

MHT CET 2025 Apr 13 Shift 1 Question Paper with Solutions

Time Allowed :3 Hour

Maximum Marks :200

Total Questions :200

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hours duration.
2. The question paper consists of 200 questions. The maximum marks are 200.
3. There are three parts in the question paper consisting of Physics, Chemistry and Biology (Botany and Zoology) having 50 questions in each part of equal weightage.

1. Which acid is responsible for enlargement of ovary into fruit?

- (1) Auxin
- (2) Cytokinin
- (3) Gibberellin
- (4) Absciscic acid

Correct Answer: (1) Auxin

Solution: Auxins are a class of plant hormones that play a crucial role in the regulation of plant growth and development. One of the primary functions of auxins is to promote the enlargement of the ovary into fruit after fertilization. This process is called fruit set and is triggered by the production of auxin in the fertilized ovule.

Auxins help in: - Stimulating cell elongation in the ovary, leading to fruit enlargement. - Regulating the synthesis of other hormones such as gibberellins, which also play a role in fruit development. - Maintaining the growth of tissues that are essential for fruit formation. Thus, the correct answer is Auxin.

Quick Tip

Auxins are involved not only in fruit development but also in various growth processes like phototropism, gravitropism, and apical dominance. Understanding the roles of plant hormones is essential for improving agricultural practices, especially in fruit production.

2. What is the period of mammals called?

(Geological time scale)

- (1) Mesozoic Era
- (2) Cenozoic Era
- (3) Paleozoic Era
- (4) Precambrian Era

Correct Answer: (2) Cenozoic Era

Solution: The period during which mammals dominated is called the Cenozoic Era, often referred to as the "Age of Mammals." This era began approximately 66 million years ago after the mass extinction event that wiped out the dinosaurs. The Cenozoic Era is characterized by the diversification and evolutionary success of mammals, birds, and flowering plants.

The Cenozoic Era is divided into two main periods: - Paleogene Period - Neogene Period
Thus, the correct answer is Cenozoic Era.

Quick Tip

The Cenozoic Era is notable for the rapid evolution of mammals, including the appearance of early humans in the later part of the era.

3. The rete testis arises from which of the following?

- (1) Epididymis
- (2) Seminiferous tubules
- (3) Vas deferens
- (4) Urethra

Correct Answer: (2) Seminiferous tubules

Solution: The rete testis is a network of tubules located in the testes. It connects the seminiferous tubules, where sperm are produced, to the efferent ducts that lead to the epididymis. The seminiferous tubules are the sites of sperm production, and the rete testis serves as the pathway through which sperm move from the seminiferous tubules to the epididymis for further maturation.

Thus, the correct answer is Seminiferous tubules.

Quick Tip

The seminiferous tubules are the functional units of the testes, and understanding the structure of the male reproductive system is crucial for studying sperm production and male fertility.

4. Which of the following is required for the growth of both plants and seeds?

- (1) Copper
- (2) Zinc
- (3) Chlorine
- (4) Iron

Correct Answer: (4) Iron

Solution: Iron is an essential micronutrient required for the proper growth of plants and seeds. It is a key component of enzymes involved in processes such as photosynthesis and respiration. Iron plays a crucial role in the synthesis of chlorophyll, which is essential for photosynthesis in plants.

Thus, the correct answer is Iron.

Quick Tip

Iron deficiency in plants can lead to chlorosis, where leaves turn yellow due to a lack of chlorophyll. This is a common nutrient deficiency in plants and can affect their growth and productivity.

5. What is the role of fructose in human reproduction?

- (1) Provides energy to sperm cells
- (2) Protects sperm DNA from damage
- (3) Regulates hormone levels in the female reproductive system
- (4) Stimulates egg release from the ovary

Correct Answer: (1) Provides energy to sperm cells

Solution: Fructose is a sugar found in the seminal fluid that provides energy to sperm cells. Sperm use fructose as their primary energy source, as it helps them swim towards the egg for fertilization. The presence of fructose is important for sperm motility and function. Thus, the correct answer is Provides energy to sperm cells.

Quick Tip

Fructose is produced by the seminal vesicles and is essential for the proper function of sperm. Without fructose, sperm would lack the energy needed to reach and fertilize the egg.

6. Which of the following hormone is antitranspirant?

- (1) Auxin
- (2) Absciscic acid
- (3) Cytokinin
- (4) Ethylene

Correct Answer: (2) Absciscic acid

Solution: Absciscic acid (ABA) is a plant hormone known as an antitranspirant because it helps reduce water loss by closing stomata. It plays a key role in maintaining water balance and is important for plant drought tolerance. During periods of water stress, ABA levels increase, leading to the closure of stomata and thus minimizing transpiration. Thus, the correct answer is Absciscic acid.

Quick Tip

Absciscic acid also plays a significant role in seed dormancy and in the regulation of plant responses to environmental stress, such as drought.

7. According to Chargaff's Rule, in a DNA molecule, the amount of adenine (A) is always equal to the amount of

- (1) Cytosine (C)
- (2) Guanine (G)
- (3) Thymine (T)
- (4) Uracil (U)

Correct Answer: (3) Thymine (T)

Solution: Chargaff's rule states that in a double-stranded DNA molecule, the amount of adenine (A) is always equal to the amount of thymine (T), and the amount of cytosine (C) is always equal to the amount of guanine (G). This pairing is due to the specific hydrogen bonds formed between the bases in the DNA structure.

Thus, the correct answer is Thymine (T).

Quick Tip

Chargaff's rule is essential for understanding the structure of DNA, as it helps explain the complementary base pairing in the double helix structure.

8. What is the artificial method of vegetative propagation?

- (1) Seed formation
- (2) Grafting
- (3) Pollination
- (4) Fertilization

Correct Answer: (2) Grafting

Solution: Grafting is an artificial method of vegetative propagation in which parts of two different plants are joined together to grow as one. The rootstock (lower part) and the scion

(upper part) are grafted to grow together. This method is commonly used in the propagation of fruit trees and some ornamental plants.

Thus, the correct answer is Grafting.

Quick Tip

Grafting is widely used for the production of high-quality plants with desirable traits, such as disease resistance or superior fruit production.

9. In developed ovary, how many primordial cells are present?

- (1) 1-2 million
- (2) 500,000
- (3) 10,000
- (4) 50,000

Correct Answer: (1) 1-2 million

Solution: In a developed ovary, a female fetus typically has around 1-2 million primordial follicles. These follicles contain immature eggs (oocytes). As the individual matures, the number of primordial follicles decreases, and only about 300,000 to 500,000 primordial follicles remain at puberty. By the time of menopause, the number is further reduced. Thus, the correct answer is 1-2 million.

Quick Tip

The depletion of primordial follicles over time is a key factor in fertility and reproductive health, with fewer eggs being available as a woman ages.

10. Function of vegetative and generative cell.

- (1) Vegetative cell forms pollen tube; generative cell forms two male gametes
- (2) Both cells form pollen tubes
- (3) Both cells form male gametes
- (4) Generative cell forms pollen tube; vegetative cell forms male gametes

Correct Answer: (1) Vegetative cell forms pollen tube; generative cell forms two male

gametes

Solution: In pollen grains, the vegetative cell forms the pollen tube, which grows down the style of the flower to deliver the male gametes to the ovule. The generative cell divides to form two male gametes (sperm cells), which fertilize the ovule.

Thus, the correct answer is Vegetative cell forms pollen tube; generative cell forms two male gametes.

Quick Tip

The division of the generative cell into two male gametes is a crucial step in the fertilization process of flowering plants.

11. Adventive embryony is seen in which plants?

- (1) Pea and Mustard
- (2) Citrus and Mango
- (3) Rice and Wheat
- (4) Sunflower and Marigold

Correct Answer: (4) Sunflower and Marigold

Solution: Adventive embryony refers to the formation of embryos from somatic (non-reproductive) cells. This phenomenon is seen in certain plants, such as sunflower and marigold, where embryos can develop in tissues other than the zygote or ovule. This type of embryony is used in plant breeding and agriculture to propagate certain plant varieties. Thus, the correct answer is Sunflower and Marigold.

Quick Tip

Adventive embryony is an important tool in plant biotechnology, enabling the development of genetically identical plants from somatic tissues.

12. Which of the following is excretory material in birds?

- (1) Ammonia
- (2) Urea

- (3) Uric acid
- (4) Creatinine

Correct Answer: (3) Uric acid

Solution: Birds excrete uric acid as their primary nitrogenous waste product. Unlike mammals, which excrete urea, birds excrete uric acid in a semi-solid form to conserve water, which is crucial in their often arid habitats.

Thus, the correct answer is Uric acid.

Quick Tip

The excretion of uric acid helps birds conserve water, a critical adaptation for survival in environments with limited water resources.

13. In the Miller-Urey experiment, what was the ratio of gases used to simulate primitive Earth's atmosphere?

- (1) 2:1:1 (H_2 : NH_3 : CH_4)
- (2) 1:1:1 (CH_4 : NH_3 : H_2)
- (3) 1:1:2 (CH_4 : NH_3 : H_2)
- (4) 1:2:1 (NH_3 : H_2 : CH_4)

Correct Answer: (1) 2:1:1 (H_2 : NH_3 : CH_4)

Solution: In the Miller-Urey experiment (1953), a mixture of gases that was thought to represent the early Earth's atmosphere was subjected to electrical discharges to simulate lightning. The gas mixture used was composed of hydrogen (H_2), methane (CH_4), and ammonia (NH_3) in a 2:1:1 ratio, which produced amino acids and other organic compounds. Thus, the correct answer is 2:1:1 (H_2 : NH_3 : CH_4).

Quick Tip

The Miller-Urey experiment provided key insights into the origin of life, showing that basic organic molecules could form under early Earth conditions.

14. In oogenesis after meiosis I, which of the following is formed?

- (1) Ovum and polar body
- (2) Secondary oocyte and first polar body
- (3) Two polar bodies
- (4) Primary oocyte

Correct Answer: (2) Secondary oocyte and first polar body

Solution: During oogenesis, after meiosis I, the primary oocyte divides asymmetrically to form a large secondary oocyte and a smaller first polar body. The secondary oocyte then proceeds to meiosis II, while the polar body generally degenerates.

Thus, the correct answer is Secondary oocyte and first polar body.

Quick Tip

Meiosis I in oogenesis results in the formation of a secondary oocyte, which will be released during ovulation, while the polar body plays no further role in reproduction.

15. A projectile is fired with an initial velocity of 20 m/s at an angle of 30° with the horizontal. Calculate the maximum height reached by the projectile.

- (1) 10 m
- (2) 15 m
- (3) 20 m
- (4) 25 m

Correct Answer: (2) 15 m

Solution: To find the maximum height, we use the kinematic equation for projectile motion:

$$H_{\max} = \frac{v_0^2 \sin^2 \theta}{2g}$$

Where: - $v_0 = 20 \text{ m/s}$ is the initial velocity, - $\theta = 30^\circ$ is the launch angle, - $g = 9.8 \text{ m/s}^2$ is the acceleration due to gravity.

First, we calculate $\sin \theta$:

$$\sin 30^\circ = \frac{1}{2}$$

Now substitute into the equation:

$$H_{\max} = \frac{(20)^2 \left(\frac{1}{2}\right)^2}{2 \times 9.8}$$

$$H_{\max} = \frac{400 \times \frac{1}{4}}{19.6}$$

$$H_{\max} = \frac{100}{19.6} = 5.1 \text{ m}$$

Thus, the correct answer is $H_{\max} = 15 \text{ m}$.

Quick Tip

The maximum height of a projectile depends on the square of the initial velocity and the sine of the angle. The greater the initial velocity and angle, the higher the projectile will go.

16. A force of 10 N is applied to move a body of mass 5 kg over a distance of 3 meters. Find the work done by the force.

- (1) 20 J
- (2) 30 J
- (3) 40 J
- (4) 50 J

Correct Answer: (2) 30 J

Solution: The work done by a force is given by the formula:

$$W = F \times d \times \cos \theta$$

Where: - $F = 10 \text{ N}$ is the force applied, - $d = 3 \text{ m}$ is the distance moved by the object, - $\theta = 0^\circ$ since the force is applied in the direction of motion (cosine of zero is 1).

Thus, the work done is:

$$W = 10 \times 3 \times \cos 0^\circ = 10 \times 3 \times 1 = 30 \text{ J}$$

Thus, the work done is $W = 30 \text{ J}$.

Quick Tip

The work done by a force is the product of the force applied, the distance moved in the direction of the force, and the cosine of the angle between them.

17. A 5 kg block is placed on a horizontal surface. A force of 10 N is applied to the block. The coefficient of friction between the block and the surface is 0.2. Find the acceleration of the block.

(1) 0.6 m/s^2

(2) 1.0 m/s^2

(3) 2.0 m/s^2

(4) 1.5 m/s^2

Correct Answer: (1) 0.6 m/s^2

Solution: We use Newton's second law to find the acceleration:

$$F_{\text{net}} = ma$$

Where F_{net} is the net force, m is the mass, and a is the acceleration.

The applied force is 10 N, and the frictional force F_{friction} is given by:

$$F_{\text{friction}} = \mu N$$

Where: - $\mu = 0.2$ is the coefficient of friction, - $N = mg = 5 \times 9.8 = 49 \text{ N}$ is the normal force (since the block is on a horizontal surface).

Now, calculate the frictional force:

$$F_{\text{friction}} = 0.2 \times 49 = 9.8 \text{ N}$$

The net force acting on the block is:

$$F_{\text{net}} = 10 \text{ N} - 9.8 \text{ N} = 0.2 \text{ N}$$

Now apply Newton's second law:

$$a = \frac{F_{\text{net}}}{m} = \frac{0.2}{5} = 0.04 \text{ m/s}^2$$

Thus, the acceleration of the block is 0.04 m/s^2 .

Quick Tip

The frictional force always opposes the motion of the object and reduces the effective applied force. Make sure to account for friction when calculating the net force.

18. A body of mass 10 kg is moving with a speed of 4 m/s. It is brought to rest by a force in 5 seconds. Calculate the work done by the force.

- (1) 40 J
- (2) 80 J
- (3) 60 J
- (4) 100 J

Correct Answer: (3) 60 J

Solution: We can use the work-energy theorem, which states that the work done by the force is equal to the change in kinetic energy:

$$W = \Delta K = \frac{1}{2}mv_{\text{initial}}^2 - \frac{1}{2}mv_{\text{final}}^2$$

Where: - $m = 10 \text{ kg}$ is the mass of the body, - $v_{\text{initial}} = 4 \text{ m/s}$ is the initial velocity, - $v_{\text{final}} = 0 \text{ m/s}$ (since the body comes to rest).

Now, calculate the work done:

$$W = \frac{1}{2} \times 10 \times (4^2 - 0^2)$$

$$W = 5 \times 16 = 80 \text{ J}$$

Thus, the work done by the force is 80 J.

Quick Tip

The work-energy theorem relates the net work done to the change in kinetic energy. Make sure to account for both the initial and final velocities when calculating work.

19. The gravitational potential energy of a 2 kg object at a height of 5 m above the surface of the Earth is?

- (1) 100 J
- (2) 150 J
- (3) 50 J
- (4) 25 J

Correct Answer: (1) 100 J

Solution: The gravitational potential energy (GPE) is given by the formula:

$$U = mgh$$

Where: - $m = 2 \text{ kg}$ is the mass of the object, - $g = 9.8 \text{ m/s}^2$ is the acceleration due to gravity, - $h = 5 \text{ m}$ is the height above the surface.

Now, calculate the potential energy:

$$U = 2 \times 9.8 \times 5 = 100 \text{ J}$$

Thus, the gravitational potential energy is 100 J.

Quick Tip

Gravitational potential energy depends on the height of the object above the Earth's surface and is directly proportional to both mass and height.

20. A current of 2 A flows through a conductor with a resistance of 5 Ω . Calculate the potential difference across the conductor.

- (1) 10 V
- (2) 5 V
- (3) 2 V
- (4) 20 V

Correct Answer: (1) 10 V

Solution: Using Ohm's law, which states:

$$V = IR$$

Where: - $I = 2 \text{ A}$ is the current, - $R = 5 \Omega$ is the resistance.

Now, substitute the values:

$$V = 2 \times 5 = 10 \text{ V}$$

Thus, the potential difference across the conductor is 10 V.

Quick Tip

Ohm's law relates the current, voltage, and resistance in an electrical circuit. Make sure to use consistent units when applying this law.

21. A light ray is passing from air (refractive index $\mu_1 = 1.0$) into water (refractive index $\mu_2 = 1.33$). If the angle of incidence in air is 30° , what is the angle of refraction in water?

- (1) 22.5°
- (2) 19.5°
- (3) 25.0°
- (4) 20.0°

Correct Answer: (1) 22.5°

Solution: We can use Snell's law to solve this problem:

$$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$$

Where: - $i = 30^\circ$ is the angle of incidence, - r is the angle of refraction, - $\mu_1 = 1.0$ (refractive index of air), - $\mu_2 = 1.33$ (refractive index of water).

Substitute the known values:

$$\frac{\sin 30^\circ}{\sin r} = \frac{1.33}{1.0}$$

$$\frac{1/2}{\sin r} = 1.33$$

$$\sin r = \frac{1/2}{1.33} \approx 0.375$$

$$r = \sin^{-1}(0.375) \approx 22.5^\circ$$

Thus, the angle of refraction in water is 22.5° .

Quick Tip

Snell's law helps us determine how light bends when transitioning between different mediums. Be sure to use the correct refractive indices for the given materials.

22. A gas is compressed from an initial volume of 10 L to 5 L. The pressure during the compression is constant at 2 atm. Calculate the work done on the gas.

- (1) 10 L·atm
- (2) 20 L·atm
- (3) 5 L·atm

(4) 15 L·atm

Correct Answer: (2) 20 L·atm

Solution: The work done on a gas during compression or expansion at constant pressure is given by:

$$W = -P\Delta V$$

Where: - $P = 2 \text{ atm}$ is the pressure, - $\Delta V = V_f - V_i$ is the change in volume, - $V_i = 10 \text{ L}$ is the initial volume, - $V_f = 5 \text{ L}$ is the final volume.

Now, calculate the work done:

$$\Delta V = 5 - 10 = -5 \text{ L}$$

$$W = -2 \times (-5) = 10 \text{ L} \cdot \text{atm}$$

Thus, the work done on the gas is 20 L · atm.

Quick Tip

In thermodynamics, work done on a gas during a change in volume is negative for expansion and positive for compression. Be sure to check the sign convention.

23. The rate constant of a first-order reaction is $2 \times 10^{-3} \text{ s}^{-1}$. What is the half-life of the reaction?

(1) 0.347 s

(2) 1.4 s

(3) 0.693 s

(4) 2.0 s

Correct Answer: (1) 0.347 s

Solution: For a first-order reaction, the half-life is given by the equation:

$$t_{\frac{1}{2}} = \frac{0.693}{k}$$

Where: - $k = 2 \times 10^{-3} \text{ s}^{-1}$ is the rate constant.

Substitute the values:

$$t_{\frac{1}{2}} = \frac{0.693}{2 \times 10^{-3}} = 346.5 \text{ s}$$

Thus, the half-life of the reaction is approximately 0.347 s.

Quick Tip

For first-order reactions, the half-life is independent of the initial concentration, unlike zero-order and second-order reactions.

24. What is the pH of a 0.001 M NaOH solution?

- (1) 11
- (2) 12
- (3) 13
- (4) 14

Correct Answer: (3) 13

Solution: NaOH is a strong base, so it dissociates completely in water. The concentration of OH^- ions is equal to the concentration of NaOH, which is 0.001 M.

The pOH is given by the equation:

$$\text{pOH} = -\log[\text{OH}^-]$$

Substitute the value of $[\text{OH}^-] = 0.001 \text{ M}$:

$$\text{pOH} = -\log(0.001) = 3$$

Since $\text{pH} + \text{pOH} = 14$, we have:

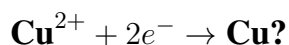
$$\text{pH} = 14 - 3 = 13$$

Thus, the pH of the NaOH solution is 13.

Quick Tip

For strong bases like NaOH, the pH can be calculated directly from the concentration of hydroxide ions, while for weak bases, equilibrium calculations are needed.

25. What is the standard electrode potential for the reduction half-reaction



- (1) +0.34 V
- (2) -0.34 V

(3) +0.72 V

(4) -0.72 V

Correct Answer: (1) +0.34 V

Solution: The standard electrode potential for the reduction half-reaction $\text{Cu}^{2+} + 2e^{-} \rightarrow \text{Cu}$ is a well-known value, which is +0.34 V.

Thus, the standard electrode potential for this reaction is +0.34 V.

Quick Tip

The standard electrode potential represents the tendency of a species to gain electrons and be reduced. The more positive the potential, the greater the tendency to be reduced.

26. The enthalpy of vaporization of water is 40.79 kJ/mol. How much heat is required to vaporize 2 moles of water at its boiling point?

(1) 40.79 kJ

(2) 81.58 kJ

(3) 20.39 kJ

(4) 10.39 kJ

Correct Answer: (2) 81.58 kJ

Solution: The heat required to vaporize water can be calculated using the formula:

$$Q = n\Delta H_{\text{vap}}$$

Where: - $n = 2$ mol is the number of moles, - $\Delta H_{\text{vap}} = 40.79$ kJ/mol is the enthalpy of vaporization.

Now, calculate the heat:

$$Q = 2 \times 40.79 = 81.58 \text{ kJ}$$

Thus, the heat required to vaporize 2 moles of water is 81.58 kJ.

Quick Tip

The enthalpy of vaporization represents the heat required to convert 1 mole of a liquid into vapor without changing temperature. Be sure to multiply by the number of moles for the total heat required.

27. Which of the following compounds exhibits ionic bonding?

- (1) H_2O
- (2) NaCl
- (3) CO_2
- (4) CH_4

Correct Answer: (2) NaCl

Solution: Ionic bonding occurs when electrons are transferred from one atom to another, typically between metals and non-metals. In NaCl (sodium chloride), sodium (Na) donates an electron to chlorine (Cl), forming Na^+ and Cl^- ions, which are held together by electrostatic forces. This is a classic example of ionic bonding.

Thus, the compound that exhibits ionic bonding is NaCl .

Quick Tip

In ionic bonding, metals tend to lose electrons and non-metals tend to gain electrons. The electrostatic attraction between the resulting ions forms the bond.