuit.

The time constant describes how quickly the current in an RL circuit increases or decreases when the circuit is switched on or off.

Inductance L has the SI unit:

$$\text{Henry (H)}$$

Resistance R has the SI unit:

$$\text{Ohm } (\Omega)$$

Step 1: Express the units in base form.

$$1\,H = \frac{V \cdot s}{A}$$

$$1\,\Omega = \frac{V}{A}$$

Step 2: Calculate the unit of L/R.

$$\frac{H}{\Omega} = \frac{\frac{V \cdot s}{A}}{\frac{V}{A}}$$

$$= s$$

Thus, the unit becomes **second (s)**.

Step 3: Interpretation.

The ratio L/R gives the **time constant** of an RL circuit, which determines how fast the current reaches its steady value.

Quick Tip: For an RL circuit, the time constant is given by:

$$\tau = \frac{L}{R}$$

It represents the time required for the current to reach about **63% of its final value**.

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8. How does the maximum kinetic energy of photoelectrons relate to wavelength (λ)?

(A) $K.E \propto \lambda$

(B) $K.E \propto \lambda^2$

(C) $K.E \propto \frac{1}{\lambda}$

(D) $K.E \propto \sqrt{\lambda}$

Correct Answer: (C) $K.E \propto \frac{1}{\lambda}$

Solution:

Concept:

The **photoelectric effect** is the phenomenon in which electrons are emitted from the surface of a metal when light of sufficient frequency falls on it. This effect provided strong evidence for the particle nature of light and was explained by Albert Einstein using the concept of photons. When light strikes a metal surface, each photon carries energy given by:

$$E = h\nu$$

where $h =$ Planck's constant $\nu =$ frequency of the incident light.

Since frequency and wavelength are related by the speed of light c,

$$\nu = \frac{c}{\lambda}$$

Substituting this into the energy expression:

$$E = \frac{hc}{\lambda}$$

According to Einstein's photoelectric equation:

$$K_{\max} = h\nu - \phi$$

where K_{max} = maximum kinetic energy of emitted electrons ϕ = work function of the metal.

Substituting $\nu = \frac{c}{\lambda}$:

$$K_{max} = \frac{hc}{\lambda} - \phi$$

This shows that the kinetic energy varies inversely with wavelength.

Step 1: Energy of incident photon.

The energy carried by a photon is proportional to the frequency of light.

Step 2: Relation between frequency and wavelength.

Frequency is inversely proportional to wavelength:

$$\nu = \frac{c}{\lambda}$$

Step 3: Dependence of kinetic energy.

Since kinetic energy depends on photon energy, it follows that:

$$K.E \propto \frac{1}{\lambda}$$

Thus, the maximum kinetic energy of photoelectrons is **inversely proportional to wavelength**.

Quick Tip: Shorter wavelength light has **higher photon energy**, therefore it produces photoelectrons with **greater kinetic energy**. Hence $K.E \propto \frac{1}{\lambda}$.

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9. Calculate the moment of inertia for two spheres of radius 10 cm placed 20 cm apart.

(A) $\frac{7}{5}MR^2$

(B) $\frac{14}{5}MR^2$

(C) $\frac{9}{5}MR^2$

(D) $2MR^2$

Correct Answer: (B) $\frac{14}{5}MR^2$

Solution:

Concept:

The **moment of inertia** of a body measures its resistance to rotational motion about a given

axis. For composite systems, the total moment of inertia is obtained by adding the moments of inertia of individual parts.

For a **solid sphere**, the moment of inertia about its own central axis is:

$$I_{\text{sphere}} = \frac{2}{5}MR^2$$

When the axis of rotation does not pass through the center of mass of the body, we use the **parallel axis theorem**:

$$I = I_{\text{cm}} + Md^2$$

where I_{cm} = moment of inertia about the center of mass d = distance between the axis and the center of mass.

Step 1: Moment of inertia of each sphere about its center.

$$I_{\text{cm}} = \frac{2}{5}MR^2$$

Step 2: Distance between the spheres.

The distance between the centers is 20 cm. If the axis is taken through the midpoint between the spheres, each sphere is at a distance R from the axis.

Thus,

$$d = R$$

Step 3: Applying the parallel axis theorem.

$$I = I_{\text{cm}} + Md^2$$

$$I = \frac{2}{5}MR^2 + MR^2$$

$$I = \frac{7}{5}MR^2$$

This is the moment of inertia for **one sphere** about the given axis.

Step 4: Total moment of inertia of two spheres.

$$I_{\text{total}} = 2 \times \frac{7}{5}MR^2$$

$$I_{\text{total}} = \frac{14}{5}MR^2$$

Thus, the moment of inertia of the system is:

$$\frac{14}{5}MR^2$$

Quick Tip: For systems of multiple bodies, calculate the moment of inertia of each body using the **parallel axis theorem** and then add them to obtain the total moment of inertia.

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10. What is the IUPAC name for Acetone?

(A) Propanal

(B) Propan-1-one

(C) Propan-2-one

(D) Butan-2-one

Correct Answer: (C) Propan-2-one

Solution:

Concept:

Acetone is the simplest and most common member of the **ketone** family of organic compounds. Ketones are characterized by the presence of a **carbonyl group** ($C = O$) bonded to two carbon atoms.

The molecular formula of acetone is:

$$C_3H_6O$$

Its structural formula is:

$$CH_3 - CO - CH_3$$

In the IUPAC system of nomenclature, naming is based on the longest carbon chain containing the functional group and the position of that group.

Key steps in naming ketones:

- Identify the longest carbon chain.
- Number the chain so that the carbonyl carbon gets the lowest possible number.
- Replace the suffix *-ane* with *-one*.

Step 1: Identify the carbon chain.

Acetone contains three carbon atoms, so the parent hydrocarbon is **propane**.

Step 2: Locate the functional group.

The carbonyl group ($C = O$) is attached to the second carbon atom.

Step 3: Apply the ketone suffix.

Replacing *-ane* with *-one* gives the name:

Propan-2-one

Thus, the IUPAC name of acetone is **Propan-2-one**.

Quick Tip: Ketones are named by replacing the suffix **-ane** with **-one**. The number indicates the position of the carbonyl group in the carbon chain.

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11. What is the IUPAC name for Glyceraldehyde?

(A) 1,2,3-trihydroxypropane

(B) 2,3-dihydroxypropanal

(C) 1,3-dihydroxypropanone

(D) 2-hydroxypropanal

Correct Answer: (B) 2,3-dihydroxypropanal

Solution:

Concept:

Glyceraldehyde is a simple **aldose sugar** belonging to the class of **monosaccharides**. It contains both an aldehyde group and hydroxyl groups.

Its molecular formula is:

$$C_3H_6O_3$$

The structural formula can be written as:

$$CHO - CHOH - CH_2OH$$

In IUPAC nomenclature, the aldehyde group has the highest priority and must be assigned carbon number 1.

Step 1: Identify the longest carbon chain.

The molecule contains three carbon atoms, so the parent chain is **propane**.

Step 2: Identify the functional groups.

- Aldehyde group ($-CHO$) at carbon 1
- Hydroxyl groups ($-OH$) at carbons 2 and 3

Step 3: Construct the name.

- Two hydroxyl groups → **dihydroxy**
- Aldehyde functional group → suffix **-al**

Thus, the IUPAC name becomes:

2,3-dihydroxypropanal

Quick Tip: When aldehyde and hydroxyl groups are present together, the aldehyde group gets priority and forms the suffix **-al**.

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12. What is the approximate magnetic moment of Mn^{2+}?

(A) 4.9 BM

(B) 5.9 BM

(C) 6.9 BM

(D) 3.9 BM

Correct Answer: (B) 5.9 BM

Solution:

Concept:

The magnetic moment of transition metal ions arises mainly due to the presence of **unpaired electrons**. The greater the number of unpaired electrons, the larger the magnetic moment. The magnetic moment is calculated using the **spin-only formula**:

$$\mu = \sqrt{n(n+2)}\,\text{BM}$$

where n is the number of unpaired electrons.

Step 1: Electronic configuration of Mn.

Atomic number of Mn $= 25$

$$Mn : [Ar]\,3d^5\,4s^2$$

Step 2: Electronic configuration of Mn^{2+}.

Two electrons are removed from the $4s$ orbital.

$$Mn^{2+} : [Ar]\,3d^5$$

This configuration contains **5 unpaired electrons**.

Step 3: Apply the magnetic moment formula.

$$\mu = \sqrt{5(5+2)}$$

$$\mu = \sqrt{35}$$

$$\mu \approx 5.9\,BM$$

Thus, the approximate magnetic moment of Mn^{2+} is **5.9 BM**.

Quick Tip: Magnetic moment increases with the number of unpaired electrons. Transition metal ions with half-filled d-orbitals often show strong paramagnetism.

13. What product is formed when Phenol reacts with concentrated Nitric acid?

(A) Nitrobenzene

(B) o-Nitrophenol

(C) Picric acid

(D) Benzoic acid

Correct Answer: (C) Picric acid

Solution:

Concept:

Phenol is highly reactive toward electrophilic substitution reactions because the hydroxyl group ($-OH$) strongly activates the benzene ring.

When phenol reacts with **concentrated nitric acid**, multiple nitration reactions occur. The nitro groups are introduced at the ortho and para positions of the benzene ring.

This leads to the formation of **2,4,6-trinitrophenol**, commonly known as **picric acid**.

The reaction can be represented as:

$$Phenol + HNO_3 \rightarrow 2,4,6\text{-trinitrophenol}$$

Step 1: Activation of benzene ring.

The hydroxyl group increases electron density on the ring.

Step 2: Electrophilic substitution.

Nitro groups ($-NO_2$) are introduced at ortho and para positions.

Step 3: Final product formation.

After three nitrations, the product formed is **picric acid**.

Quick Tip: Phenol reacts with dilute nitric acid to form **o-nitrophenol and p-nitrophenol**, but with **concentrated nitric acid** it forms **picric acid**.

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14. What is the oxidation state of Chlorine in Cl_2O_7?

(A) +3

(B) +5

(C) +7

(D) -1

Correct Answer: (C) +7

Solution:

Concept:

The oxidation state of an element represents the hypothetical charge that an atom would have if all bonds were completely ionic.

To determine oxidation states, we use standard rules:

- Oxygen usually has oxidation state -2.
- The sum of oxidation states in a neutral compound is zero.

Step 1: Assign oxidation states.

Let the oxidation state of chlorine be x.

There are two chlorine atoms and seven oxygen atoms.

Oxygen oxidation state $= -2$

Step 2: Write the equation.

$$2x + 7(-2) = 0$$

Step 3: Solve for x.

$$2x - 14 = 0$$

$$2x = 14$$

$$x = +7$$

Thus, the oxidation state of chlorine in Cl_2O_7 is **+7**.

Quick Tip: Chlorine can exhibit multiple oxidation states such as $-1, +1, +3, +5$, and **+7**. In Cl_2O_7, chlorine shows its **highest oxidation state**.

