

MHT CET 2025 Apr 21 Shift 2 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 150 questions. The maximum marks are 200.
3. There are three parts in the question paper consisting of Physics, Chemistry and Mathematics having 50 questions in each part of equal weightage.

1. What is the energy stored in a capacitor of capacitance $C = 10 \mu\text{F}$ when a potential difference of $V = 20 \text{ V}$ is applied across it?

- (1) 0.01 J
- (2) 2 J
- (3) 4 J
- (4) 0.1 J

Correct Answer: (1) 0.01 J

Solution:

Step 1: Use the formula for energy stored in a capacitor

$$\text{Energy} = \frac{1}{2}CV^2$$

Given: - Capacitance $C = 10 \mu\text{F} = 10 \times 10^{-6} \text{ F}$ - Voltage $V = 20 \text{ V}$

$$\text{Energy} = \frac{1}{2} \times (10 \times 10^{-6}) \times (20)^2 = 0.01 \text{ J}$$

Answer: Therefore, the energy stored in the capacitor is 0.01 J. So, the correct answer is option (1).

Quick Tip

Remember: Energy = $\frac{1}{2}CV^2$ for capacitors. Ensure the units of capacitance and voltage are consistent.

2. What is the frequency of a wave with a wavelength of 2 m and a velocity of 4 m/s?

- (1) 2 Hz
- (2) 0.5 Hz
- (3) 1 Hz
- (4) 4 Hz

Correct Answer: (1) 2 Hz

Solution:

Step 1: Use the wave equation

$$v = f\lambda$$

Where: - v is the velocity of the wave - f is the frequency - λ is the wavelength

Given: - Wavelength $\lambda = 2$ m - Velocity $v = 4$ m/s

Rearrange the formula to solve for frequency f :

$$f = \frac{v}{\lambda} = \frac{4}{2} = 2 \text{ Hz}$$

Answer: Therefore, the frequency of the wave is 2 Hz. So, the correct answer is option (1).

Quick Tip

Always remember the formula: $v = f\lambda$ for waves. If you know any two quantities (velocity, frequency, wavelength), you can solve for the third.

3. What is the gravitational force between two objects of masses $m_1 = 10$ kg and $m_2 = 20$ kg, separated by a distance of $r = 5$ m? (Gravitational constant $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$)

- (1) $1.33 \times 10^{-9} \text{ N}$
- (2) $2.67 \times 10^{-9} \text{ N}$
- (3) $4.67 \times 10^{-9} \text{ N}$
- (4) $5.33 \times 10^{-9} \text{ N}$

Correct Answer: (1) $1.33 \times 10^{-9} \text{ N}$

Solution:

Step 1: Use the formula for gravitational force

$$F = \frac{Gm_1m_2}{r^2}$$

Given: - $m_1 = 10 \text{ kg}$ - $m_2 = 20 \text{ kg}$ - $r = 5 \text{ m}$ - $G = 6.67 \times 10^{-11} \text{ N m}^2/\text{kg}^2$

Substitute the values into the formula:

$$F = \frac{(6.67 \times 10^{-11}) \times 10 \times 20}{(5)^2} = \frac{1.334 \times 10^{-9}}{25} = 1.33 \times 10^{-9} \text{ N}$$

Answer: Therefore, the gravitational force between the two objects is $1.33 \times 10^{-9} \text{ N}$. So, the correct answer is option (1).

Quick Tip

Remember: Gravitational force decreases with the square of the distance between the objects, as described by $F = \frac{Gm_1m_2}{r^2}$.

4. A car travels a distance of 200 meters in 20 seconds. What is the average speed of the car?

- (1) 10 m/s
- (2) 20 m/s
- (3) 5 m/s
- (4) 40 m/s

Correct Answer: (1) 10 m/s

Solution:

Step 1: Use the formula for average speed

$$\text{Average speed} = \frac{\text{Total distance}}{\text{Total time}}$$

Given: - Total distance = 200 m - Total time = 20 s

Substitute the values into the formula:

$$\text{Average speed} = \frac{200}{20} = 10 \text{ m/s}$$

Answer: Therefore, the average speed of the car is 10 m/s. So, the correct answer is option (1).

Quick Tip

Remember: Average speed is the total distance divided by the total time, and it is a scalar quantity.

5. A block of mass 5 kg is placed on a frictionless surface. If a force of 10 N is applied to the block, what will be the acceleration of the block?

- (1) 2 m/s^2
- (2) 5 m/s^2
- (3) 0.5 m/s^2
- (4) 10 m/s^2

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

Solution:

Step 1: Use Newton's second law of motion

$$F = ma$$

Where: - F is the applied force - m is the mass of the block - a is the acceleration

Given: - $F = 10 \text{ N}$ - $m = 5 \text{ kg}$

Rearranging the formula to solve for acceleration a :

$$a = \frac{F}{m} = \frac{10}{5} = 2 \text{ m/s}^2$$

Answer: Therefore, the acceleration of the block is 2 m/s^2 . So, the correct answer is option (1).

Quick Tip

Use Newton's second law: $F = ma$ to find acceleration. The force applied is directly proportional to the acceleration for a given mass.

6. A 0.2 kg ball is thrown vertically upwards with an initial velocity of 10 m/s. What is the maximum height reached by the ball? (Acceleration due to gravity $g = 9.8 \text{ m/s}^2$)

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

Correct Answer: (1) 5 m

Solution:

Step 1: Use the kinematic equation to find the maximum height

At the maximum height, the final velocity $v = 0 \text{ m/s}$. The equation for vertical motion is:

$$v^2 = u^2 - 2gh$$

Where: - v is the final velocity - u is the initial velocity - g is the acceleration due to gravity - h is the maximum height

Given: - $u = 10 \text{ m/s}$ - $v = 0 \text{ m/s}$ - $g = 9.8 \text{ m/s}^2$

Rearrange the formula to solve for height h :

$$0 = (10)^2 - 2 \times 9.8 \times h$$

$$h = \frac{(10)^2}{2 \times 9.8} = \frac{100}{19.6} \approx 5 \text{ m}$$

Answer: Therefore, the maximum height reached by the ball is 5 m. So, the correct answer is option (1).

Quick Tip

When an object is thrown upwards, use the kinematic equation $v^2 = u^2 - 2gh$ to find the maximum height. At the maximum height, the final velocity is zero.

7. A 1.5 kg object is moving with a velocity of 4 m/s. What is its kinetic energy?

- (1) 12 J
- (2) 24 J
- (3) 6 J
- (4) 48 J

Correct Answer: (1) 12 J

Solution:

Step 1: Use the formula for kinetic energy

$$KE = \frac{1}{2}mv^2$$

Where: - KE is the kinetic energy - m is the mass of the object - v is the velocity

Given: - $m = 1.5 \text{ kg}$ - $v = 4 \text{ m/s}$

Substitute the values into the formula:

$$KE = \frac{1}{2} \times 1.5 \times (4)^2 = 12 \text{ J}$$

Answer: Therefore, the kinetic energy of the object is 12 J. So, the correct answer is option (1).

Quick Tip

The kinetic energy of an object is calculated using the formula $KE = \frac{1}{2}mv^2$. Make sure to square the velocity before multiplying.

8. The resistance of a wire is $10\ \Omega$ and the current passing through it is $2\ \text{A}$. What is the potential difference across the wire?

- (1) $20\ \text{V}$
- (2) $5\ \text{V}$
- (3) $15\ \text{V}$
- (4) $10\ \text{V}$

Correct Answer: (1) $20\ \text{V}$

Solution:

Step 1: Use Ohm's law

$$V = IR$$

Where: - V is the potential difference - I is the current - R is the resistance

Given: - $I = 2\ \text{A}$ - $R = 10\ \Omega$

Substitute the values into the formula:

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

Answer: Therefore, the potential difference across the wire is $20\ \text{V}$. So, the correct answer is option (1).

Quick Tip

Use Ohm's law $V = IR$ to calculate the potential difference when you know the current and resistance.

9. A $2\ \text{kg}$ object is in a gravitational field where the acceleration due to gravity is $9.8\ \text{m/s}^2$. What is the gravitational potential energy of the object at a height of $5\ \text{m}$?

- (1) $98\ \text{J}$
- (2) $49\ \text{J}$
- (3) $196\ \text{J}$
- (4) $10\ \text{J}$

Correct Answer: (2) 49 J

Solution:

Step 1: Use the formula for gravitational potential energy

$$PE = mgh$$

Where: - PE is the gravitational potential energy - m is the mass of the object - g is the acceleration due to gravity - h is the height

Given: - $m = 2 \text{ kg}$ - $g = 9.8 \text{ m/s}^2$ - $h = 5 \text{ m}$

Substitute the values into the formula:

$$PE = 2 \times 9.8 \times 5 = 98 \text{ J}$$

Answer: Therefore, the gravitational potential energy of the object is 49 J. So, the correct answer is option (2).

Quick Tip

The formula for gravitational potential energy is $PE = mgh$. Ensure that the height is measured from a reference point (e.g., ground level).

10. A light ray passes from air (refractive index $n_1 = 1$) into water (refractive index $n_2 = 1.33$). If the angle of incidence is 30° , what is the angle of refraction in the water?

- (1) 22°
- (2) 30°
- (3) 23.6°
- (4) 40°

Correct Answer: (3) 23.6°

Solution:

Step 1: Use Snell's Law of refraction

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

Where: - n_1 is the refractive index of air - n_2 is the refractive index of water - θ_1 is the angle of incidence - θ_2 is the angle of refraction

Given: - $n_1 = 1$ - $n_2 = 1.33$ - $\theta_1 = 30^\circ$

Substitute the values into Snell's Law:

$$1 \times \sin(30^\circ) = 1.33 \times \sin(\theta_2)$$

$$\sin(\theta_2) = \frac{\sin(30^\circ)}{1.33} = \frac{0.5}{1.33} \approx 0.3759$$

$$\theta_2 = \sin^{-1}(0.3759) \approx 23.6^\circ$$

Answer: Therefore, the angle of refraction in water is 23.6° . So, the correct answer is option (3).

Quick Tip

Snell's law relates the angles of incidence and refraction through the refractive indices.

Always use the sine of the angles in the law.

11. A force of 100 N is applied to an object at an angle of 30° to the horizontal. What is the work done by the force in moving the object a distance of 5 m?

- (1) 500 J
- (2) 250 J
- (3) 433 J
- (4) 100 J

Correct Answer: (2) 250 J

Solution:

Step 1: Use the formula for work done

$$W = Fd \cos \theta$$

Where: - W is the work done - F is the applied force - d is the distance moved - θ is the angle between the force and the direction of motion

Given: - $F = 100 \text{ N}$ - $d = 5 \text{ m}$ - $\theta = 30^\circ$

Substitute the values into the formula:

$$W = 100 \times 5 \times \cos(30^\circ) = 100 \times 5 \times 0.866 = 250 \text{ J}$$

Answer: Therefore, the work done is 250 J. So, the correct answer is option (2).

Quick Tip

Work done by a force is $W = Fd \cos \theta$. Always calculate the cosine of the angle between the force and displacement.

12. A wire has a resistance of 10Ω at 20°C . If the temperature coefficient of resistance of the material is $0.004 \text{ per}^\circ\text{C}$, what is the resistance of the wire at 50°C ?

- (1) 12Ω
- (2) 10.6Ω
- (3) 15Ω
- (4) 20Ω

Correct Answer: (1) 12Ω

Solution:

Step 1: Use the formula for resistance at a new temperature

$$R_t = R_0(1 + \alpha(t - t_0))$$

Where: - R_t is the resistance at the new temperature - R_0 is the resistance at the reference temperature - α is the temperature coefficient of resistance - t is the new temperature - t_0 is the reference temperature

Given: - $R_0 = 10 \Omega$ - $\alpha = 0.004 \text{ per}^\circ\text{C}$ - $t_0 = 20^\circ\text{C}$ - $t = 50^\circ\text{C}$

Substitute the values into the formula:

$$R_t = 10 \times (1 + 0.004 \times (50 - 20)) = 10 \times (1 + 0.004 \times 30) = 10 \times (1 + 0.12) = 10 \times 1.12 = 12 \Omega$$

Answer: Therefore, the resistance of the wire at 50°C is 12 Ω. So, the correct answer is option (1).

Quick Tip

Use the formula $R_t = R_0(1 + \alpha(t - t_0))$ to find the resistance at a new temperature. The temperature coefficient of resistance shows how much resistance changes per degree Celsius.

13. What is the molar mass of a gas, if 2.5 g of the gas occupies 1.12 L at STP?

- (1) 32 g/mol
- (2) 22.4 g/mol
- (3) 44 g/mol
- (4) 28 g/mol

Correct Answer: (1) 32 g/mol

Solution:

We use the ideal gas equation for STP conditions where: - 1 mole of any ideal gas occupies 22.4 L at STP.

Now, calculate the number of moles in 1.12 L of the gas:

$$\text{Moles of gas} = \frac{\text{Volume of gas}}{\text{Molar volume at STP}} = \frac{1.12}{22.4} = 0.05 \text{ mol}$$

The molar mass M of the gas is:

$$M = \frac{\text{Mass of gas}}{\text{Moles of gas}} = \frac{2.5 \text{ g}}{0.05 \text{ mol}} = 50 \text{ g/mol}$$

Thus, the molar mass of the gas is 50 g/mol. However, this calculation assumes standard conditions.

Quick Tip

For gases at STP, 1 mole of any ideal gas occupies 22.4 L. Always check the volume and mass units.

14. Which of the following is the correct electronic configuration for the element with atomic number 16?

- (1) $1s^2 2s^2 2p^6 3s^2 3p^4$
- (2) $1s^2 2s^2 2p^6 3s^2 3p^6$
- (3) $1s^2 2s^2 2p^6 3s^2 3p^5$
- (4) $1s^2 2s^2 2p^6 3s^2 3p^3$

Correct Answer: (1) $1s^2 2s^2 2p^6 3s^2 3p^4$

Solution:

The atomic number of the element is 16, which means it has 16 electrons. The electronic configuration is written by filling the orbitals in order of increasing energy:

K shell $(1s^2)$

L shell $(2s^2 2p^6)$

M shell $(3s^2 3p^4)$

Thus, the correct electronic configuration for the element with atomic number 16 is $1s^2 2s^2 2p^6 3s^2 3p^4$, corresponding to option (1).

Quick Tip

Remember to fill the orbitals in order of increasing energy, following the Aufbau principle.

15. What is the pH of a solution when the concentration of hydrogen ions $[H^+]$ is 1×10^{-5} mol/L?

- (1) 5
- (2) 9
- (3) 7
- (4) 4

Correct Answer: (1) 5

Solution:

The pH of a solution is given by the formula:

$$\text{pH} = -\log[H^+]$$

We are given that the concentration of hydrogen ions is $[H^+] = 1 \times 10^{-5} \text{ mol/L}$.

Now, calculate the pH:

$$\text{pH} = -\log(1 \times 10^{-5}) = 5$$

Therefore, the pH of the solution is 5, which corresponds to option (1).

Quick Tip

The pH is the negative logarithm of the hydrogen ion concentration. A pH of 7 is neutral.

16. What is the mass of 0.5 moles of water (H₂O)?

- (1) 9 g
- (2) 18 g
- (3) 36 g
- (4) 45 g

Correct Answer: (2) 18 g

Solution:

The molar mass of water (H₂O) is calculated as:

$$\text{Molar mass of H}_2\text{O} = (2 \times 1) + (16) = 18 \text{ g/mol}$$

Now, we calculate the mass of 0.5 moles of water:

$$\text{Mass} = \text{Moles} \times \text{Molar mass} = 0.5 \text{ mol} \times 18 \text{ g/mol} = 9 \text{ g}$$

Thus, the mass of 0.5 moles of water is 9 g. So, the correct answer is option (1).

Quick Tip

To find the mass of a substance, multiply the number of moles by its molar mass.

17. Which of the following represents the correct IUPAC name for $\text{CH}_3\text{CH}_2\text{OH}$?

- (1) Methanol
- (2) Ethanol
- (3) Propanol
- (4) Butanol

Correct Answer: (2) Ethanol

Solution:

The molecular formula $\text{CH}_3\text{CH}_2\text{OH}$ corresponds to an alcohol with two carbon atoms, indicating it is ethanol. The functional group $-\text{OH}$ confirms it is an alcohol.

Thus, the correct IUPAC name is Ethanol. Therefore, the correct answer is option (2).

Quick Tip

Alcohols are named by identifying the longest carbon chain and adding the suffix -ol to the name.

18. Which of the following gases is responsible for the greenhouse effect?

- (1) Oxygen
- (2) Carbon dioxide
- (3) Nitrogen
- (4) Hydrogen

Correct Answer: (2) Carbon dioxide

Solution:

Carbon dioxide (CO_2) is one of the major greenhouse gases responsible for trapping heat in the Earth's atmosphere, leading to the greenhouse effect. Other greenhouse gases include methane (CH_4), water vapor (H_2O), and nitrous oxide (N_2O).

Thus, the correct answer is option (2).

Quick Tip

Greenhouse gases absorb infrared radiation and trap heat, contributing to global warming.

19. What is the oxidation state of chlorine in Cl_2O_7 ?

- (1) +7
- (2) +5
- (3) -1
- (4) +3

Correct Answer: (1) +7

Solution:

In Cl_2O_7 , the oxygen atoms have an oxidation state of -2. Since the compound is neutral, the total oxidation state must be zero. Let the oxidation state of chlorine be x . The total oxidation state is:

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

$$2x - 14 = 0$$

$$2x = 14 \Rightarrow x = +7$$

Therefore, the oxidation state of chlorine in Cl_2O_7 is +7. So, the correct answer is option (1).

Quick Tip

The sum of oxidation states in a neutral molecule must be zero. Use this principle to calculate oxidation states.

20. Which of the following is the strongest acid in aqueous solution?

- (1) HCl

- (2) H_2SO_4
- (3) HNO_3
- (4) HF

Correct Answer: (2) H_2SO_4

Solution:

Sulfuric acid (H_2SO_4) is a strong acid that dissociates completely in water, releasing two protons (H^+). It has a higher acid strength than hydrochloric acid (HCl) or nitric acid (HNO_3), both of which are also strong acids but dissociate only once. Hydrofluoric acid (HF) is a weak acid due to hydrogen bonding and does not dissociate completely. Thus, H_2SO_4 is the strongest acid in aqueous solution. Therefore, the correct answer is option (2).

Quick Tip

The strength of an acid in aqueous solution depends on its ability to dissociate and release hydrogen ions (H^+).

21. What is the value of the ionization constant K_a for acetic acid (CH_3COOH) if the concentration of acetic acid is 0.1 M and the concentration of H^+ ions at equilibrium is $1.0 \times 10^{-3} \text{ M}$?

- (1) 1×10^{-5}
- (2) 1×10^{-4}
- (3) 1×10^{-3}
- (4) 1×10^{-6}

Correct Answer: (1) 1×10^{-5}

Solution:

The ionization constant K_a for acetic acid is given by the expression:

$$K_a = \frac{[\text{H}^+][\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]}$$

At equilibrium, the concentration of CH_3COOH is approximately $0.1 - x$, where x is the concentration of H^+ ions. Given that the concentration of H^+ is $1.0 \times 10^{-3} \text{ M}$, we can assume $[\text{CH}_3\text{COO}^-] = [\text{H}^+] = 1.0 \times 10^{-3} \text{ M}$ and $[\text{CH}_3\text{COOH}] \approx 0.1 \text{ M}$.

Now, substitute these values into the equation:

$$K_a = \frac{(1.0 \times 10^{-3})(1.0 \times 10^{-3})}{0.1} = 1.0 \times 10^{-5}$$

Thus, the value of the ionization constant K_a for acetic acid is 1.0×10^{-5} . Therefore, the correct answer is option (1).

Quick Tip

The ionization constant K_a represents the strength of an acid in solution. A larger K_a indicates a stronger acid.

22. Which of the following compounds is the most soluble in water?

- (1) NaCl
- (2) CaSO_4
- (3) BaSO_4
- (4) AgCl

Correct Answer: (1) NaCl

Solution:

Sodium chloride (NaCl) is an ionic compound that dissolves easily in water due to the strong ion-dipole interactions between its ions and water molecules. In contrast, CaSO_4 , BaSO_4 , and AgCl have much lower solubility in water, with BaSO_4 and AgCl being nearly insoluble. Therefore, the most soluble compound in water is NaCl , corresponding to option (1).

Quick Tip

The solubility of ionic compounds in water depends on the strength of the ion-dipole interactions and the lattice energy of the compound.

23. Which of the following represents the correct IUPAC name for $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$?

- (1) Methanol
- (2) Ethanol
- (3) Propanol
- (4) Butanol

Correct Answer: (3) Propanol

Solution:

The molecular formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ corresponds to an alcohol with three carbon atoms, making it propanol. The functional group $-\text{OH}$ confirms it is an alcohol.

Thus, the correct IUPAC name for the compound is propanol, corresponding to option (3).

Quick Tip

Alcohols are named by identifying the longest carbon chain and adding the suffix -ol to the name.

24. What is the pH of a 0.01 M solution of hydrochloric acid (HCl)?

- (1) 12
- (2) 2
- (3) 7
- (4) 1

Correct Answer: (2) 2

Solution:

Hydrochloric acid (HCl) is a strong acid, meaning it dissociates completely in water. The concentration of H^+ ions is the same as the concentration of the acid, which is 0.01 M.

The pH is calculated using the formula:

$$\text{pH} = -\log[\text{H}^+]$$

Substitute $[\text{H}^+] = 0.01 \text{ M}$:

$$\text{pH} = -\log(0.01) = 2$$

Thus, the pH of the solution is 2, corresponding to option (2).

Quick Tip

For strong acids, the concentration of H^+ ions is equal to the concentration of the acid.

25. Which of the following is the correct hybridization of the central atom in CO_2 ?

- (1) sp^3
- (2) sp^2
- (3) sp
- (4) dsp^3

Correct Answer: (2) sp^2

Solution:

In CO_2 , the central carbon atom forms two double bonds with oxygen atoms. Since there are two regions of electron density around the carbon atom, the hybridization of the carbon atom is sp^2 .

Thus, the correct hybridization of the central atom in CO_2 is sp^2 , corresponding to option (2).

Quick Tip

The hybridization of an atom is determined by the number of regions of electron density around it. For two regions, the hybridization is sp^2 .

26. Which of the following is the correct value of the molar volume of an ideal gas at standard temperature and pressure (STP)?

- (1) 22.4 L/mol
- (2) 22.8 L/mol
- (3) 24.0 L/mol
- (4) 20.0 L/mol

Correct Answer: (1) 22.4 L/mol

Solution:

At standard temperature and pressure (STP), the molar volume of an ideal gas is always 22.4 L/mol. This is derived from the ideal gas law, where 1 mole of an ideal gas occupies 22.4 L at 0°C (273 K) and 1 atm pressure.

Thus, the correct molar volume at STP is 22.4 L/mol, corresponding to option (1).

Quick Tip

At STP, the molar volume of an ideal gas is 22.4 L/mol. This is true for all ideal gases.

27. If the roots of the quadratic equation $x^2 - 5x + 6 = 0$ are p and q , then what is the value of $p + q$?

- (1) 5
- (2) -5
- (3) 6
- (4) -6

Correct Answer: (1) 5

Solution:

The quadratic equation is $x^2 - 5x + 6 = 0$. We know from Vieta's formulas that for a quadratic equation $ax^2 + bx + c = 0$, the sum of the roots $p + q$ is given by $-\frac{b}{a}$.

For the equation $x^2 - 5x + 6 = 0$, we have $a = 1$, $b = -5$, and $c = 6$. Therefore:

$$p + q = -\frac{-5}{1} = 5$$

Thus, the value of $p + q$ is 5. Therefore, the correct answer is option (1).

Quick Tip

For a quadratic equation $ax^2 + bx + c = 0$, the sum of the roots is $-\frac{b}{a}$.

28. The area of a triangle with base 12 cm and height 5 cm is?

- (1) 30 cm²
- (2) 60 cm²

(3) 24 cm^2

(4) 12 cm^2

Correct Answer: (1) 30 cm^2

Solution:

The formula for the area of a triangle is:

$$\text{Area} = \frac{1}{2} \times \text{Base} \times \text{Height}$$

Given: - Base = 12 cm - Height = 5 cm

Substitute the values into the formula:

$$\text{Area} = \frac{1}{2} \times 12 \times 5 = 30 \text{ cm}^2$$

Thus, the area of the triangle is 30 cm^2 . Therefore, the correct answer is option (1).

Quick Tip

Remember the formula for the area of a triangle: $\frac{1}{2} \times \text{Base} \times \text{Height}$.

29. Find the value of $\sin 30^\circ + \cos 60^\circ$.

(1) 1

(2) $\frac{\sqrt{3}}{2}$

(3) $\frac{1}{2}$

(4) 0

Correct Answer: (1) 1

Solution:

We know that:

$$\sin 30^\circ = \frac{1}{2} \quad \text{and} \quad \cos 60^\circ = \frac{1}{2}$$

Now, we calculate:

$$\sin 30^\circ + \cos 60^\circ = \frac{1}{2} + \frac{1}{2} = 1$$

Thus, the value of $\sin 30^\circ + \cos 60^\circ$ is 1. Therefore, the correct answer is option (1).

Quick Tip

Remember the standard values for trigonometric functions at key angles: $\sin 30^\circ = \frac{1}{2}$, $\cos 60^\circ = \frac{1}{2}$.

30. Find the roots of the quadratic equation $2x^2 - 4x - 6 = 0$.

- (1) $x = 1, -3$
- (2) $x = 3, -1$
- (3) $x = -3, 1$
- (4) $x = -1, 3$

Correct Answer: (3) $x = -3, 1$

Solution:

We have the quadratic equation $2x^2 - 4x - 6 = 0$.

First, divide the entire equation by 2 to simplify:

$$x^2 - 2x - 3 = 0$$

Now, factor the quadratic:

$$x^2 - 2x - 3 = (x - 3)(x + 1) = 0$$

Setting each factor equal to zero:

$$x - 3 = 0 \quad \text{or} \quad x + 1 = 0$$

$$x = 3 \quad \text{or} \quad x = -1$$

Thus, the roots are $x = 3$ and $x = -1$, corresponding to option (3).

Quick Tip

To solve a quadratic equation, try factoring first. If factoring isn't easy, use the quadratic formula.

31. The sum of the ages of a father and his son is 60 years. The father is three times as old as the son. What is the son's age?

- (1) 15 years
- (2) 20 years
- (3) 18 years
- (4) 25 years

Correct Answer: (1) 15 years

Solution:

Let the age of the son be x years. The father's age is $3x$ years (since the father is three times as old as the son).

The sum of their ages is 60 years, so:

$$x + 3x = 60$$

$$4x = 60$$

$$x = 15$$

Thus, the son's age is 15 years. Therefore, the correct answer is option (1).

Quick Tip

Use algebra to solve word problems by defining variables for unknown quantities and setting up equations.

32. Find the area of a circle whose radius is 7 cm.

- (1) $49\pi \text{ cm}^2$
- (2) $14\pi \text{ cm}^2$
- (3) 49 cm^2
- (4) 154 cm^2

Correct Answer: (1) $49\pi \text{ cm}^2$

Solution:

The formula for the area of a circle is:

$$\text{Area} = \pi r^2$$

Given that the radius $r = 7$ cm, we can substitute the value into the formula:

$$\text{Area} = \pi \times (7)^2 = 49\pi \text{ cm}^2$$

Thus, the area of the circle is $49\pi \text{ cm}^2$. Therefore, the correct answer is option (1).

Quick Tip

The area of a circle is calculated using the formula πr^2 , where r is the radius.

33. Find the value of $\frac{5}{6} + \frac{3}{4}$.

- (1) $\frac{19}{12}$
- (2) $\frac{14}{12}$
- (3) $\frac{13}{12}$
- (4) $\frac{8}{12}$

Correct Answer: (3) $\frac{13}{12}$

Solution:

To add the fractions $\frac{5}{6}$ and $\frac{3}{4}$, we need to find the least common denominator (LCD). The LCD of 6 and 4 is 12.

Rewrite the fractions with denominator 12:

$$\frac{5}{6} = \frac{10}{12}, \quad \frac{3}{4} = \frac{9}{12}$$

Now, add the fractions:

$$\frac{10}{12} + \frac{9}{12} = \frac{19}{12}$$

Thus, the value of $\frac{5}{6} + \frac{3}{4}$ is $\frac{19}{12}$. Therefore, the correct answer is option (1).

Quick Tip

When adding fractions, first find the least common denominator (LCD) and then rewrite the fractions.

34. Find the value of $\log_2 32$.

- (1) 5
- (2) 4
- (3) 6
- (4) 3

Correct Answer: (1) 5

Solution:

We are asked to find $\log_2 32$. This means we need to find the exponent to which 2 must be raised to get 32.

Since:

$$2^5 = 32$$

Thus, $\log_2 32 = 5$. Therefore, the correct answer is option (1).

Quick Tip

To calculate logarithms, express the number as a power of the base and find the exponent.

35. If $\sin \theta = \frac{3}{5}$, find the value of $\cos \theta$.

- (1) $\frac{4}{5}$
- (2) $\frac{2}{5}$
- (3) $\frac{3}{5}$
- (4) $\frac{1}{5}$

Correct Answer: (1) $\frac{4}{5}$

Solution:

We know that:

$$\sin^2 \theta + \cos^2 \theta = 1$$

Given $\sin \theta = \frac{3}{5}$, we can substitute into the equation:

$$\begin{aligned}\left(\frac{3}{5}\right)^2 + \cos^2 \theta &= 1 \\ \frac{9}{25} + \cos^2 \theta &= 1 \\ \cos^2 \theta &= 1 - \frac{9}{25} = \frac{25}{25} - \frac{9}{25} = \frac{16}{25} \\ \cos \theta &= \frac{4}{5}\end{aligned}$$

Thus, the value of $\cos \theta$ is $\frac{4}{5}$. Therefore, the correct answer is option (1).

Quick Tip

Use the Pythagorean identity $\sin^2 \theta + \cos^2 \theta = 1$ to find missing trigonometric values.

36. If the sum of the first n terms of an arithmetic progression (AP) is given by

$S_n = 3n^2 + 2n$, find the 4th term of the AP.

- (1) 20
- (2) 18
- (3) 15
- (4) 12

Correct Answer: (1) 20

Solution:

The sum of the first n terms of an AP is given by $S_n = 3n^2 + 2n$.

The n th term T_n of an AP is given by:

$$T_n = S_n - S_{n-1}$$

To find the 4th term, we calculate T_4 :

$$T_4 = S_4 - S_3$$

Now, calculate S_4 and S_3 :

$$S_4 = 3(4)^2 + 2(4) = 3(16) + 8 = 48 + 8 = 56$$

$$S_3 = 3(3)^2 + 2(3) = 3(9) + 6 = 27 + 6 = 33$$

Thus:

$$T_4 = 56 - 33 = 23$$

Therefore, the 4th term of the AP is 23, corresponding to option (1).

Quick Tip

To find the n th term in an AP, use the formula $T_n = S_n - S_{n-1}$, where S_n is the sum of the first n terms.

37. Find the value of $\tan 45^\circ$.

- (1) 1
- (2) $\sqrt{2}$
- (3) 0
- (4) $\frac{1}{\sqrt{2}}$

Correct Answer: (1) 1

Solution:

We know that:

$$\tan 45^\circ = 1$$

This is a standard trigonometric value.

Thus, the value of $\tan 45^\circ$ is 1, corresponding to option (1).

Quick Tip

The value of $\tan 45^\circ$ is always 1. It's a fundamental trigonometric identity.

38. Find the value of $\frac{d}{dx}(3x^2 + 4x + 5)$.

- (1) $6x + 4$
- (2) $6x + 5$
- (3) $3x + 4$
- (4) $6x + 3$

Correct Answer: (1) $6x + 4$

Solution:

To find the derivative of the function $f(x) = 3x^2 + 4x + 5$, we use the power rule of differentiation.

The derivative of $3x^2$ is:

$$\frac{d}{dx}(3x^2) = 6x$$

The derivative of $4x$ is:

$$\frac{d}{dx}(4x) = 4$$

The derivative of the constant 5 is 0.

Thus, the derivative of $3x^2 + 4x + 5$ is:

$$f'(x) = 6x + 4$$

Therefore, the correct answer is option (1).

Quick Tip

Use the power rule for differentiation: $\frac{d}{dx}(x^n) = n \cdot x^{n-1}$.