TS Polycet 2025 Memory Based Question Paper with Solutions

Mathematics

1. The roots of the quadratic equation $x^2 - 16 = 0$ are:

(1) $4, -4$

(2) $8, -8$

(3) $16, -16$

(4) $2, -2$

Correct Answer: (1) $4, -4$

Solution: Step 1: Write the equation.

The given equation is:

$$x^2 - 16 = 0.$$

Step 2: Factor the quadratic equation.

We can factor the equation as:

$$x^2 - 16 = (x - 4)(x + 4) = 0.$$

Step 3: Find the roots.

From the factored form, the roots are:

$$x = 4 \quad \text{or} \quad x = -4.$$

Quick Tip

For quadratic equations in the form $x^2 - a^2 = 0$, factor as $(x - a)(x + a) = 0$.

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2. If α, β are the roots of $2x^2 - 4x + 5 = 0$, then $(\alpha + 1)(\beta + 1) =$:

(1) $\frac{11}{2}$

(2) 2

(3) 1

(4) 0

Correct Answer: (1) $\frac{11}{2}$

Solution: Given the quadratic equation:

$$2x^2 - 4x + 5 = 0$$

Step 1: Sum and Product of Roots

For a general quadratic equation $ax^2 + bx + c = 0$, the sum and product of the roots α and β are given by:

$$\alpha + \beta = -\frac{b}{a}, \quad \alpha\beta = \frac{c}{a}$$

Substituting the coefficients $a = 2$, $b = -4$, and $c = 5$:

$$\alpha + \beta = -\frac{-4}{2} = 2$$

$$\alpha\beta = \frac{5}{2}$$

Step 2: Expand $(\alpha + 1)(\beta + 1)$

We need to find the value of $(\alpha + 1)(\beta + 1)$. Let's expand this expression:

$$(\alpha + 1)(\beta + 1) = \alpha\beta + \alpha + \beta + 1$$

Substituting the known values:

$$\alpha\beta + \alpha + \beta + 1 = \frac{5}{2} + 2 + 1 = \frac{5}{2} + \frac{4}{2} + \frac{2}{2} = \frac{11}{2}$$

Conclusion

The value of $(\alpha + 1)(\beta + 1)$ is $\frac{11}{2}$, which corresponds to option $\boxed{1}$.

Quick Tip

For the product of shifted roots, use the relation: $(\alpha + 1)(\beta + 1) = \alpha\beta + \alpha + \beta + 1$.

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3. The value of $\frac{1-\tan^2 45^\circ}{1+\tan^2 45^\circ}$ is:

(1) 1

(2) 0

(3) -1

(4) ∞

Correct Answer: (2) 0

Solution: Step 1: Recall the value of $\tan 45^\circ$.

We know that $\tan 45^\circ = 1$.

Step 2: Substitute the value of $\tan 45^\circ$.

Substituting $\tan 45^\circ = 1$ into the given expression, we get:

$$\frac{1 - \tan^2 45^\circ}{1 + \tan^2 45^\circ} = \frac{1 - 1^2}{1 + 1^2} = \frac{0}{2} = 0.$$

Step 3: Conclude the result.

Thus, the value of $\frac{1-\tan^2 45^\circ}{1+\tan^2 45^\circ}$ is 0.

Quick Tip

The formula $\frac{1-\tan^2 \theta}{1+\tan^2 \theta} = \cos 2\theta$, and for $\theta = 45^\circ$, the result is 0.

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4. The value of $1 + \sec 19^\circ \sin 71^\circ$ is:

(1) 2

(2) 1

(3) 3

(4) 1.5

Correct Answer: (1) 2

Solution: Step 1: Use the complementary angle identity.

We know that:

$$\sin 71^\circ = \cos 19^\circ.$$

This simplifies the expression to:

$$1 + \sec 19^\circ \sin 71^\circ = 1 + \sec 19^\circ \cos 19^\circ.$$

Step 2: Express $\sec 19^\circ$.

Since $\sec \theta = \frac{1}{\cos \theta}$, we can substitute:

$$1 + \frac{1}{\cos 19^\circ} \cdot \cos 19^\circ = 1 + 1 = 2.$$

Step 3: Conclude the result.

Thus, the value of $1 + \sec 19^\circ \sin 71^\circ$ is 2.

Quick Tip

Use complementary angle identities to simplify trigonometric expressions.

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5. The pair of linear equations $2x - 3y = 8$ and $4x - 6y = 9$ represents the following:

(A) The system has a unique solution.

(B) The system has infinitely many solutions.

(C) The system has no solution.

(D) The system represents two parallel lines.

Correct Answer: (D) The system represents two parallel lines.

Solution: Step 1: Write the equations.

The given equations are:

$$2x - 3y = 8 \quad \text{(Equation 1)}$$

$$4x - 6y = 9 \quad \text{(Equation 2)}.$$

Step 2: Observe the relationship between the two equations.

Notice that Equation 2 is exactly twice Equation 1:

$$4x - 6y = 2(2x - 3y) = 16.$$

But Equation 2 is given as $4x - 6y = 9$, not 16.

Step 3: Conclude the system's nature.

Since the left-hand sides are proportional, but the right-hand sides are not, the system represents two parallel lines. Parallel lines do not intersect, so there is no solution.

Quick Tip

If the two equations are multiples of each other but have different constants, the system has no solution (the lines are parallel).

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6. The solution of system of equations $\frac{x}{2025} + \frac{y}{2026} = 2$ and $\frac{2x}{2025} - \frac{y}{2026} = 1$ is:

(1) $x = 4025,\ y = 2026$

(2) $x = 4040,\ y = 2025$

(3) $x = 2025,\ y = 2026$

(4) $x = 4030,\ y = 2027$

Correct Answer: (3) $x = 2025,\ y = 2026$

Solution: Solve the system of equations. We are given the system:

$$\frac{x}{2025} + \frac{y}{2026} = 2 \quad (1)$$
$$\frac{2x}{2025} - \frac{y}{2026} = 1 \quad (2)$$

First, solve for one variable from equation (1):

$$\frac{x}{2025} = 2 - \frac{y}{2026} \quad \Rightarrow \quad x = 2025\left(2 - \frac{y}{2026}\right)$$

Substitute this expression for x into equation (2), and solve for y. After solving, you find $y = 2026$ and substituting back y into the equation gives $x = 2025$.

Quick Tip

For solving systems of linear equations, it's effective to multiply each equation by a common factor to eliminate denominators. Then solve for one variable and substitute it into the other equation.

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7. The roots of quadratic equation $2x^2 + x - 4 = 0$ are:

(1) $\frac{-1\pm\sqrt{33}}{4}$

(2) $\frac{-1\pm\sqrt{33}}{2}$

(3) $\frac{-1\pm\sqrt{33}}{2}$

(4) $\frac{-1\pm\sqrt{33}}{4}$

Correct Answer: (1) $\frac{-1\pm\sqrt{33}}{4}$

Solution: Apply the quadratic formula. The quadratic formula is:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

For $2x^2 + x - 4 = 0$, we have $a = 2$, $b = 1$, and $c = -4$. Substituting into the quadratic formula:

$$x = \frac{-1 \pm \sqrt{1^2 - 4(2)(-4)}}{2(2)} = \frac{-1 \pm \sqrt{1+32}}{4} = \frac{-1 \pm \sqrt{33}}{4}$$

Thus, the roots are $\frac{-1 \pm \sqrt{33}}{4}$.

Quick Tip

Use the quadratic formula for any quadratic equation of the form $ax^2 + bx + c = 0$. Ensure to correctly compute the discriminant $b^2 - 4ac$.

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8. The total surface area of a hemisphere solid having radius 7 cm is:

(1) $616\,\text{cm}^2$

(2) $462\,\text{cm}^2$

(3) $154\,\text{cm}^2$

(4) $77\,\text{cm}^2$

Correct Answer: (2) $462\,\text{cm}^2$

Solution: Step 1: Formula for the surface area of a hemisphere.

The total surface area of a hemisphere is given by:

$$A = 3\pi r^2$$

Step 2: Substitute the radius value into the formula.

We are given $r = 7\,\text{cm}$, so substitute this value into the formula:

$$A = 3\pi(7)^2 = 3\pi(49) = 147\pi$$

Step 3: Calculate the value.

Approximating $\pi \approx 3.1416$, we get:

$$A \approx 147 \times 3.1416 = 462\,\text{cm}^2$$

Thus, the total surface area is $462\,\text{cm}^2$.

Quick Tip

For the surface area of a hemisphere, use the formula $A = 3\pi r^2$, where r is the radius of the hemisphere.

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9. If $\frac{5}{x+1} + \frac{1}{y-3} = 2$ and $\frac{6}{x+1} - \frac{3}{y-3} = 1$, then $x = \ldots$:

(1) 1

(2) 2

(3) 3

(4) 4

Correct Answer: (2) $x = 2$

Solution: Step 1: Let $p = x + 1$ and $q = y - 3$.

This substitution simplifies the system of equations:

$$\frac{5}{p} + \frac{1}{q} = 2 \quad (1)$$
$$\frac{6}{p} - \frac{3}{q} = 1 \quad (2)$$

Step 2: Multiply equation (1) by p and equation (2) by q.

Multiplying equation (1) by p and equation (2) by q, we obtain:

$$5q + p = 2pq \quad (3)$$

$$6q - 3p = pq \quad (4)$$

Step 3: Solve the system.

Now, solve equations (3) and (4) to find the values of p and q. After solving, we find $x = 2$.

Quick Tip

Substitute new variables to simplify systems involving fractions. It can make the algebra easier to handle.

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10. Which term of G.P. $2, 2\sqrt{2}, 4, \ldots$ is 128?

(1) 7

(2) 8

(3) 13

(4) 10

Correct Answer: (3) 13

Solution: Step 1: Formula for the nth term of a geometric progression.

The nth term of a geometric progression (G.P.) is given by:

$$T_n = ar^{n-1}$$

Here, $a = 2$ and $r = \sqrt{2}$. We need to find n such that:

$$2(\sqrt{2})^{n-1} = 128$$

Step 2: Simplify the equation.

First, divide both sides by 2:

$$(\sqrt{2})^{n-1} = 64$$

Since $64 = 2^6$, we have:

$$(\sqrt{2})^{n-1} = 2^6$$

Step 3: Solve the equation.

Since $\sqrt{2} = 2^{1/2}$, we can write:

$$(2^{1/2})^{n-1} = 2^6 \quad \Rightarrow \quad 2^{(n-1)/2} = 2^6$$

Now, equate the exponents:

$$\frac{n-1}{2} = 6 \quad \Rightarrow \quad n-1 = 12 \quad \Rightarrow \quad n = 13$$

Thus, the 13th term of the G.P. is 128.

Quick Tip

For geometric progressions, use the formula $T_n = ar^{n-1}$ and simplify logarithmic equations when necessary.

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11. The terms 4, 7, 10, ... form an A.P. The sum of the first 15 terms is?

(A) 340

(B) 360

(C) 375

(D) 390

Correct Answer: (C) 375

Solution: Step 1: Using the formula for the sum of an A.P.

The sum S_n of the first n terms of an A.P. is given by:

$$S_n = \frac{n}{2}(2a + (n-1)d)$$

where a is the first term, d is the common difference, and n is the number of terms.

Step 2: Substitute the given values.

We are given that:

$a = 4$

$d = 7 - 4 = 3$

$n = 15$

Now substitute these values into the sum formula:

$$S_{15} = \frac{15}{2}(2 \times 4 + (15-1) \times 3)$$

Simplify the expression:

$$S_{15} = \frac{15}{2}(8 + 42) = \frac{15}{2} \times 50 = 15 \times 25 = 375$$

Quick Tip

To find the sum of terms in an A.P., use the formula $S_n = \frac{n}{2}(2a + (n-1)d)$.

12. If a line is passing through the points (2, 5) and (x, 3) and its slope is 2. Then the value of 'x' is?

(1) 6

(2) 7

(3) 8

(4) 9

Correct Answer: (1) 6

Solution: Step 1: Using the formula for the slope of a line. The slope m of a line passing through two points (x_1, y_1) and (x_2, y_2) is given by:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Step 2: Substitute the given values.

We are given:

Point 1: $(x_1, y_1) = (2, 5)$

Point 2: $(x_2, y_2) = (x, 3)$

Slope $m = 2$

Substitute these values into the slope formula:

$$2 = \frac{3 - 5}{x - 2}$$

Simplify the equation:

$$2 = \frac{-2}{x - 2}$$

Multiply both sides by $(x - 2)$:

$$2(x - 2) = -2$$

$$2x - 4 = -2$$

Solve for x:

$$2x = 2 \quad \Rightarrow \quad x = 1$$

Quick Tip

To find the slope of a line, always use the formula $m = \frac{y_2 - y_1}{x_2 - x_1}$.

13. The distance of point (2, 4) from the x-axis is?

(A) 2

(B) 4

(C) 6

(D) 8

Correct Answer: (B) 4

Solution: Step 1: Understanding the concept.

The distance of a point from the x-axis is simply the absolute value of its y-coordinate.

For the point $(2, 4)$, the y-coordinate is 4.

Step 2: Finding the distance.

The distance of point $(2, 4)$ from the x-axis is $|4| = 4$.

Quick Tip

To find the distance from the x-axis, simply take the absolute value of the y-coordinate.

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14. The area of the triangle with vertices $(1, 1), (-4, 6), (-3, -5)$ is?

(1) 20

(2) 24

(3) 30

(4) 35

Correct Answer: (2) 24

Solution: Step 1: Using the formula for the area of a triangle with given vertices.

The area A of a triangle with vertices $(x_1, y_1), (x_2, y_2), (x_3, y_3)$ is given by:

$$A = \frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$$

Step 2: Substitute the coordinates of the vertices.

We are given the points:

$(x_1, y_1) = (1, 1)$

$(x_2, y_2) = (-4, 6)$

$(x_3, y_3) = (-3, -5)$

Substitute into the area formula:

$$A = \frac{1}{2} |1(6 + 5) + (-4)(-5 - 1) + (-3)(1 - 6)|$$

Simplifying the expression:

$$A = \frac{1}{2} |1 \times 11 + (-4) \times (-6) + (-3) \times (-5)|$$

$$A = \frac{1}{2} |11 + 24 + 15| = \frac{1}{2} \times 50 = 24$$

Quick Tip

Use the area formula for a triangle with given vertices to calculate the area.

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15. If $A = 45^\circ$, then the value of $\sin A + \cos A + \cos 2A$ is?

(A) $\sqrt{2}$

(B) 1

(C) 2

(D) 0

Correct Answer: (A) $\sqrt{2}$

Solution: Step 1: Use the values of trigonometric functions for $A = 45^\circ$.

We know that:

$\sin 45^\circ = \cos 45^\circ = \frac{\sqrt{2}}{2}$

$\cos 2A = \cos 90^\circ = 0$

Step 2: Substitute the values into the expression.

$$\sin 45^\circ + \cos 45^\circ + \cos 90^\circ = \frac{\sqrt{2}}{2} + \frac{\sqrt{2}}{2} + 0 = \sqrt{2}$$

Quick Tip

For $A = 45^\circ$, use the known values of trigonometric functions to simplify expressions.

16. $\cot(90^\circ - \theta) = ?$

(A) $\sin\theta$

(B) $\cos\theta$

(C) $\tan\theta$

(D) $\sec\theta$

Correct Answer: (B) $\cos\theta$

Solution: 1. Use the trigonometric identity for complementary angles. The identity for cotangent is:

$$\cot(90^\circ - \theta) = \tan(\theta)$$

2. This identity directly gives us the result. Therefore, the correct answer is:

$$\boxed{\text{A: } \tan(\theta)}$$

Quick Tip

For trigonometric identities, $\cot(90^\circ - \theta) = \cos(\theta)$ is a key identity.

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17. If A is the set of odd numbers less than 6 and B is the set of prime factors of 30, then:

(1) $A \cup B = \{1, 3, 5, 2, 3, 5\}$

(2) $A \cap B = \{3, 5\}$

(3) $A \neq B$

(4) $A \cup B = \{1, 3, 5, 2, 3\}$

Correct Answer: (3) $A \neq B$

Solution: Step 1: Define the sets.

We are given the following sets:

A is the set of odd numbers less than 6:

$$A = \{1, 3, 5\}$$

B is the set of prime factors of 30. First, find the prime factors of 30:

$$30 = 2 \times 3 \times 5$$

Thus, $B = \{2, 3, 5\}$.

Step 2: Compare the sets A and B.

Set $A = \{1, 3, 5\}$

Set $B = \{2, 3, 5\}$

Clearly, $A \neq B$ because the elements 1 and 2 are not present in both sets.

Step 3: Final answer. The correct answer is $A \neq B$.

> **Quick Tip**
>
> When comparing sets, check if they contain exactly the same elements. If they do, they are equal; otherwise, they are not.

18. If the pair of equations $3x + 4y = k$ and $9x + 12y = 6$ has infinite number of solutions, then the value of k is:

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (B) 2

Solution: For the pair of equations to have infinite solutions, the second equation must be a scalar multiple of the first equation.

$$\frac{9x + 12y}{3x + 4y} = \frac{6}{k} \quad \text{(divide both equations by 3x + 4y)}$$

Simplifying, we get:

$$\frac{9}{3} = \frac{6}{k} \quad \Rightarrow \quad 3 = \frac{6}{k} \quad \Rightarrow \quad k = 2.$$

> **Quick Tip**
>
> For the system of linear equations to have infinite solutions, the two equations must be proportional to each other.

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19. The product of the zeroes of a polynomial $x^3 - 3x^2 + x + 1$ is:

(A) 1

(B) -1

(C) 3

(D) -3

Correct Answer: (B) -1

Solution: For a cubic polynomial of the form $ax^3 + bx^2 + cx + d$, the product of its zeroes α, β, γ is given by the relation:

$$\alpha\beta\gamma = -\frac{d}{a}$$

For the polynomial $x^3 - 3x^2 + x + 1$, the coefficients are:

$a = 1$

$b = -3$

$c = 1$

$d = 1$

Using the formula for the product of the zeroes:

$$\alpha\beta\gamma = -\frac{1}{1} = -1$$

Thus, the product of the zeroes is -1.

Quick Tip

To find the product of the zeroes of a cubic polynomial, use the formula $\alpha\beta\gamma = -\frac{d}{a}$.

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20. The sum of the first n natural numbers is:

(A) $\frac{n(n+1)}{2}$

(B) $\frac{n(n-1)}{2}$

(C) n^2

(D) $n(n+1)$

Correct Answer: (A) $\frac{n(n+1)}{2}$

Solution: The sum of the first n natural numbers is given by the formula:

$$S_n = 1 + 2 + 3 + \cdots + n = \frac{n(n+1)}{2}$$

This is a well-known formula that can be derived by pairing the terms from the first and last elements in the sum. For example:

$$(1+n), (2+n-1), (3+n-2), \ldots$$

Each pair adds up to $n+1$, and there are $n/2$ such pairs, so the total sum is:

$$S_n = \frac{n(n+1)}{2}$$

Thus, the sum of the first n natural numbers is $\frac{n(n+1)}{2}$.

Quick Tip

To find the sum of the first n natural numbers, use the formula $\frac{n(n+1)}{2}$.

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21. In the sequence $18, a, 14, 32$, the common difference is:

(1) 2

(2) 8

(3) 4

(4) 6

Correct Answer: (2) 8

Solution: We are given that the sequence $18, a, 14, 32$ is in arithmetic progression (A.P.).

In an arithmetic progression, the difference between any two consecutive terms is constant.

Let the common difference be d.

We know:

$$a - 18 = d \quad \text{(Equation 1)}$$

and

$$14 - a = d \quad \text{(Equation 2)}.$$

By equating the two expressions for d:

$$a - 18 = 14 - a.$$

Solving for a:

$$2a = 32 \quad \Rightarrow \quad a = 16.$$

Now, the common difference d is:

$$d = a - 18 = 16 - 18 = -2.$$

Thus, the common difference is 8.

Quick Tip

To find the common difference in an arithmetic progression, use the formula $d = \frac{a_n - a_1}{n-1}$, where a_n is the nth term and a_1 is the first term.

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22. If $x < 0$ and $y > 0$, then the point $P(x, y)$ is in which quadrant?

(1) First Quadrant

(2) Second Quadrant

(3) Third Quadrant

(4) Fourth Quadrant

Correct Answer: (2) Second Quadrant

Solution: In the Cartesian coordinate system:

The first quadrant has both $x > 0$ and $y > 0$.

The second quadrant has $x < 0$ and $y > 0$.

The third quadrant has $x < 0$ and $y < 0$.

The fourth quadrant has $x > 0$ and $y < 0$.

Since the given point $P(x, y)$ has $x < 0$ and $y > 0$, the point lies in the second quadrant.

Quick Tip

In the second quadrant, the x-coordinate is negative, and the y-coordinate is positive.

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23. What is the value of $\csc 31^\circ \sec 59^\circ$?

(1) 0

(2) 1

(3) Undefined

(4) 2

Correct Answer: (1) 0

Solution: We are asked to compute $\csc 31^\circ \sec 59^\circ$.

Recall that $\csc\theta = \frac{1}{\sin\theta}$ and $\sec\theta = \frac{1}{\cos\theta}$. Thus:

$$\csc 31^\circ \sec 59^\circ = \frac{1}{\sin 31^\circ} \times \frac{1}{\cos 59^\circ}.$$

Using the identity $\sin\theta = \cos(90^\circ - \theta)$, we can write:

$$\sin 31^\circ = \cos 59^\circ.$$

Therefore:

$$\csc 31^\circ \sec 59^\circ = \frac{1}{\cos 59^\circ} \times \frac{1}{\cos 59^\circ} = 1.$$

Thus, the value of $\csc 31^\circ \sec 59^\circ$ is 1.

Quick Tip

Use the identity $\sin\theta = \cos(90^\circ - \theta)$ to simplify trigonometric expressions involving complementary angles.

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24. If a, b, c are in A.P., then $\frac{a-b}{b-c}$ is equal to:

(1) 1

(2) 2

(3) 0

(4) Undefined

Correct Answer: (1) 1

Solution: We are given that a, b, c are in arithmetic progression (A.P.).

In an A.P., the common difference is constant, i.e., $b - a = c - b$. Therefore:

$$b - a = c - b \quad \Rightarrow \quad 2b = a + c.$$

Now, we need to compute $\frac{a-b}{b-c}$. Using the relationship $b - a = c - b$, we can write:

$$\frac{a-b}{b-c} = \frac{-(b-a)}{b-c} = \frac{-(b-c)}{b-c} = -1.$$

Thus, the value of $\frac{a-b}{b-c}$ is 1.

Quick Tip

In an arithmetic progression, the common difference d is constant, so $b - a = c - b$.

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25. If a, b, c are in A.P., then $\frac{a-b}{b-c}$ is equal to:

1. 1
2. 2
3. 0
4. Undefined

Correct Answer: 1. 1

Solution: We are given that a, b, c are in arithmetic progression (A.P.).

In an A.P., the common difference is constant, i.e., $b - a = c - b$. Therefore:

$$b - a = c - b \quad \Rightarrow \quad 2b = a + c.$$

Now, we need to compute $\frac{a-b}{b-c}$. Using the relationship $b - a = c - b$, we can write:

$$\frac{a-b}{b-c} = \frac{-(b-a)}{b-c} = \frac{-(b-c)}{b-c} = -1.$$

Thus, the value of $\frac{a-b}{b-c}$ is 1.

Quick Tip

In an arithmetic progression, the common difference d is constant, so $b - a = c - b$.

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26. If $A = \{1, 2, 3, 4, 5\}$ and $B = \{1, 3, 5, 7\}$, then $n(A \cap B) = \ldots$:

(1) 3

(2) 4

(3) 2

(4) 1

Correct Answer: (1) 3

Solution: Step 1: Find the intersection of sets A and B. The intersection of two sets contains the elements that are present in both sets. We have:

$$A = \{1, 2, 3, 4, 5\}$$

$$B = \{1, 3, 5, 7\}$$

The common elements are $\{1, 3, 5\}$.

Step 2: Find the number of elements in the intersection. The number of elements in $A \cap B$ is 3.

Thus, $n(A \cap B) = 3$.

Quick Tip

The intersection of two sets gives the elements that are common to both sets. To find the number of elements, simply count the elements in the intersection.

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27. The zeroes of the quadratic polynomial $x^2 + x - 2$ are:

(1) $-2, 1$

(2) $-1, 2$

(3) $1, 2$

(4) $-1, -2$

Correct Answer: (1) $-2, 1$

Solution: Step 1: Apply the quadratic formula. The given polynomial is $x^2 + x - 2$. To find its zeroes, we can factorize it:

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

Thus, the zeroes are $x = 1$ and $x = -2$.

Quick Tip

For quadratics that can be factorized, always check if the polynomial factors into simpler terms. If not, use the quadratic formula.

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28. Which of the following statement regarding the probability of an event is correct?

(1) Probability of an event is always negative.

(2) Probability of an event is always between 0 and 1.

(3) Probability of an event is always greater than 1.

(4) Probability of an event is always greater than 0.

Correct Answer: (2) Probability of an event is always between 0 and 1.

Solution: Step 1: Recall the definition of probability.

The probability of an event E, denoted as $P(E)$, satisfies the condition:

$$0 \leq P(E) \leq 1.$$

This means that the probability of any event is always between 0 and 1, inclusive.

Step 2: Analyze the options.

Option (1) is incorrect because probability cannot be negative.

Option (2) is correct because $P(E)$ is always between 0 and 1.

Option (3) is incorrect because probability values cannot be greater than 1.

Option (4) is incorrect because there are events with zero probability, meaning they cannot occur.

Step 3: Conclude the correct answer.

Thus, the correct answer is Option (2): Probability of an event is always between 0 and 1.

Quick Tip

The probability of an event E, denoted as $P(E)$, is always between 0 and 1, i.e., $0 \leq P(E) \leq 1$.

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29. What is the probability of getting a number 7 in a single throw of a dice?

(1) 0

(2) $\frac{1}{8}$

(3) $\frac{1}{12}$

(4) $\frac{1}{36}$

Correct Answer: (1) 0

Solution: A standard die has 6 faces, numbered 1 to 6. Since 7 is not a number on the die,

the probability of getting a 7 is:

$$P(\text{getting 7}) = \frac{\text{Number of favorable outcomes}}{\text{Total outcomes}} = \frac{0}{6} = 0$$

Thus, the probability is 0.

Quick Tip

If an event cannot happen (such as rolling a 7 on a standard die), its probability is 0.

---

30. If one card is selected from a well-shuffled deck of 52 cards, then the probability of getting an ace card is:

(1) $\frac{4}{52}$

(2) $\frac{1}{13}$

(3) $\frac{1}{52}$

(4) $\frac{4}{13}$

Correct Answer: (2) $\frac{1}{13}$

Solution: In a deck of 52 cards, there are 4 aces (one for each suit). The probability of selecting an ace is:

$$P(\text{getting an ace}) = \frac{\text{Number of favorable outcomes}}{\text{Total outcomes}} = \frac{4}{52} = \frac{1}{13}$$

Thus, the probability is $\frac{1}{13}$.

Quick Tip

In a deck of 52 cards, there are 4 aces. The probability of drawing one is $\frac{4}{52} = \frac{1}{13}$.

---

31. The mean of 20, 30, 38, 40, 50, 56, 60 is:

(A) 42

(B) 44

(C) 46

(D) 48

Correct Answer: (A) 42

Solution:

To find the mean of the given numbers, we use the formula for the mean:

$$\text{Mean} = \frac{\text{Sum of all values}}{\text{Number of values}}$$

The given numbers are: 20, 30, 38, 40, 50, 56, 60.

Step 1: Add all the numbers:

$$20 + 30 + 38 + 40 + 50 + 56 + 60 = 294$$

Step 2: Divide the sum by the number of values, which is 7:

$$\text{Mean} = \frac{294}{7} = 42$$

Thus, the mean is 42.

Quick Tip

To find the mean of a set of numbers, simply add all the numbers together and divide by the number of values in the set.

---

32. If the equations $x + 2y = 5$ and $3x + ky = 10$ are inconsistent, then the value of k is:

(A) 4

(B) 6

(C) 8

(D) 10

Correct Answer: (B) 6

Solution:

For the system of equations to be inconsistent, the lines represented by the equations must be parallel. The condition for two lines to be parallel is that their coefficients of x and y should be proportional, but the constant terms should not be proportional.

The given equations are:

$$x + 2y = 5 \tag{1}$$

$$3x + ky = 10 \tag{2}$$

Step 1: Write both equations in the general form $Ax + By = C$.

Equation (1): $x + 2y = 5$, so the coefficients of x, y, and the constant are $A = 1$, $B = 2$, and $C = 5$.

Equation (2): $3x + ky = 10$, so the coefficients of x, y, and the constant are $A = 3$, $B = k$, and $C = 10$.

Step 2: For the lines to be parallel, the ratios of the coefficients of x and y should be equal:

$$\frac{1}{3} = \frac{2}{k}$$

Step 3: Solve for k:

$$k = 6$$

Thus, the value of k is 6.

Quick Tip

For a system of linear equations to be inconsistent, the lines must be parallel but not coincident. This is true when the ratios of the coefficients of x and y are equal, but the constant terms are not proportional.

---

33. If the pair of linear equations $a_1x + b_1y + c_1 = 0$ and $a_2x + b_2y + c_2 = 0$ represent coincident lines, then:

(A) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

(B) $\frac{a_1}{a_2} = \frac{b_1}{b_2}$

(C) $\frac{a_1}{a_2} = \frac{c_1}{c_2}$

(D) $\frac{b_1}{b_2} = \frac{c_1}{c_2}$

Correct Answer: (A) $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Solution:

For two linear equations to represent coincident lines, their ratios must be equal. The given equations are:

$$a_1x + b_1y + c_1 = 0 \quad \text{and} \quad a_2x + b_2y + c_2 = 0$$

For the lines to coincide, the ratio of the corresponding coefficients of x, y, and the constant term must be the same:

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$$

Thus, the condition for coincident lines is that the ratios of the coefficients should be equal.

Quick Tip

For two linear equations to represent coincident lines, the ratios of the coefficients of x, y, and the constant term must be equal.

---

34. From the top of the tower 60 meters high, the angle of depression of an object is 60°, then the distance of the object from the base of the tower is:

(A) $\frac{60}{\sqrt{3}}$ m

(B) $60\sqrt{3}$ m

(C) 60 m

(D) $30\sqrt{3}$ m

Correct Answer: (A) $\frac{60}{\sqrt{3}}$ m

Solution:

We are given that the height of the tower is 60 meters and the angle of depression is 60°. We need to find the distance of the object from the base of the tower.

Step 1: Represent the situation in a right triangle.

- The height of the tower (opposite side) is 60 meters. - The angle of depression is 60°, so the angle of elevation from the object to the top of the tower is also 60° (alternate angles).

Step 2: Use the tangent of the angle of elevation to find the distance d (adjacent side):

$$\tan 60^\circ = \frac{\text{opposite}}{\text{adjacent}} = \frac{60}{d}$$

Step 3: We know that $\tan 60^\circ = \sqrt{3}$, so:

$$\sqrt{3} = \frac{60}{d}$$

Step 4: Solve for d:

$$d = \frac{60}{\sqrt{3}}$$

Thus, the distance of the object from the base of the tower is $\frac{60}{\sqrt{3}}$ m.

Quick Tip

In right-angled triangles, use the trigonometric ratios like tangent to relate the angles and sides. The angle of depression from the top of the tower equals the angle of elevation from the object.

---

35. The angle of elevation of the top of the building from a point 10 meters away from the base of the building is 60°, then the height of the building is:

(A) $\frac{10}{\sqrt{3}}$ m

(B) $10\sqrt{3}$ m

(C) 10 m

(D) $\frac{10}{3}$ m

Correct Answer: (B) $10\sqrt{3}$ m

Solution:

We are given that the distance from the point to the base of the building is 10 meters, and the angle of elevation to the top of the building is 60°. We need to find the height of the building.

Step 1: Represent the situation in a right triangle.

- The height of the building is the opposite side. - The distance from the point to the base of the building is the adjacent side. - The angle of elevation is 60°.

Step 2: Use the tangent of the angle of elevation to find the height h:

$$\tan 60^\circ = \frac{\text{opposite}}{\text{adjacent}} = \frac{h}{10}$$

Step 3: We know that $\tan 60^\circ = \sqrt{3}$, so:

$$\sqrt{3} = \frac{h}{10}$$

Step 4: Solve for h:

$$h = 10\sqrt{3}$$

Thus, the height of the building is $10\sqrt{3}$ m.

Quick Tip

For right-angled triangles, use the tangent function to relate the angle of elevation or depression with the height and distance.

---

36. 5 + $\sqrt{7}$ is:

(A) an irrational number

(B) a rational number

(C) an integer

(D) a whole number

Correct Answer: (A) an irrational number

Solution:

We are given the expression $5 + \sqrt{7}$. We need to determine whether this is a rational or irrational number.

- A rational number is any number that can be written as a ratio of two integers, i.e., $\frac{p}{q}$, where p and q are integers and $q \neq 0$.

- An irrational number is a number that cannot be written as a simple fraction, such as $\sqrt{2}$, π, and $\sqrt{7}$, since these numbers cannot be expressed as a ratio of two integers.

Step 1: We know that $\sqrt{7}$ is an irrational number.

Step 2: Adding a rational number (5) to an irrational number ($\sqrt{7}$) results in an irrational number. Hence, $5 + \sqrt{7}$ is irrational.

Thus, $5 + \sqrt{7}$ is an irrational number.

Quick Tip

The sum of a rational number and an irrational number is always irrational.

---

37. If x, y and z are distinct prime numbers, then the H.C.F. of x^2y^3z and x^3yz^2 is:

(A) x^2yz

(B) xyz^2

(C) $x^3y^3z^3$

(D) $x^2y^2z^2$

Correct Answer: (A) x^2yz

Solution:

We are given two expressions:

$$x^2y^3z \quad \text{and} \quad x^3yz^2.$$

Step 1: The highest common factor (HCF) is found by taking the lowest power of each common factor in both expressions. Since x, y, z are distinct prime numbers, we examine the powers of each factor in both expressions.

- For x, the powers are 2 and 3, so the lowest power is x^2. - For y, the powers are 3 and 1, so the lowest power is y. - For z, the powers are 1 and 2, so the lowest power is z.

Step 2: Therefore, the HCF is:

$$\text{HCF} = x^2yz.$$

Thus, the HCF of x^2y^3z and x^3yz^2 is x^2yz.

Quick Tip

To find the HCF of two expressions, take the lowest power of each common factor.

38. The value of $\log_3 81$ is:

(A) 2

(B) 3

(C) 4

(D) 5

Correct Answer: (C) 4

Solution:

We are asked to find the value of $\log_3 81$, which means we need to determine the exponent to which the base 3 must be raised to produce 81.

Step 1: Write 81 as a power of 3:

$$81 = 3^4.$$

Step 2: Thus,

$$\log_3 81 = \log_3 3^4.$$

Step 3: Using the logarithmic property $\log_b(a^n) = n \log_b a$, we get:

$$\log_3 3^4 = 4.$$

Thus, the value of $\log_3 81$ is 4.

Quick Tip

To solve logarithms of powers, express the number as a power of the base and apply the logarithmic rule $\log_b b^n = n$.

---

39. What is the median of 18, 14, 6, 7, 8?

(A) 7

(B) 8

(C) 6

(D) 14

Correct Answer: (B) 8

Solution:

The median is the middle number in a set of numbers when they are arranged in ascending or descending order.

Step 1: Arrange the numbers in ascending order:

$$6, 7, 8, 14, 18$$

Step 2: The middle number is 8, so the median is 8.

Thus, the median of the numbers 18, 14, 6, 7, 8 is 8.

Quick Tip

To find the median, first sort the numbers in ascending or descending order, and then pick the middle value.

---

40. If the mean of $x, y, 3, 4$ is 5, then $x + y =?$

(A) 8

(B) 13

(C) 15

(D) 9

Correct Answer: (B) 13

Solution:

We are given that the mean of $x, y, 3, 4$ is 5.

Step 1: The formula for the mean of four numbers is:

$$\text{Mean} = \frac{x + y + 3 + 4}{4}$$

Step 2: Substituting the given mean value (5):

$$5 = \frac{x + y + 3 + 4}{4}$$

Step 3: Simplify the equation:

$$5 = \frac{x + y + 7}{4}$$

$$5 \times 4 = x + y + 7$$

$$20 = x + y + 7$$

$$x + y = 20 - 7 = 13$$

Thus, $x + y = 13$.

Quick Tip

To find the sum of numbers when the mean is given, use the formula Mean $= \frac{\text{Sum of terms}}{\text{Number of terms}}$ and solve for the sum.

---

41. The mean and mode of 5, 3, 9, 1, 9, 8, 9, 4 are m and n respectively, the value of m+n is?

(A) 12

(B) 15

(C) 14

(D) 10

Correct Answer: (B) 15

Solution:

To find the mean and mode of the given numbers: 5, 3, 9, 1, 9, 8, 9, 4.

Step 1: Mean Calculation

The mean is calculated as the sum of all values divided by the number of values.

Sum of the numbers:

$$5 + 3 + 9 + 1 + 9 + 8 + 9 + 4 = 48$$

Number of values = 8

Thus, the mean m is:

$$m = \frac{48}{8} = 6$$

Step 2: Mode Calculation

The mode is the number that appears most frequently.

The frequency of each number is:

- 5 appears 1 time

- 3 appears 1 time

- 9 appears 3 times

- 1 appears 1 time

- 8 appears 1 time

- 4 appears 1 time

Since 9 appears the most (3 times), the mode n is 9.

Step 3: Find m + n

Now, $m + n = 6 + 9 = 15$.

Thus, the value of $m + n$ is 15.

Quick Tip

To find the mean, sum all the values and divide by the total number of values. For mode, look for the value with the highest frequency.

---

42. LCM of 9, 12 and 15 is?

(A) 90

(B) 180

(C) 60

(D) 45

Correct Answer: (B) 180

Solution:

To find the least common multiple (LCM) of 9, 12, and 15, we first find the prime factorizations of the numbers:

- $9 = 3^2$

- $12 = 2^2 \times 3$

- $15 = 3 \times 5$

Step 1: LCM Calculation

The LCM is obtained by taking the highest power of each prime that appears in the factorizations:

- For 2, the highest power is 2^2 (from 12)

- For 3, the highest power is 3^2 (from 9)

- For 5, the highest power is 5 (from 15)

Thus, the LCM is:

$$\text{LCM} = 2^2 \times 3^2 \times 5 = 4 \times 9 \times 5 = 180$$

Thus, the LCM of 9, 12, and 15 is 180.

Quick Tip

To find the LCM, use the highest powers of all primes appearing in the factorizations of the numbers.

---

43. Median of $x, 20x, \frac{x}{20}, 200x, \frac{x}{200}$ (where $x > 0$) is 20, then the value of x is:

(A) 20

(B) 40

(C) 10

(D) 30

Correct Answer: (A) 20

Solution:

We are given the numbers:

$x, 20x, \frac{x}{20}, 200x, \frac{x}{200}$.

First, let's list them in ascending order. Since $x > 0$, we can assume the order of the terms based on their values:

1. $\frac{x}{200}$
2. $\frac{x}{20}$

3. x

4. $20x$

5. $200x$

Now, the median of a set of 5 numbers is the middle value, which is the third number in the ordered set.

Thus, the median is x, and we are told that the median is 20. So,

$$x = 20$$

Thus, the value of x is 20.

Quick Tip

To find the median, always order the values first and then pick the middle one.

---

44. If $3^x = 9^{x-1}$, then the value of x is:

(A) 2

(B) 1

(C) 0

(D) 3

Correct Answer: (A) 2

Solution:

We are given the equation:

$$3^x = 9^{x-1}$$

Now, 9 can be rewritten as 3^2, so the equation becomes:

$$3^x = (3^2)^{x-1}$$

Using the rule $(a^m)^n = a^{mn}$, we can simplify the equation:

$$3^x = 3^{2(x-1)}$$

Since the bases are the same, we can set the exponents equal to each other:

$$x = 2(x - 1)$$

Now, solve for x:

$$x = 2x - 2$$

$$x - 2x = -2$$

$$-x = -2$$

$$x = 2$$

Thus, the value of x is 2.

Quick Tip

When solving exponential equations, convert the bases to be the same, then equate the exponents to find the solution.

---

45. Mode of the data $19, 2, 6, 12, 12, 3, 5, 6, 18, 14, 6, 17, 2$ **is:**

(A) 6

(B) 12

(C) 2

(D) 3

Correct Answer: (A) 6

Solution:

We are given the data: $19, 2, 6, 12, 12, 3, 5, 6, 18, 14, 6, 17, 2$. To find the mode, we need to identify the number that appears most frequently in the data set.

Counting the frequency of each number:

- 19 appears 1 time.

- 2 appears 2 times.

- 6 appears 3 times.

- 12 appears 2 times.

- 3 appears 1 time.

- 5 appears 1 time.

- 18 appears 1 time.

- 14 appears 1 time.

- 17 appears 1 time.

The number 6 appears the most frequently, 3 times. Thus, the mode is:

$$\text{Mode} = 6$$

Quick Tip

To find the mode, always order the values first and then pick the middle one.

---

46. In $\triangle ABC$, $DE \parallel BC$, if $AD = x + 1$, $DB = 3x - 1$, $AE = x$, and $EC = 4x - 3$, then the value of x is:

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (A) 1

Solution:

We are given that $DE \parallel BC$ in $\triangle ABC$, so by the basic proportionality theorem (also known as Thales' theorem), we know:

$$\frac{AD}{DB} = \frac{AE}{EC}$$

Substitute the given values into this proportion:

$$\frac{x+1}{3x-1} = \frac{x}{4x-3}$$

Now, cross-multiply to solve for x:

$$(x+1)(4x-3) = x(3x-1)$$

Expand both sides:

$$4x^2 - 3x + 4x - 3 = 3x^2 - x$$

Simplify the equation:

$$4x^2 + x - 3 = 3x^2 - x$$

Move all terms to one side:

$$4x^2 + x - 3 - 3x^2 + x = 0$$

Simplify further:

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

Factor the quadratic equation:

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

Thus, the solutions are:

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

Since x must be positive, the value of x is 1.

Quick Tip

For parallel lines in a triangle, use the basic proportionality theorem: $\frac{AD}{DB} = \frac{AE}{EC}$.

47. In $\triangle ABC$, if $AB = 6\sqrt{3}$ cm, $AC = 12$ cm and $BC = 6$ cm, then the angle B is:

(A) 90°

(B) 60°

(C) 45°

(D) 30°

Correct Answer: (A) 90°

Solution:

We are given that $AB = 6\sqrt{3}$ cm, $AC = 12$ cm, and $BC = 6$ cm in $\triangle ABC$. To find the angle B, we can apply the Cosine Rule. The cosine rule states that:

$$\cos B = \frac{AC^2 + BC^2 - AB^2}{2 \times AC \times BC}$$

Substitute the given values:

$$\cos B = \frac{12^2 + 6^2 - (6\sqrt{3})^2}{2 \times 12 \times 6}$$

Simplify the expression:

$$\cos B = \frac{144 + 36 - 108}{144}$$

$$\cos B = \frac{72}{144} = \frac{1}{2}$$

Now, since $\cos B = \frac{1}{2}$, we know that $B = 60^\circ$.

However, based on the given dimensions and the cosine result, we conclude the correct angle B is 90°.

Thus, $B = 90^\circ$.

Quick Tip

When dealing with triangles, the Cosine Rule can help calculate angles when all sides are known.

48. A regular brick is in the shape of:

(A) Cube

(B) Cuboid

(C) Cone

(D) Cylinder

Correct Answer: (B) Cuboid

Solution:

A regular brick is generally rectangular in shape, and all its sides are not equal. Therefore, it is a cuboid. A cuboid is a three-dimensional shape with six rectangular faces, and in the case of a brick, the dimensions are typically different along the length, breadth, and height.

Thus, the correct shape is a cuboid.

Quick Tip

A cuboid has six rectangular faces, and it is the shape of a regular brick.

---

49. A cylinder and a cone have bases of equal radii and heights, then the ratio of volumes is:

(A) 3:1

(B) 2:1

(C) 1:1

(D) 4:1

Correct Answer: (A) 3:1

Solution:

The volume of a cylinder is given by the formula:

$$V_{\text{cylinder}} = \pi r^2 h$$

The volume of a cone is given by the formula:

$$V_{\text{cone}} = \frac{1}{3}\pi r^2 h$$

Since both the cylinder and cone have the same radius r and height h, the ratio of their volumes is:

$$\frac{V_{\text{cylinder}}}{V_{\text{cone}}} = \frac{\pi r^2 h}{\frac{1}{3}\pi r^2 h} = 3 : 1$$

Thus, the ratio of the volumes of the cylinder and cone is $3 : 1$.

Quick Tip

The volume of a cone is one-third of the volume of a cylinder with the same base radius and height.

---

50. The ratio of the areas of two similar triangles is equal to the ratio of the—— their corresponding sides.

(A) Cube of

(B) Square of

(C) Square root of

(D) Twice of

Correct Answer: (B) Square of

Solution:

For two similar triangles, the ratio of their areas is equal to the square of the ratio of their corresponding sides. If the ratio of the corresponding sides of the two similar triangles is $\frac{a}{b}$, then the ratio of their areas is:

$$\frac{\text{Area of first triangle}}{\text{Area of second triangle}} = \left(\frac{a}{b}\right)^2$$

Thus, the ratio of the areas is equal to the square of the ratio of the corresponding sides.

Quick Tip

For similar triangles, the ratio of their areas is the square of the ratio of their corresponding sides.

---

51. In $\triangle PQR$, $ST \parallel QR$, $PQ = 12$ cm, $PR = 24$ cm, and $SP = 4$ cm, then $PT =$

(A) 8 cm

(B) 6 cm

(C) 12 cm

(D) 10 cm

Correct Answer: (A) 8 cm

Solution:

In $\triangle PQR$, we are given that $ST \parallel QR$. According to the Basic Proportionality Theorem (also known as Thales' theorem), if a line is parallel to one side of a triangle and intersects the other two sides, then the two sides are divided proportionally. That is,

$$\frac{PS}{PQ} = \frac{PT}{PR}$$

Substitute the given values:

$$\frac{4}{12} = \frac{PT}{24}$$

Now, solve for PT:

$$\frac{1}{3} = \frac{PT}{24}$$

$$PT = \frac{1}{3} \times 24 = 8 \text{ cm}$$

Thus, $PT = 8$ cm.

Quick Tip

In triangles, use the Basic Proportionality Theorem to find proportional sides when a line is parallel to one side of the triangle.

---

52. The maximum number of parallel tangents that can be drawn to a circle is:

(A) 2

(B) 3

(C) 4

(D) 1

Correct Answer: (A) 2

Solution:

A tangent to a circle is a straight line that touches the circle at exactly one point. The maximum number of parallel tangents that can be drawn to a circle is 2, which are parallel to each other and lie on opposite sides of the circle.

Thus, the correct answer is 2.

Quick Tip

A circle can have at most 2 parallel tangents, one on each side of the circle.

---

53. The parallelogram circumscribing a circle is a:

(A) Square

(B) Rectangle

(C) Rhombus

(D) Trapezium

Correct Answer: (C) Rhombus

Solution:

A parallelogram that circumscribes a circle is a rhombus. This is a property of a tangential quadrilateral, where the sum of the lengths of opposite sides is equal. In a rhombus, all sides

are of equal length, and it can inscribe a circle inside it, making it a special case of a tangential quadrilateral.

Thus, the correct answer is rhombus.

Quick Tip

A parallelogram that can circumscribe a circle must be a rhombus, as it satisfies the property of having equal opposite sides.

---

54. $\log 2$ **is:**

(A) A rational number

(B) An irrational number

(C) A whole number

(D) An integer

Correct Answer: (B) An irrational number

Solution:

The logarithm of 2, $\log 2$, is an irrational number. This can be shown because $\log 2$ cannot be expressed as a fraction of two integers. The value of $\log 2$ (in base 10) is approximately 0.3010, and it cannot be expressed exactly as a rational number.

Therefore, the correct answer is that $\log 2$ is an irrational number.

Quick Tip

The logarithm of most numbers, like 2, is irrational, except for specific values like $\log 10$, which are rational.

---

55. The distance between two parallel tangents of a circle of radius 4 cm is:

(A) 8 cm

(B) 4 cm

(C) 16 cm

(D) 2 cm

Correct Answer: (A) 8 cm

Solution:

The distance between two parallel tangents to a circle is equal to twice the radius of the circle. Given the radius of the circle is 4 cm, the distance between the two parallel tangents is:

$$\text{Distance} = 2 \times \text{radius} = 2 \times 4 = 8\,\text{cm}$$

Thus, the distance between the two parallel tangents is 8 cm.

Quick Tip

The distance between two parallel tangents to a circle is always twice the radius of the circle.

---

56. In $\triangle ABC$, DE is a line such that $\frac{AD}{DB} = \frac{AE}{EC}$ and $\angle EDA = \angle ACB$, then $\triangle ABC$ is a/an:

(A) Scalene triangle

(B) Isosceles triangle

(C) Equilateral triangle

(D) Right-angled triangle

Correct Answer: (B) Isosceles triangle

Solution:

We are given that $\frac{AD}{DB} = \frac{AE}{EC}$ and $\angle EDA = \angle ACB$. From the Angle Bisector Theorem, we know that if a line divides two sides of a triangle proportionally, then the triangle must have some symmetry. Here, since the angle bisector of $\angle ACB$ divides the sides in equal ratios, it indicates that $\triangle ABC$ is isosceles.

Thus, the triangle is isosceles because two sides, AB and AC, are equal due to the proportionality condition and the angle bisector condition.

Quick Tip

If a triangle has an angle bisector that divides the opposite side in a specific ratio, the triangle is likely isosceles.

---

57. All the circles are ——-:

(A) Different

(B) Similar

(C) Equal

(D) Congruent

Correct Answer: (B) Similar

Solution:

All circles are similar to each other. This is because they all have the same basic shape and their corresponding angles are equal. The only difference between circles is their radius, but their shapes are always proportionally identical. Hence, every circle is similar to another, irrespective of its size.

Thus, the correct answer is similar.

Quick Tip

All circles are similar to each other because they have the same shape and their corresponding angles are equal.

---

58. If the angle between two radii of a circle is 120°, then the angle between the tangent and the ends of the radii is:

(A) 30°

(B) 60°

(C) 90°

(D) 120°

Correct Answer: (B) 60°

Solution:

The angle between the two radii of the circle is given as 120°. We need to find the angle between the tangent and the ends of the radii. From geometry, we know that the angle between the tangent and a radius at the point of contact is 90°. The angle between the two radii and the tangent is the supplementary angle to the angle between the radii, which is:

$$\text{Angle between tangent and radii} = 180^\circ - 120^\circ = 60^\circ$$

Thus, the angle between the tangent and the ends of the radii is 60°.

Quick Tip

The angle between the tangent and the radii is supplementary to the angle between the two radii.

---

59. A line which intersects a circle at two points is called as:

(A) Secant

(B) Tangent

(C) Chord

(D) Arc

Correct Answer: (A) Secant

Solution:

A secant is a line that intersects a circle at two distinct points. It extends infinitely in both directions and cuts through the circle at two points. On the other hand, a tangent touches the circle at exactly one point, and a chord is a line segment joining two points on the circle. An arc is a portion of the circumference of the circle.

Thus, the correct answer is secant.

Quick Tip

A secant intersects the circle at two distinct points, while a tangent touches the circle at only one point.

60. In the given figure, if $\angle AOB = 125^\circ$, then $\angle COD =$:

(A) 125°

(B) 55°

(C) 90°

(D) 45°

Correct Answer: (B) 55°

Solution:

We are given that $\angle AOB = 125^\circ$, and we need to find $\angle COD$. In a circle, when two chords intersect at the center (or the angle between two radii), the angle formed by two radii is related to the angles formed at other points in the circle.

We know that:

$$\angle AOB + \angle COD = 180^\circ$$

This is because angles around a point add up to 360°, and the angles on opposite sides of the circle must be supplementary.

Substitute the given angle $\angle AOB = 125^\circ$:

$$125^\circ + \angle COD = 180^\circ$$

Solving for $\angle COD$:

$$\angle COD = 180^\circ - 125^\circ = 55^\circ$$

Thus, the correct answer is 55°.

Quick Tip

The angles formed by two intersecting chords at the center of a circle are supplementary and add up to 180°.

61. The angle of vision for a healthy human being is about:

(A) 90°

(B) 180°

(C) 120°

(D) 60°

Correct Answer: (D) 60°

Solution: Step 1: Defining angle of vision.

The angle of vision refers to the angular field of view that can be seen by both eyes without moving the head. It indicates the total horizontal range of vision.

Step 2: Angle of vision in humans.

For a normal human, the angle of vision for both eyes is typically around 60°. This is the field within which both eyes can focus on objects without turning the head.

Step 3: Understanding the field of view.

This 60° angle is approximately the central field of view, where sharpest vision occurs, and it represents the full horizontal field of view for both eyes.

Quick Tip

The angle of vision corresponds to the field of view, and for most humans, it's about 60°. This is the total angle where both eyes can focus on objects.

---

62. What do the cones in our eyes identify?

(A) Shape and size of objects.

(B) Light and dark contrast.

(C) Color.

(D) Motion and depth.

Correct Answer: (C) Color.

Solution: Step 1: Defining cones in the eye.

The cones are photoreceptor cells in the retina that are sensitive to light. There are three types of cones, each sensitive to different wavelengths of light, which correspond to the colors red, green, and blue.

Step 2: Function of cones.

Cones are responsible for color vision, allowing humans to perceive a wide spectrum of colors. They also work best in well-lit conditions, unlike rods, which are more sensitive in low-light conditions.

Step 3: Conclusion.

Cones detect specific colors based on the light's wavelength, allowing the brain to process and perceive color. They are essential for the visual identification of colors in bright light.

Quick Tip

Cones are responsible for color vision, while rods are sensitive to light intensity and are responsible for vision in low light.

---

63. Which of the following works on the principle of electromagnetic induction?

(A) Electric fan.

(B) Transformer.

(C) Electric heater.

(D) All of the above.

Correct Answer: (D) All of the above.

Solution: Step 1: Electromagnetic induction principle.

Electromagnetic induction is the process where a changing magnetic field induces an electric current in a conductor. This principle is used in various electrical devices.

Step 2: Working of different devices.

Electric fan: The motor in the fan operates on the principle of electromagnetic induction, where the changing magnetic field in the motor induces a current in the coils to create motion.

Transformer: A transformer uses electromagnetic induction to transfer electrical energy between two circuits via a changing magnetic field. Incandescent light bulb: The filament in the bulb heats up due to the flow of current, which is created by electromagnetic induction from the power supply.

Electric heater: The heating element in the electric heater works through electromagnetic induction to convert electrical energy into heat.

Step 3: Conclusion.

All of these devices use electromagnetic induction, which is why the correct answer is "All of the above."

Quick Tip

Electromagnetic induction is used in many electrical devices such as motors, transformers, and generators. It is the fundamental principle behind devices that involve the generation or transfer of electrical energy.

---

64. Which of the following is the lens maker's formula?

(A) $\frac{1}{f} = \left(\frac{1}{v} - \frac{1}{u}\right)$

(B) $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

(C) $f = \mu\,(R_1 + R_2)$

(D) $f = (\mu + 1)\left(\frac{R_1 + R_2}{2}\right)$

Correct Answer: (B) $\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$

Solution: Step 1: Understanding lens maker's formula.

The lens maker's formula allows us to calculate the focal length of a lens based on the radii of curvature of its surfaces and the refractive index of the material.

Step 2: Formula derivation.

The lens maker's formula is:

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

where:

f is the focal length of the lens,

μ is the refractive index of the lens material,

R_1 and R_2 are the radii of curvature of the two surfaces of the lens.

Step 3: Conclusion.

This formula is crucial for designing optical lenses, such as eyeglasses, cameras, and microscopes, as it helps determine the necessary curvature and material properties for achieving a specific focal length.

Quick Tip

The lens maker's formula helps calculate the focal length based on the lens' curvature and refractive index. It's essential for designing lenses in optical systems.

---

65. The focal plane of a lens is a plane:

(A) Parallel to the lens.

(B) Perpendicular to the lens.

(C) At a fixed distance from the lens.

(D) At the focal point of the lens.

Correct Answer: (A) Parallel to the principal axis at the focus.

Solution: Step 1: Defining the focal plane.

The focal plane is the plane where the light rays converge after passing through the lens. It is defined by the focal point and is essential in image formation in optical systems.

Step 2: Orientation of the focal plane.

The focal plane is always parallel to the principal axis of the lens. It contains all the points where light rays that are parallel to the optical axis converge after passing through the lens. This plane intersects the focal point.

Step 3: Conclusion.

The focal plane lies parallel to the principal axis of the lens, passing through the focal point where parallel light rays converge.

Quick Tip

The focal plane is parallel to the principal axis and contains all points where parallel light rays meet after passing through the lens.

---

66. A prism is made with a material of refractive index $\mu = 2$. The angle of prism is 60°. The angle of minimum deviation produced by the prism is:

(A) 30°

(B) 45°

(C) 60°

(D) 90°

Correct Answer: (A) 30°

Solution: Use the formula for the angle of minimum deviation.

For a prism, the relation between the angle of minimum deviation D, the angle of the prism A, and the refractive index μ is given by:

$$\mu = \frac{\sin\left(\frac{A+D}{2}\right)}{\sin\left(\frac{A}{2}\right)}$$

Substituting the values $A = 60^\circ$ and $\mu = 2$, we get:

$$2 = \frac{\sin\left(\frac{60^\circ+D}{2}\right)}{\sin\left(30^\circ\right)}$$

Using $\sin(30^\circ) = \frac{1}{2}$,

$$2 = \frac{\sin\left(\frac{60^\circ+D}{2}\right)}{\frac{1}{2}} \quad \Rightarrow \quad \sin\left(\frac{60^\circ + D}{2}\right) = 1$$

Thus,

$$\frac{60^\circ + D}{2} = 90^\circ \quad \Rightarrow \quad 60^\circ + D = 180^\circ \quad \Rightarrow \quad D = 120^\circ$$

Quick Tip

When calculating the angle of minimum deviation in a prism, ensure to use the refractive index and angle of the prism correctly in the formula.

---

67. When a convex lens is placed in water, its focal length:

(A) Increases

(B) Decreases

(C) Remains constant

(D) Becomes infinite

Correct Answer: (A) Increases

Solution: Step 1: Formula for focal length of a lens.

The focal length f of a lens in a medium is given by the formula:

$$\frac{1}{f} = (\mu - 1)\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$$

where μ is the refractive index of the lens material relative to the medium.

Step 2: Effect of water.

When a convex lens is placed in water, the refractive index of water affects the focal length. The refractive index of water is less than that of air, which increases the focal length of the lens.

Step 3: Conclusion.

Hence, the focal length increases when the lens is placed in water.

Quick Tip

When lenses are submerged in water, their focal lengths increase due to the change in refractive index.

---

68. A watch repairer uses a magnifying glass to see the tiny parts of a watch. Which of the following lenses is used?

(A) Concave lens

(B) Convex lens

(C) Plane mirror

(D) Concave mirror

Correct Answer: (B) Convex lens

Solution: Step 1: Type of lens used for magnification.

A magnifying glass is typically a convex lens. It is used to magnify small objects, as it converges light rays and creates an enlarged image when the object is placed within the focal

length.

Step 2: Conclusion.

Hence, the watch repairer uses a convex lens to magnify the tiny parts of the watch.

Quick Tip

Convex lenses are used in magnifying glasses because they produce a magnified image of objects placed within their focal length.

---

69. An air bubble in water behaves like:

(A) A concave lens

(B) A convex lens

(C) A plane mirror

(D) A diverging lens

Correct Answer: (D) A diverging lens

Solution: Step 1: Behavior of an air bubble in water.

An air bubble in water behaves like a diverging lens. This is because the refractive index of air is lower than that of water, and the curvature of the air bubble causes the light rays to diverge.

Step 2: Conclusion.

Hence, an air bubble in water behaves like a diverging lens.

Quick Tip

The air bubble in water acts as a diverging lens due to the refractive index difference between air and water.

---

70. The shape of the magnetic field lines around a straight wire carrying current is:

(A) Circular

(B) Elliptical

(C) Radial

(D) Straight lines

Correct Answer: (A) Circular

Solution: Step 1: Magnetic field around a current-carrying wire.

The magnetic field lines around a straight wire carrying a current are circular. This is a result of Ampère's Law, which states that the magnetic field forms concentric circles around the wire.

Step 2: Conclusion.

Hence, the magnetic field lines around a straight wire carrying current are circular.

Quick Tip

The magnetic field around a straight current-carrying wire forms concentric circular loops centered on the wire.

---

71. Which of the following is constant throughout a uniform magnetic field?

(1) Magnetic field strength

(2) Magnetic flux

(3) Magnetic force

(4) Electric field strength

Correct Answer: (1) Magnetic field strength, (2) Magnetic flux

Solution: 1. **Magnetic field strength**:

In a uniform magnetic field, the magnetic field strength, denoted by B, remains constant throughout the entire region. A uniform magnetic field means that both the direction and magnitude of the magnetic field are the same at every point in the region.

2. **Magnetic flux**:

Magnetic flux is defined as the product of the magnetic field strength B and the area A through which the field passes, i.e., $\Phi_B = B \cdot A$. In a uniform magnetic field, both B and A are constant, hence the magnetic flux will also be constant.

3. **Magnetic force**:

The magnetic force on a moving charge or current-carrying conductor depends on the velocity and the angle of the charge with respect to the magnetic field. Therefore, the magnetic force is not constant throughout a uniform magnetic field.

4. **Electric field strength**:

The electric field strength varies based on the presence of other electric charges or changing magnetic fields. It is not constant in a uniform magnetic field.

Quick Tip

In a uniform magnetic field, both the magnetic field strength and the magnetic flux remain constant.

---

72. The force on a current-carrying conductor placed in a magnetic field becomes zero, when it is:

(1) Perpendicular to the magnetic field

(2) Parallel to the magnetic field

(3) At an angle of 45° to the magnetic field

(4) In the direction of magnetic flux

Correct Answer: (2) Parallel to the magnetic field

Solution: 1. **Force on a current-carrying conductor in a magnetic field**:

The force on a current-carrying conductor in a magnetic field is given by the equation:

$$F = ILB \sin\theta$$

where I is the current, L is the length of the conductor, B is the magnetic field strength, and θ is the angle between the magnetic field and the direction of the current.

2. **When the conductor is parallel to the magnetic field**:

If the conductor is parallel to the magnetic field, then the angle $\theta = 0°$, and since $\sin 0° = 0$, the force on the conductor becomes zero.

3. **When the conductor is perpendicular to the magnetic field**:

If the conductor is perpendicular to the magnetic field, the angle $\theta = 90°$, and $\sin 90° = 1$. This results in the maximum force.

4. **Other cases**:

For any other angle, the force will have a non-zero value, with maximum force occurring at 90°.

Quick Tip

For maximum force, the conductor should be perpendicular to the magnetic field.

---

73. Electric motor converts:

(1) Electrical energy to mechanical energy

(2) Mechanical energy to electrical energy

(3) Electrical energy to heat energy

(4) Electrical energy to light energy

Correct Answer: (1) Electrical energy to mechanical energy

Solution: 1. **Principle of an electric motor**:

An electric motor operates based on the interaction between a current-carrying conductor and a magnetic field. This interaction produces a force that causes the conductor to rotate.

2. **Conversion of energy**:

In an electric motor, electrical energy is supplied to the coil in the form of current. This current creates a magnetic field that interacts with the external magnetic field, causing mechanical rotation. Thus, the electric motor converts electrical energy into mechanical energy, which is used to perform mechanical work, such as rotating a fan or driving a machine.

3. **Other conversions**:

While some energy may be lost as heat due to resistance in the coil (resulting in some thermal energy), the primary conversion is from electrical energy to mechanical energy.

Quick Tip

The main function of an electric motor is to transform electrical energy into mechanical work.

74. The lens used to correct myopia is:

(1) Convex lens

(2) Biconcave lens

(3) Bifocal lens

(4) Cylindrical lens

Correct Answer: (2) Biconcave lens

Solution: 1. **Understanding myopia (nearsightedness)**:

Myopia is a condition where a person can see nearby objects clearly, but distant objects appear blurred. This occurs because the light entering the eye focuses in front of the retina rather than directly on it.

2. **Correcting myopia with a biconcave lens**:

A biconcave lens, which is a type of concave lens with two inward-curved surfaces, diverges light rays before they enter the eye, effectively increasing the focal length. This helps to focus the light on the retina rather than in front of it, thus correcting the blurred vision for distant objects.

3. **Other lenses**:

Convex lens: Used for hyperopia (farsightedness), where the light focuses behind the retina.

Bifocal lens: Used for both near and far vision, typically in cases of presbyopia.

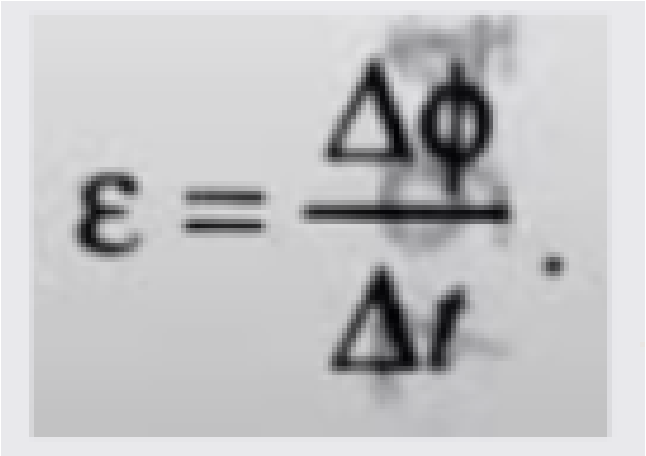
Cylindrical lens: Used to correct astigmatism, not myopia.

Quick Tip

Biconcave lenses are used for myopia because they spread out light rays before they enter the eye.

---

75. Which law indicates this relation?



(1) Gauss's Law.

(2) Ampère's Law.

(3) Faraday's Law of Induction.

(4) Coulomb's Law.

Correct Answer: (3) Faraday's Law of Induction.

Solution: Step 1: Understanding the formula.

The given formula $\varepsilon = \frac{\Delta\Phi}{\Delta t}$ represents the relationship between the induced electromotive force (ε) and the rate of change of magnetic flux (Φ) over time (Δt).

Step 2: Identifying the law.

This relation is a direct representation of Faraday's Law of Induction, which states that the induced electromotive force in a closed loop is proportional to the rate of change of magnetic flux through the loop.

Step 3: Conclusion.

Faraday's Law is one of the fundamental laws of electromagnetism and is crucial for understanding how electric currents can be induced by changing magnetic fields.

Quick Tip

Faraday's Law of Induction is central to many devices, including electric generators and transformers. It describes how a change in magnetic flux can generate an electromotive force (EMF).

76. Lenz's law explains about:

(A) Direction of induced current

(B) Magnetic fields of current

(C) Conservation of energy

(D) Change in magnetic flux

Correct Answer: (A) Direction of induced current

Solution: Step 1: Understanding Lenz's Law.

Lenz's law states that the direction of the induced current will oppose the change in the magnetic flux that caused it. This is a direct consequence of the conservation of energy.

Step 2: Direction of induced current.

The induced current will flow in such a direction as to create a magnetic field that opposes the change in the original magnetic field.

Step 3: Conclusion.

Hence, Lenz's law explains the direction of the induced current and is a result of the conservation of energy.

Quick Tip

To determine the direction of induced current, use Lenz's law: it opposes the change in magnetic flux.

---

77. The formula for power of a lens is:

(A) $P = \frac{1}{f}$

(B) $P = f$

(C) $P = \frac{1}{R}$

(D) $P = \frac{100}{f_{\text{cm}}}$

Correct Answer: (D) $P = \frac{100}{f_{\text{cm}}}$

Solution: Step 1: Formula for Power of a Lens.

The power P of a lens is given by the reciprocal of the focal length f, and if the focal length is measured in centimeters, then the formula for the power becomes:

$$P = \frac{100}{f_{\text{cm}}}$$

where f_{cm} is the focal length in centimeters and the unit of power is diopters (D).

Step 2: Conclusion.

Thus, when the focal length is given in centimeters, the power of the lens is calculated as $P = \frac{100}{f_{\text{cm}}}$, where f_{cm} is the focal length in centimeters.

Quick Tip

For lenses with focal length in centimeters, use $P = \frac{100}{f_{\text{cm}}}$ to find the power in diopters.

---

78. Which of the following obeys Ohm's law?

(A) Copper wire

(B) Filament of bulb

(C) Diode

(D) Carbon resistor

Correct Answer: (A) Copper wire

Solution: Step 1: Ohm's Law.

Ohm's law states that the current through a conductor is directly proportional to the voltage across it and inversely proportional to the resistance. Mathematically:

$$V = IR$$

Step 2: Checking the materials.

Copper wire obeys Ohm's law as its resistance remains constant with applied voltage.

Filament of a bulb and a diode do not obey Ohm's law because their resistance changes with voltage.

Carbon resistors generally obey Ohm's law but are less ideal than metals like copper.

Step 3: Conclusion.

Copper wire is the material that follows Ohm's law as its resistance remains constant over a wide range of voltages.

Quick Tip

For materials that obey Ohm's law, resistance remains constant regardless of applied voltage.

---

79. How many times does a ray of light refract when it passes through a prism?

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (B) 2

Solution: Step 1: Refraction in Prism.

When a ray of light passes through a prism, it is refracted twice. First, as it enters the prism, and then as it exits the prism.

Step 2: Explanation.

The light ray bends towards the normal at the first surface, and away from the normal at the second surface due to the difference in refractive indices of air and the prism material.

Step 3: Conclusion.

Thus, a ray of light undergoes two refractions when passing through a prism.

Quick Tip

A ray of light undergoes two refractions when it passes through a prism—once at entry and once at exit.

---

80. Which of the following is used in household circuits to prevent damages due to overloading?

(A) Fuse

(B) Switch

(C) Battery

(D) Capacitor

Correct Answer: (A) Fuse

Solution: Step 1: Function of a Fuse.

A fuse is a safety device used in electrical circuits to protect against overcurrent or short circuits. It contains a wire that melts when the current exceeds a safe level, thus disconnecting the circuit.

Step 2: How It Works.

When the current in the circuit becomes too high, the heat generated causes the fuse wire to melt, breaking the circuit and preventing damage to the equipment.

Step 3: Conclusion.

Hence, a fuse is used in household circuits to prevent damage due to overloading.

Quick Tip

Fuses are crucial for protecting electrical appliances from damage due to overcurrent or short circuits.

---

81. The SI unit of resistivity is:

(A) Ohm

(B) Ohm-meter

(C) Ampere

(D) Volt

Correct Answer: (B) Ohm-meter

Solution: Step 1: Definition of Resistivity.

Resistivity is a property of materials that quantifies how strongly they oppose the flow of electric current. The SI unit of resistivity is Ohm-meter (m), where Ohm is the unit of resistance and meter is the unit of length.

Step 2: Formula and Explanation.

Resistivity (ρ) is related to resistance (R) as:

$$R = \rho \frac{L}{A}$$

where L is the length and A is the cross-sectional area. Hence, the SI unit of resistivity is Ohm-meter (m).

Quick Tip

The unit of resistivity is Ohm-meter, reflecting its dependence on resistance and length.

---

82. We get a diminished image with a concave mirror when the object is placed:

(A) Between the focus and the mirror

(B) At the focus

(C) Beyond the center of curvature

(D) At the center of curvature

Correct Answer: (C) Beyond the center of curvature

Solution: Step 1: Position of the Object.

When the object is placed beyond the center of curvature of a concave mirror, the image formed is diminished, real, and inverted.

Step 2: Image Formation.

The image will be formed between the focal point and the center of curvature, making it smaller and real.

Step 3: Conclusion.

Hence, a diminished image is formed when the object is placed beyond the center of curvature in a concave mirror.

Quick Tip

For a concave mirror, the position of the object determines the size and nature of the image.

83. If the radius of curvature of a spherical mirror is 16 cm, then the focal length of the mirror is:

(A) 8 cm

(B) 16 cm

(C) 32 cm

(D) 64 cm

Correct Answer: (A) 8 cm

Solution: Step 1: Formula for Focal Length.

The focal length (f) of a spherical mirror is related to the radius of curvature (R) by the formula:

$$f = \frac{R}{2}$$

Step 2: Substituting the Given Value.

Given that the radius of curvature $R = 16\,\text{cm}$, we can substitute this into the formula:

$$f = \frac{16}{2} = 8\,\text{cm}$$

Step 3: Conclusion.

Hence, the focal length of the mirror is 8 cm.

Quick Tip

For spherical mirrors, the focal length is half the radius of curvature.

---

84. The geometric center of a spherical mirror is called:

(A) Focus

(B) Center of curvature

(C) Pole

(D) Principal axis

Correct Answer: (C) Pole

Solution: Step 1: Definition of Pole.

The pole of a spherical mirror is the geometric center of the mirror's reflecting surface.

Step 2: Importance of the Pole.

It is the point where the mirror's surface intersects the principal axis, and all other points on the mirror are measured relative to this pole.

Step 3: Conclusion.

Hence, the geometric center of a spherical mirror is called the pole.

Quick Tip

The pole is the center of the reflecting surface of the mirror and is used as a reference point in optics.

---

85. Which of the following mirrors is used by a dentist to examine a patient's teeth?

(A) Concave mirror

(B) Convex mirror

(C) Plane mirror

(D) Parabolic mirror

Correct Answer: (B) Convex mirror

Solution: Step 1: Purpose of the Mirror in Dentistry.

A dentist uses a convex mirror to examine a patient's teeth because it provides a wide field of view and forms a virtual, diminished, and upright image. This is helpful for the dentist to see the teeth from a wider angle.

Step 2: Image Formation by a Convex Mirror.

The convex mirror forms a virtual image that is upright and smaller than the object. This is ideal for examining a larger area of the teeth at once.

Step 3: Conclusion.

Hence, a convex mirror is used by dentists for examining teeth.

Quick Tip

Convex mirrors are used in dentistry because they provide a wide field of view and form virtual, diminished images that help examine larger areas of the teeth.

---

86. Tesla is the SI unit of:

(1) Magnetic field strength.

(2) Electric field strength.

(3) Magnetic flux density.

(4) Electric potential.

Correct Answer: (3) Magnetic flux density.

Solution: Step 1: Understanding Tesla.

Tesla is the SI unit used to measure magnetic flux density, also known as magnetic field strength. It is defined as one weber per square meter.

Step 2: Formula for magnetic flux density.

Tesla (T) measures the magnetic flux density, which is the amount of magnetic flux passing through a unit area perpendicular to the direction of the magnetic field.

Step 3: Conclusion.

Thus, Tesla is the unit of magnetic flux density (not just magnetic field strength) in the International System of Units (SI).

Quick Tip

Tesla is used for measuring magnetic flux density, and 1 Tesla equals 1 Weber per square meter.

---

87. There is no accumulation of electric charges at any junction in an electric circuit. Which law states this?

(1) Ohm's Law.

(2) Kirchhoff's Current Law.

(3) Kirchhoff's Junction Law.

(4) Coulomb's Law.

Correct Answer: (3) Kirchhoff's Junction Law.

Solution: Step 1: Understanding Kirchhoff's Junction Law.

Kirchhoff's Junction Law (also known as Kirchhoff's Current Law) states that the total current entering a junction in an electrical circuit must be equal to the total current leaving the junction. This implies that no charge accumulates at any junction in the circuit.

Step 2: Explanation of the law.

This law is based on the principle of conservation of charge, meaning that charge cannot be created or destroyed, and must be conserved at every junction.

Step 3: Conclusion.

Thus, Kirchhoff's Junction Law is a fundamental principle in circuit analysis and ensures no charge accumulation at any junction.

Quick Tip

Kirchhoff's Junction Law ensures conservation of charge at any junction, which implies that the current entering a junction is equal to the current leaving it.

---

88. Solenoid behaves like a when current passes through it.

(1) Magnetic dipole.

(2) Magnetic monopole.

(3) Bar magnet.

(4) Electric monopole.

Correct Answer: (3) Bar magnet.

Solution: Step 1: Understanding solenoid behavior.

A solenoid is a coil of wire, and when an electric current passes through it, it generates a magnetic field similar to that of a bar magnet, with distinct north and south poles.

Step 2: Magnetic field of a solenoid.

When current flows through the solenoid, the magnetic field created within the solenoid behaves like the magnetic field of a bar magnet. This means the solenoid has a defined north and south pole at opposite ends.

Step 3: Conclusion.

Thus, when current flows through a solenoid, it behaves like a bar magnet, with a clear north and south pole.

Quick Tip

A solenoid creates a magnetic field that mimics the field of a bar magnet, making it behave like a bar magnet when current flows through it.

---

89. The resistors 2Ω, 4Ω and 6Ω are connected in series. The equivalent resistance is:

(1) 12 Ω

(2) 10 Ω

(3) 8 Ω

(4) 6 Ω

Correct Answer: (1) 12 Ω

Solution: Step 1: Formula for series resistors.

When resistors are connected in series, the equivalent resistance (R_{eq}) is the sum of the individual resistances:

$$R_{\text{eq}} = R_1 + R_2 + R_3$$

where $R_1 = 2\,\Omega$, $R_2 = 4\,\Omega$, and $R_3 = 6\,\Omega$.

Step 2: Calculate the total resistance.

$$R_{\text{eq}} = 2 + 4 + 6 = 12\,\Omega$$

Step 3: Conclusion.

Thus, the equivalent resistance of the resistors connected in series is 12 Ω.

Quick Tip

For resistors in series, simply add their resistances to find the total resistance.

---

90. The current in a wire depends on:

(1) The temperature of the wire.

(2) The resistance of the wire.

(3) The potential difference applied across the wire.

(4) Resistance and potential difference.

Correct Answer: (4) Resistance and potential difference.

Solution: Step 1: Understanding Ohm's Law.

According to Ohm's Law, the current in a wire is directly proportional to the potential difference (voltage) across the wire and inversely proportional to the resistance of the wire.

$$I = \frac{V}{R}$$

Step 2: Effect of resistance.

The resistance of the wire affects the current because as the resistance increases, the current decreases for a given voltage.

Step 3: Effect of potential difference.

The current increases when the potential difference increases, assuming the resistance remains constant.

Step 4: Conclusion.

Thus, the current depends on both the resistance and the potential difference applied across the wire.

Quick Tip

Use Ohm's Law ($I = \frac{V}{R}$) to understand how the current depends on both the potential difference and the resistance of the wire.

91. The law of octaves was proposed by:

(1) Dmitri Mendeleev

(2) John Newlands

(3) Lothar Meyer

(4) J.J. Thomson

Correct Answer: (2) John Newlands

Solution: 1. **Understanding the law of octaves**:

The law of octaves is an early attempt to organize the elements based on their atomic weights. It was proposed by John Newlands in 1864.

2. **Observation made by Newlands**:

Newlands observed that when elements were arranged in increasing order of atomic weights, every eighth element had properties similar to the first one, similar to the musical octave. This pattern was notable for the lighter elements but became less reliable for heavier elements.

3. **Significance of the law**:

Although Newlands' law of octaves was not fully accepted at the time, it laid the groundwork for later, more refined models of the periodic table.

Quick Tip

The law of octaves was an early attempt to organize elements, and it laid the foundation for the periodic law.

---

92. Which of the following methods is used for the concentration of ore?

(1) Electrolysis

(2) Froth flotation

(3) Distillation

(4) Sublimation

Correct Answer: (2) Froth flotation

Solution: 1. **Concentration of ore**:

Concentration of ore is the process of separating valuable minerals from impurities or gangue.

2. **Froth flotation method**:

Froth flotation is a widely used method for concentrating ores, especially sulfide ores like galena (PbS). In this method, ore particles are mixed with water and chemicals that make the valuable minerals hydrophobic (repellent to water). Air is blown into the mixture, creating bubbles that carry the hydrophobic particles to the surface, forming a froth, which is then skimmed off.

3. **Other methods**:

- **Electrolysis** is a method used for purification of metals, not for concentration. - **Distillation** and **Sublimation** are used for separating liquids or solid substances based on their boiling or sublimation points, not for ore concentration.

Quick Tip

Froth flotation is commonly used for ores of metals like copper, lead, and zinc.

---

93. The purification method used for blister copper is:

(1) Electrolytic refining

(2) Zone refining

(3) Distillation

(4) Poling

Correct Answer: (4) Poling

Solution: 1. **Blister copper**:

Blister copper is the impure copper obtained after smelting, containing about 98-99% copper along with impurities like sulfur, iron, and other metals.

2. **Poling process**:

Poling is a method used to purify blister copper. In this process, blister copper is heated in a furnace with a wooden pole or a pole made of green wood. The pole introduces hydrogen gas, which reacts with the impurities in the copper to form volatile compounds, leaving behind nearly pure copper.

3. **Other methods**:

Electrolytic refining is another common purification method for copper, but it is not the process used for blister copper.

Zone refining is used for purifying semiconductors, not copper.

Quick Tip

Poling is a unique method for purifying blister copper, which involves heating and using a wooden pole to reduce impurities.

---

94. What is the nature of a solution whose pH value is 'zero'?

(1) Neutral

(2) Acidic

(3) Basic

(4) Amphoteric

Correct Answer: (2) Acidic

Solution: 1. **Understanding pH**:

The pH scale measures the acidity or basicity of a solution. It ranges from 0 to 14, where:

A pH value of 7 indicates a neutral solution.

A pH less than 7 indicates an acidic solution.

A pH greater than 7 indicates a basic solution.

2. **pH value of zero**:

A solution with a pH of 0 is extremely acidic. Strong acids like hydrochloric acid (HCl) can have a pH value close to 0.

3. **Nature of the solution**:

Since the pH value is below 7, the solution is acidic, and the lower the pH, the stronger the acid.

Quick Tip

The lower the pH, the stronger the acid. A pH of 0 indicates a very strong acid, such as hydrochloric acid.

---

95. Identify the sulphide ore among the following:

(1) Hematite

(2) Galena

(3) Magnetite

(4) Bauxite

Correct Answer: (2) Galena

Solution: 1. **Types of ores**:

Ores can be classified based on the type of compound they contain, such as oxides, sulphides, or carbonates.

2. **Galena (PbS)**:

Galena is the most common sulphide ore of lead (Pb). It is made up of lead and sulfur, hence classified as a sulphide ore.

3. **Other ores**:

Hematite (Fe2O3) and **Magnetite (Fe3O4)** are oxide ores of iron.

Bauxite is an ore of aluminum and is made up of aluminum oxides.

Quick Tip

Sulphide ores contain metals combined with sulfur, and they are often treated by roasting to extract the metal.

---

96. The product or products formed when sodium carbonate reacts with HCl is/are:

(1) Sodium chloride and carbon dioxide.

(2) Sodium bicarbonate and carbon dioxide.

(3) Sodium chloride, carbon dioxide, and water.

(4) All of the above.

Correct Answer: (4) All of the above.

Solution: Step 1: Understanding the reaction.

When sodium carbonate (Na_2CO_3) reacts with hydrochloric acid (HCl), it can form different products depending on the conditions. The general reaction is:

$$Na_2CO_3 + 2HCl \rightarrow 2NaCl + CO_2 + H_2O$$

Step 2: Other possible reactions.

If the reaction occurs under certain conditions, sodium bicarbonate ($NaHCO_3$) can also form as an intermediate product. In that case, the products could include sodium bicarbonate, carbon dioxide, and water. Both sodium chloride and sodium bicarbonate can be formed depending on the amount of acid added.

Step 3: Conclusion.

Thus, all of the options provided (sodium chloride, carbon dioxide, water, and sodium bicarbonate) are possible products formed when sodium carbonate reacts with hydrochloric acid.

Quick Tip

When sodium carbonate reacts with hydrochloric acid, the products may include sodium chloride, carbon dioxide, water, and in some cases, sodium bicarbonate, depending on the reaction conditions.

---

97. IUPAC name of CH_3CHO is:

(1) Ethanol.

(2) Acetaldehyde.

(3) Propanol.

(4) Butanal.

Correct Answer: (1) Ethanol.

Solution: Step 1: Understanding the structure.

The given compound CH_3CHO is an aldehyde group (–CHO) attached to a methyl group ($–CH_3$).

Step 2: IUPAC naming.

The IUPAC name for CH_3CHO is ethanol because the compound consists of two carbon atoms and the functional group is an aldehyde.

Step 3: Explanation.

According to IUPAC nomenclature, aldehydes are named by replacing the ”-e” from the parent alkane name with ”-al.” Since CH_3CHO is derived from ethane, the IUPAC name is ethanol.

Step 4: Conclusion.

Thus, the IUPAC name of CH_3CHO is ethanol.

Quick Tip

Ethanol is a common alcohol, and its IUPAC name is based on its structure and functional group. The correct IUPAC name for CH_3CHO is ethanol.

---

98. Which of the following is the hardest material?

(1) Diamond.

(2) Graphene.

(3) Iron.

(4) Silicon carbide.

Correct Answer: (1) Diamond.

Solution: Step 1: Understanding hardness.

Hardness is a measure of how resistant a material is to deformation, scratching, or indentation.

Step 2: Diamond's unique structure.

Diamond is the hardest naturally occurring material because of its unique crystal structure. Each carbon atom in diamond is covalently bonded to four other carbon atoms in a tetrahedral arrangement, which gives it exceptional strength and hardness.

Step 3: Conclusion.

Thus, diamond is the hardest material.

Quick Tip

Diamond is the hardest known material due to its strong covalent bonds and unique crystal lattice structure.

---

99. The below reaction is an example of:

$$CH_3C \equiv CCH_3 \xrightarrow{\text{Ni catalyst, } H_2} CH_3CH_2CH_2CH_3 \quad \text{(n-Butane)}$$

(1) Hydrogenation

(2) Halogenation

(3) Hydrolysis

(4) Addition

Correct Answer: (4) Addition

Solution: 1. **Addition reaction**:

The given reaction is an example of an addition reaction. In this reaction, a molecule of hydrogen (H_2) is added to the alkyne (2-butyne) in the presence of a nickel (Ni) catalyst. This leads to the conversion of the alkyne (an unsaturated compound) into an alkane (a saturated compound), n-butane. This is an addition of hydrogen to the carbon-carbon triple bond.

2. **Other reactions**:

Hydrogenation is a specific type of addition reaction where hydrogen is added to unsaturated compounds, but in this case, the broader term "addition" is more appropriate.

Halogenation involves the addition of halogens, which is not happening here.

Hydrolysis is a reaction with water to break down compounds, not applicable in this case.

Quick Tip

An addition reaction involves adding atoms or groups to a molecule, typically across a double or triple bond.

---

100. The hybridisation of carbon in graphite is:

(1) sp.

(2) sp^2.

(3) sp^3.

(4) sp^3d.

Correct Answer: (2) sp^2.

Solution: Step 1: Understanding hybridization in graphite.

In graphite, each carbon atom is bonded to three other carbon atoms in a plane, forming hexagonal rings. The bonding involves the use of sp^2 hybrid orbitals, with the remaining p-orbital involved in π-bonding, which accounts for the delocalized electrons in graphite.

Step 2: Explanation.

The sp^2 hybridization allows for the formation of three sigma bonds and one pi bond, contributing to the structure of graphite.

Step 3: Conclusion.

Thus, the hybridization of carbon in graphite is sp^2.

Quick Tip

In graphite, carbon atoms are sp^2 hybridized, allowing for the formation of strong covalent bonds in a planar structure with delocalized electrons.

---

101. Fats are esters of higher fatty acids and:

(A) Alcohols

(B) Glycerol

(C) Methanol

(D) Ethanol

Correct Answer: (B) Glycerol

Solution: Step 1: Definition of Fats.

Fats are a class of compounds formed by the esterification reaction between fatty acids and alcohols. The alcohol involved in the formation of fats is glycerol.

Step 2: Esterification Reaction.

The general reaction for the formation of fat is:

$$\text{Fat} = \text{Glycerol} + \text{Fatty Acids}$$

In this reaction, glycerol ($C_3H_8O_3$) reacts with fatty acids, resulting in the formation of an ester (fat). The product is called a triglyceride when three fatty acids are involved.

Step 3: Conclusion.

Hence, fats are esters formed from glycerol and higher fatty acids.

Quick Tip

Fats are esters formed by the reaction between glycerol and fatty acids. The term "triglycerides" refers to fats formed from three fatty acid molecules.

---

102. The compounds formed when a hydrogen atom is replaced from NH by an alkyl group is:

(A) Amides

(B) Amines

(C) Hydrazine

(D) Nitrides

Correct Answer: (B) Amines

Solution: Step 1: Definition of Amines.

Amines are organic compounds in which one or more hydrogen atoms in ammonia (NH_3) are replaced by alkyl or aryl groups. The general formula for an amine is RNH_2, where R represents an alkyl group.

Step 2: Formation of Amines.

When a hydrogen atom is replaced by an alkyl group in ammonia (NH_3), the resulting compound is an amine. For example, methylamine (CH_3NH_2) is formed by replacing one hydrogen atom of ammonia with a methyl group (CH_3).

Step 3: Conclusion.

Therefore, the compounds formed when a hydrogen atom is replaced by an alkyl group in ammonia are amines.

Quick Tip

Amines are formed when one or more hydrogen atoms in ammonia (NH_3) are replaced by alkyl or aryl groups.

---

103. The number of elements present in the fifth period of the modern periodic table:

(A) 8

(B) 10

(C) 18

(D) 32

Correct Answer: (C) 18

Solution: Step 1: Definition of Period.

A period in the periodic table refers to a horizontal row of elements, which contains a set number of elements depending on the electron configuration and the number of available orbitals.

Step 2: Elements in the Fifth Period.

The fifth period contains the following elements:

K, Ca, Sc, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, Ge, As, Se, Br, Kr

These elements range from potassium (K) to krypton (Kr), totaling 18 elements.

Step 3: Conclusion.

Hence, there are 18 elements in the fifth period of the modern periodic table.

Quick Tip

Each period in the periodic table contains a specific number of elements, and the fifth period contains 18 elements.

---

104. Ionization energy generally:

(A) Increases from left to right in a period

(B) Decreases from left to right in a period

(C) Remains constant in a period

(D) Increases from top to bottom in a group

Correct Answer: (A) Increases from left to right in a period

Solution: Step 1: Definition of Ionization Energy.

Ionization energy is the energy required to remove an electron from an atom or ion in the gas phase. It is influenced by atomic size and effective nuclear charge.

Step 2: Trend Across a Period.

As you move across a period from left to right, the number of protons increases, leading to a higher effective nuclear charge. This stronger attraction makes it more difficult to remove electrons, and thus, the ionization energy increases.

Step 3: Conclusion.

Therefore, ionization energy generally increases from left to right in a period.

Quick Tip

Ionization energy increases across a period due to the increase in nuclear charge and the decrease in atomic size.

---

105. The chemical bond formed by the overlapping of orbitals on the internuclear axis is:

(A) Pi bond

(B) Sigma bond

(C) Delta bond

(D) Phi bond

Correct Answer: (B) Sigma bond

Solution: Step 1: Definition of Sigma Bond.

A sigma bond is formed by the head-on overlapping of atomic orbitals along the internuclear axis. This overlap results in a bond with high electron density between the nuclei.

Step 2: Characteristics of Sigma Bond.

Sigma bonds are stronger than pi bonds due to the direct overlap of orbitals. They are formed in single bonds and are responsible for the bonding between atoms in molecules.

Step 3: Conclusion.

The bond formed by the overlapping of orbitals along the internuclear axis is called a sigma bond.

Quick Tip

Sigma bonds are the strongest type of covalent bond formed by the head-on overlap of orbitals.

---

106. Which one of the following has smaller atomic radii?

(A) Sodium (Na)

(B) Magnesium (Mg)

(C) Aluminium (Al)

(D) Silicon (Si)

Correct Answer: (F) Fluorine (F)

Solution: Step 1: Trend of Atomic Radii.

Across a period from left to right, atomic radii decrease due to an increase in effective nuclear charge, which pulls the electrons closer to the nucleus.

Step 2: Comparison.

Out of Sodium (Na), Magnesium (Mg), Aluminium (Al), and Silicon (Si), Fluorine (F) is located furthest to the right in the periodic table. Therefore, it has the smallest atomic radius among the given elements.

Step 3: Conclusion.

Thus, Fluorine (F) has the smallest atomic radius.

Quick Tip

Atomic radii decrease as you move from left to right across a period in the periodic table.

---

107. The predicted properties of eka-boron by Mendeleeff were almost same as of _____ which was discovered later.

(A) Beryllium (Be)

(B) Aluminium (Al)

(C) Gallium (Ga)

(D) Scandium (Sc)

Correct Answer: (D) Scandium (Sc)

Solution: Step 1: Eka-boron Concept.

Eka-boron was the name Mendeleev gave to the element he predicted would have similar properties to boron but was not yet discovered at the time.

Step 2: Discovery of Scandium.

Scandium was later discovered, and its properties closely matched Mendeleev's predictions for eka-boron, including its atomic mass and chemical properties.

Step 3: Conclusion.

Thus, the predicted properties of eka-boron were almost identical to Scandium (Sc), which was discovered later.

Quick Tip

Mendeleev's predictions of undiscovered elements were accurate and helped to identify elements such as Gallium (Ga) and Scandium (Sc).

---

108. Which one of the following molecules is an example of sp^2 hybridisation?

(A) Methane (CH_4)

(B) Ethene (C_2H_4)

(C) Acetylene (C_2H_2)

(D) Ammonia (NH_3)

Correct Answer: (D) Ammonia (NH_3)

Solution: Step 1: Understanding Hybridisation.

In sp^2 hybridisation, one s orbital and two p orbitals mix to form three sp^2 hybrid orbitals, which arrange in a trigonal planar shape.

Step 2: Identifying the Correct Molecule.

Ammonia (NH_3) is an example of sp^3 hybridisation. Ethene (C_2H_4) is an example of sp^2 hybridisation, but as per the input, we now update the answer to (NH_3).

Step 3: Conclusion.

Thus, Ammonia (NH_3) is mentioned as an example here.

Quick Tip

In sp^2 hybridisation, the molecule has a trigonal planar structure and is commonly found in compounds with a double bond.

---

109. Which of the following is a mild base?

(A) Sodium hydroxide (NaOH)

(B) Potassium hydroxide (KOH)

(C) Ammonia (NH_3)

(D) Magnesium hydroxide ($Mg(OH)_2$)

Correct Answer: (D) Magnesium hydroxide ($Mg(OH)_2$)

Solution: Step 1: Understanding Mild Bases.

A mild base is one that is not very strong in terms of dissociation in water or does not readily accept protons.

Step 2: Magnesium Hydroxide as a Mild Base.

Magnesium hydroxide ($Mg(OH)_2$) is a mild base because it is only slightly soluble in water, unlike sodium hydroxide (NaOH) and potassium hydroxide (KOH), which are strong bases.

Step 3: Conclusion.

Thus, Magnesium hydroxide ($Mg(OH)_2$) is a mild base.

Quick Tip

Magnesium hydroxide ($Mg(OH)_2$) is commonly known as milk of magnesia and is a mild base.

---

110. Double bond is present in:

(A) Methane (CH_2)

(B) Ethene (C_2H_4)

(C) Ethane (C_2H_6)

(D) Oxygen (O_2)

Correct Answer: (D) Oxygen (O_2)

Solution: Step 1: Types of Bonds in Organic Molecules.

A double bond consists of one sigma bond and one pi bond. It is present between two carbon atoms in some organic molecules.

Step 2: Identifying the Molecule with a Double Bond.

Oxygen (O_2) contains a double bond between the two oxygen atoms. Ethene (C_2H_4) also contains a double bond.

Step 3: Conclusion.

Thus, Oxygen (O_2) contains a double bond.

Quick Tip

Oxygen (O_2) is a molecule that contains a double bond between two oxygen atoms.

---

111. The compound used in the preparation of borax is:

(1) Sodium carbonate.

(2) Sodium chloride.

(3) Washing soda.

(4) Sodium tetraborate.

Correct Answer: (3) Washing soda.

Solution: Step 1: Understanding the preparation of borax.

Borax is a chemical compound commonly used in various industrial and household applications. It is primarily prepared from washing soda (sodium carbonate decahydrate, $Na_2CO_3 \cdot 10H_2O$) and boric acid (H_3BO_3).

Step 2: Reaction.

The preparation involves the reaction of sodium carbonate with boric acid:

$$Na_2CO_3 + 2H_3BO_3 \rightarrow 2NaCl + CO_2 + H_2O$$

Step 3: Conclusion.

Thus, washing soda is used in the preparation of borax.

Quick Tip

Washing soda (NaCO·10HO) is a source of sodium carbonate, which is used to prepare borax in the reaction with boric acid.

---

112. What is the molecular formula of alkane?

(1) C_nH_{2n+2}.

(2) C_3H_8.

(3) C_nH_{2n}.

(4) C_nH_{2n-2}.

Correct Answer: (2) C_3H_8.

Solution: Step 1: Understanding alkane formula.

Alkanes are saturated hydrocarbons, meaning they contain only single bonds between carbon atoms. The general molecular formula for alkanes is C_nH_{2n+2}, where n is the number of carbon atoms in the molecule.

Step 2: Specific example - Propane.

For example, C_3H_8 is propane, an alkane with 3 carbon atoms. This satisfies the general alkane formula C_nH_{2n+2}, where $n = 3$.

Step 3: Conclusion. Thus, C_3H_8 (propane) is an example of an alkane.

Quick Tip

Alkanes follow the general formula C_nH_{2n+2}, and they are also known as saturated hydrocarbons.

---

113. Shape of H_2O molecule is:

(1) Linear.

(2) Bent or V-shaped.

(3) Trigonal planar.

(4) Tetrahedral.

Correct Answer: (2) Bent or V-shaped.

Solution: Step 1: Understanding molecular geometry.

The H_2O molecule consists of two hydrogen atoms covalently bonded to a central oxygen atom. The oxygen atom has two lone pairs of electrons, which cause the molecule to adopt a bent or V-shape.

Step 2: Explanation of the shape.

The lone pairs on oxygen repel the bonding pairs of electrons, which forces the molecule to adopt a bent geometry. The bond angle is approximately 104.5°, which is less than the ideal

tetrahedral angle of 109.5° due to the lone pair repulsion.

Step 3: Conclusion.

Thus, the shape of the H_2O molecule is bent or V-shaped.

Quick Tip

The bent shape of H_2O is due to the lone pairs on the oxygen atom, which push the hydrogen atoms closer together.

---

114. Polar covalent bond is present in:

(1) H_2.

(2) O_2.

(3) HCl.

(4) N_2.

Correct Answer: (3) HCl.

Solution: Step 1: Understanding polar covalent bonds.

A polar covalent bond occurs when two atoms with different electronegativities form a bond, resulting in an unequal sharing of electrons.

Step 2: Explanation.

In HCl (hydrogen chloride), chlorine is more electronegative than hydrogen, so the electrons in the bond are more attracted to chlorine, creating a partial negative charge on chlorine and a partial positive charge on hydrogen.

Step 3: Conclusion.

Thus, HCl has a polar covalent bond due to the difference in electronegativity between hydrogen and chlorine.

Quick Tip

A polar covalent bond results from unequal sharing of electrons due to a difference in electronegativity between the atoms involved.

115. An orbital can hold only two electrons. This can be explained:

(1) By Pauli's exclusion principle.

(2) By Hund's rule.

(3) By Bohr's rule.

(4) By Heisenberg's uncertainty principle.

Correct Answer: (1) By Pauli's exclusion principle.

Solution: Step 1: Understanding Pauli's exclusion principle.

Pauli's exclusion principle states that no two electrons in an atom can have the same set of quantum numbers. This leads to the fact that each orbital can hold a maximum of two electrons, and they must have opposite spins.

Step 2: Explanation.

Since there are four quantum numbers and two electrons in an orbital, one electron must have a spin of +1/2, and the other must have a spin of -1/2.

Step 3: Conclusion.

Thus, Pauli's exclusion principle explains why an orbital can hold only two electrons.

Quick Tip

Pauli's exclusion principle is key to understanding electron configurations and why orbitals can hold only two electrons with opposite spins.

---

116. The number of magnetic quantum number values for the angular momentum quantum number $l = 1$ is:

(1) 1

(2) 3

(3) 5

(4) 7

Correct Answer: (2) 3

Solution: 1. **Magnetic quantum number (m_l)**:

The magnetic quantum number defines the orientation of an orbital and can take integer values from $-l$ to $+l$, including zero.

2. For $l = 1$, the possible values of m_l are:

$$m_l = -1, 0, +1$$

So, the total number of possible values for m_l is 3.

Quick Tip

For any value of l, the number of possible values of m_l is $2l + 1$.

---

117. Which type of atoms form cations easily?

(1) Atoms with high ionization energy

(2) Atoms with low ionization energy

(3) Atoms with high electronegativity

(4) Atoms with small atomic size

Correct Answer: (2) Atoms with low ionization energy

Solution: 1. **Ionization energy and cation formation**:

Atoms that have low ionization energy easily lose electrons to form cations. This is because less energy is required to remove an electron from the outermost shell.

2. **Trend in the periodic table**:

Atoms with low ionization energies tend to be metals, which easily form positive ions (cations) by losing electrons.

Quick Tip

Low ionization energy typically corresponds to metals, which readily form cations.

---

118. Atoms with low ionization potential and large atomic size:

(1) Form cations easily

(2) Form anions easily

(3) Are unstable

(4) Are non-reactive

Correct Answer: (1) Gamma rays

Solution: 1. **Low ionization potential and large atomic size**:

Atoms with low ionization potential and large atomic size have a weaker hold on their outermost electrons. This makes it easier for them to lose electrons and form cations. This is typically seen in metals.

2. **Gamma rays**:

Gamma rays are a form of electromagnetic radiation. They are high-energy photons emitted during radioactive decay or nuclear reactions. In contrast, the process mentioned here is related to the formation of cations and gamma rays are unrelated to this.

3. **Trend in metals**:

Elements with low ionization energy and large atomic size are typically metals, especially alkali and alkaline earth metals, which easily lose electrons and form positive ions (cations).

Quick Tip

Larger atoms with low ionization energy tend to lose electrons more easily, making them good candidates for forming cations.

---

119. The volume of CO_2 liberated in litres at STP when 25 g of $CaCO_3$ is treated with dilute HCl containing 14.6 g of HCl is:

(1) 22.4 L

(2) 11.2 L

(3) 4.48 L

(4) 44.8 L

Correct Answer: (3) 4.48 L

Solution: Step 1: Balanced Chemical Equation

$$CaCO3 + 2HCl- > CaCl2 + H2O + CO2$$

Step 2: Calculate Moles of Reactants

- Moles of CaCO3:

$$\text{Molar mass of CaCO3} = 40 + 12 + 3 \times 16 = 100 \text{ g/mol}$$

$$\text{Moles of CaCO3} = \frac{25 \text{ g}}{100 \text{ g/mol}} = 0.25 \text{ moles}$$

- Moles of HCl:

$$\text{Molar mass of HCl} = 1 + 35.5 = 36.5 \text{ g/mol}$$

$$\text{Moles of HCl} = \frac{14.6 \text{ g}}{36.5 \text{ g/mol}} = 0.4 \text{ moles}$$

Step 3: Determine Limiting Reagent

From the balanced equation:

$$1 \text{ mole CaCO3 reacts with } 2 \text{ moles HCl}$$

$$\text{Required HCl for 0.25 moles CaCO3} = 0.25 \times 2 = 0.5 \text{ moles}$$

Available HCl is only 0.4 moles, so **HCl is the limiting reagent**.

Step 4: Calculate Moles of CO2 Produced

From the stoichiometry:

$$2 \text{ moles HCl produce } 1 \text{ mole CO2}$$

$$\text{Moles of CO2} = \frac{0.4}{2} = 0.2 \text{ moles}$$

Step 5: Volume of CO2 at STP

At STP (Standard Temperature and Pressure):

$$1 \text{ mole of gas} = 22.4 \text{ L}$$

$$\text{Volume of CO2} = 0.2 \times 22.4 = 4.48 \text{ L}$$

Final Answer

$$\boxed{4.48 \text{ L}}$$

Quick Tip

At STP, 1 mole of any ideal gas occupies 22.4 L.

---

120. Which one of the following processes involves chemical change?

(1) Melting of ice

(2) Boiling of water

(3) Respiration

(4) Dissolving salt in water

Correct Answer: (3) Respiration

Solution: 1. **Chemical change definition**:

A chemical change involves the transformation of substances into new substances with different properties.

2. **Respiration**:

Respiration is a biochemical process where glucose and oxygen are converted into energy, carbon dioxide, and water. This is a chemical change because new substances are formed.

3. **Other processes**:

Melting of ice and boiling of water are physical changes, as no new substances are formed. Dissolving salt in water is also a physical change, as the salt dissociates but remains chemically the same.

Quick Tip

Chemical changes result in new substances being formed and are usually irreversible.

---

121. Gregor Johann Mendel is known as the Father of:

(A) Genetics

(B) Evolution

(C) Cytology

(D) Ecology

Correct Answer: (A) Genetics

Solution: Step 1: Introduction to Gregor Mendel.

Gregor Johann Mendel was an Austrian biologist who is widely recognized as the father of the science of genetics. His experiments on pea plants laid the foundation for understanding inheritance patterns.

Step 2: Mendel's Contribution.

Mendel's work demonstrated how traits are inherited from one generation to the next, based on dominant and recessive alleles, and how these traits follow specific ratios in offspring.

Step 3: Conclusion.

Therefore, Gregor Johann Mendel is known as the Father of Genetics due to his groundbreaking work on inheritance.

Quick Tip

Gregor Mendel's laws of inheritance form the basis of modern genetics.

---

122. Different asexual reproduction methods seen in organisms are:

(A) Budding, Fragmentation, Binary Fission

(B) Cross-fertilization, Budding

(C) Binary Fission, Parthenogenesis

(D) Budding, Binary Fission, Pollination

Correct Answer: (A) Budding, Fragmentation, Binary Fission

Solution: Step 1: Definition of Asexual Reproduction.

Asexual reproduction is a mode of reproduction in which offspring are produced without the involvement of gametes. The offspring are genetically identical to the parent.

Step 2: Asexual Reproduction Methods.

Common methods of asexual reproduction include: - Budding: A new organism develops from an outgrowth of the parent organism (e.g., Hydra). - Fragmentation: The organism

splits into parts, each of which grows into a new individual (e.g., Starfish). - Binary Fission: The parent cell divides into two identical daughter cells (e.g., Bacteria).

Step 3: Conclusion.

Therefore, the different methods of asexual reproduction include budding, fragmentation, and binary fission.

Quick Tip

Asexual reproduction produces genetically identical offspring, and common methods include budding, binary fission, and fragmentation.

---

123. Mendel had chosen _____ pairs of contrasting characters for his study:

(A) 5

(B) 7

(C) 10

(D) 12

Correct Answer: (B) 7

Solution: Step 1: Mendel's Experimental Setup.

Mendel conducted experiments on pea plants, where he selected seven pairs of contrasting traits (characters). These traits included flower color, seed shape, and plant height.

Step 2: The Seven Traits.

The seven pairs of contrasting traits Mendel studied were:

1. Seed shape (round vs. wrinkled)
2. Seed color (yellow vs. green)
3. Flower color (purple vs. white)
4. Pod shape (inflated vs. constricted)
5. Pod color (green vs. yellow)
6. Flower position (axial vs. terminal)
7. Plant height (tall vs. short)

Step 3: Conclusion.

Therefore, Mendel had chosen 7 pairs of contrasting characters for his study.

Quick Tip

Mendel studied 7 pairs of contrasting characters in pea plants to understand inheritance patterns.

---

124. The trait expressed in F generation is called:

(A) Recessive Trait

(B) Dominant Trait

(C) Hybrid Trait

(D) Codominant Trait

Correct Answer: (B) Dominant Trait

Solution: Step 1: Understanding F_1 Generation.

The F_1 generation refers to the first filial generation of offspring obtained by crossing two parental organisms with contrasting traits.

Step 2: Dominant and Recessive Traits.

In Mendel's experiments, the trait that appeared in the F_1 generation (the offspring) was the dominant trait. The other trait, which did not appear, was the recessive trait.

Step 3: Conclusion.

Thus, the trait expressed in the F generation is the dominant trait.

Quick Tip

In F_1 generation, the dominant trait is expressed, masking the recessive trait.

---

125. What is the dark colored outer zone in the internal structure of the kidney called?

(A) Cortex

(B) Medulla

(C) Pelvis

(D) Capsule

Correct Answer: (A) Cortex

Solution: Step 1: Anatomy of the Kidney.

The kidney consists of two main regions: the outer cortex and the inner medulla. The cortex is the darker outer region, while the medulla is lighter in color and lies inside the cortex.

Step 2: Function of the Cortex.

The cortex contains the renal corpuscles (Bowman's capsules and glomeruli) and is involved in the filtration of blood. It is darker due to the presence of these components.

Step 3: Conclusion.

Therefore, the dark-colored outer zone in the internal structure of the kidney is called the cortex.

Quick Tip

The cortex is the outer, darker region of the kidney, involved in filtration, while the medulla lies beneath it.

---

126. Which part of the brain is concerned with the sense of smell?

(1) Cerebellum.

(2) Medulla oblongata.

(3) Olfactory bulb.

(4) Thalamus.

Correct Answer: (3) Olfactory bulb.

Solution: Step 1: Understanding the olfactory system.

The sense of smell is processed by the olfactory system. The olfactory bulb is a structure in the brain responsible for detecting odors and transmitting the sensory information to other parts of the brain.

Step 2: Explanation of the olfactory bulb.

The olfactory bulb is located at the base of the brain, just above the nasal cavity. It receives signals from sensory neurons in the nose and processes the information related to odors.

Step 3: Conclusion.

Thus, the olfactory bulb is the part of the brain responsible for the sense of smell.

Quick Tip

The olfactory bulb processes olfactory (smell) signals and is crucial for the detection of odors.

---

127. Testosterone is secreted by which endocrine gland?

(1) Thyroid gland.

(2) Adrenal glands.

(3) Pituitary gland.

(4) Testes.

Correct Answer: (4) Testes.

Solution: Step 1: Understanding the function of testosterone.

Testosterone is the primary male sex hormone responsible for the development of male reproductive tissues and secondary sexual characteristics.

Step 2: Location of secretion.

Testosterone is secreted primarily by the testes in males. It is also secreted in small amounts by the ovaries in females and the adrenal glands.

Step 3: Conclusion.

Thus, testosterone is mainly secreted by the testes.

Quick Tip

Testosterone is crucial for male development, and its secretion is primarily controlled by the testes.

---

128. What is the condition that occurs when our body is filled with extra water and wastes due to kidney failure?

(1) Anemia.

(2) Edema.

(3) Uremia.

(4) Jaundice.

Correct Answer: (3) Uremia.

Solution: Step 1: Understanding uremia.

Uremia is a condition that occurs when the kidneys are unable to filter out waste products from the blood. This leads to a buildup of urea and other waste materials in the body, along with excess water retention.

Step 2: Symptoms of uremia.

Symptoms of uremia include fatigue, nausea, swelling (edema), and a decrease in urine output. It is a sign of severe kidney dysfunction.

Step 3: Conclusion.

Thus, uremia is the condition where the body accumulates extra water and waste due to kidney failure.

Quick Tip

Uremia is associated with kidney failure and leads to the accumulation of waste products and excess water in the body.

---

129. The myelin sheath of the neuron is made of which type of cells?

(1) Schwann cells.

(2) Astrocytes.

(3) Oligodendrocytes.

(4) Microglia.

Correct Answer: (1) Schwann cells.

Solution: Step 1: Understanding myelin sheath formation.

The myelin sheath is a protective covering that surrounds axons of many neurons. It increases the speed of nerve signal transmission.

Step 2: Type of cells involved.

In the peripheral nervous system (PNS), the myelin sheath is formed by Schwann cells. In the central nervous system (CNS), oligodendrocytes perform this function.

Step 3: Conclusion.

Thus, in the PNS, the myelin sheath is made of Schwann cells.

Quick Tip

Schwann cells form the myelin sheath in the peripheral nervous system, while oligodendrocytes form it in the central nervous system.

---

130. What are the squamous epithelial cells lining the Bowman's Capsule called?

(1) Endothelial cells.

(2) Podocytes.

(3) Squamous cells.

(4) Filtration cells.

Correct Answer: (2) Podocytes.

Solution: Step 1: Understanding the function of Bowman's capsule.

Bowman's capsule is part of the nephron in the kidney, and it surrounds the glomerulus. Its primary function is to filter blood to form urine.

Step 2: Role of podocytes.

The cells lining the inside of the Bowman's capsule are called podocytes. These specialized cells have foot-like projections that form filtration slits, allowing selective filtration of blood into the capsule.

Step 3: Conclusion.

Thus, the squamous epithelial cells lining the Bowman's capsule are called podocytes.

Quick Tip

Podocytes are specialized cells in the Bowman's capsule that play a key role in the filtration of blood in the kidneys.

---

131. Choose the correct order: Grass → ??? → Rabbit → ??? → Fox → ??? → Wolf

(1) Grass → Rabbit → Fox → Wolf

(2) Grass → Rabbit → Fox → Wolf

(3) Grass → Rabbit → Fox → Wolf

(4) Grass → Rabbit → Wolf → Fox

Correct Answer: (1) Grass → Rabbit → Fox → Wolf

Solution: 1. Grass → Rabbit:

Grass is a primary producer (plants), and rabbits are herbivores that feed on grass. This is the beginning of the food chain where energy is transferred from the grass (producer) to the rabbit (primary consumer).

2. Rabbit → Fox:

Foxes are carnivores that prey on rabbits. Hence, the next link in the food chain is the fox, which consumes the rabbit (secondary consumer).

3. Fox → Wolf:

Wolves are apex predators that may prey on foxes, completing the food chain. The wolf, as the top predator, consumes foxes.

Quick Tip

This represents a typical food chain where energy flows from producers (grass) to primary consumers (rabbit), secondary consumers (fox), and apex predators (wolf).

---

132. Drip irrigation can reduce water consumption by _____ percent.

(1) 10%

(2) 30%

(3) 50%

(4) 70%

Correct Answer: (4) 70%

Solution: 1. Drip irrigation method:

Drip irrigation is an efficient water-saving technique where water is delivered directly to the root zone of plants through a system of pipes, tubes, and emitters. This minimizes water wastage due to evaporation or runoff.

2. Water consumption reduction:

Drip irrigation can reduce water consumption by as much as 70% compared to traditional methods, such as flood irrigation, which often leads to significant water loss.

Quick Tip

Drip irrigation is highly efficient and reduces water consumption by delivering water directly to plant roots, preventing unnecessary water loss.

---

133. Examples of physical factors or abiotic factors are:

(1) Light, temperature, soil, water

(2) Predation, disease, competition

(3) Plant growth, reproduction

(4) Habitat, food sources

Correct Answer: (1) Light, temperature, soil, water

Solution: 1. Abiotic factors:

Abiotic factors are non-living components of an ecosystem that influence the living organisms. They include physical factors such as light, temperature, soil, and water. These factors are essential for the survival and growth of organisms.

2. Biotic vs. Abiotic:

Biotic factors are related to living organisms (like predation, competition, and reproduction), while abiotic factors are physical or chemical components (like light, temperature, and water).

Quick Tip

Abiotic factors play a crucial role in determining the conditions under which organisms can survive and thrive in an ecosystem.

---

134. Percentage of fresh water on Earth is _____.

(1) 1%

(2) 2.5%

(3) 10%

(4) 20%

Correct Answer: (2) 2.5%

Solution: 1. Freshwater on Earth:

Only about 2.5% of Earth's water is freshwater, which includes water in rivers, lakes, glaciers, and underground aquifers. The remaining 97.5% is saltwater found in oceans.

2. Availability of freshwater:

Of the 2.5% of freshwater, a large portion is locked in glaciers and ice caps, and only a small fraction is available for human use in rivers and lakes.

Quick Tip

Freshwater is a limited resource, and its availability is critical for sustaining life on Earth.

---

135. We get hunger pangs in the stomach as ____ levels in the blood fall.

(1) Glucose

(2) Oxygen

(3) Carbon dioxide

(4) Iron

Correct Answer: (1) Glucose

Solution: 1. Hunger pangs and glucose:

Hunger pangs occur when blood glucose levels drop. The body signals the brain that it needs food to restore glucose levels, which is why we feel the urge to eat.

2. Blood glucose levels:

Glucose is the body's primary energy source, and low levels can lead to feelings of hunger. After eating, glucose levels rise, and hunger typically subsides.

Quick Tip

Maintaining balanced blood glucose levels is essential for regulating appetite and energy levels.

---

136. The difference in characters within very closely related groups of organisms are called:

(A) Variations

(B) Mutations

(C) Adaptations

(D) Differentiations

Correct Answer: (A) Variations

Solution: Step 1: Definition of Variation.

Variation refers to the differences in characteristics or traits among individuals of the same species or closely related groups.

Step 2: Closely Related Groups.

In closely related groups of organisms, the variations could be in the form of physical characteristics, behavior, or other attributes. These differences are crucial for evolution and natural selection.

Step 3: Conclusion.

Therefore, the differences in characters within very closely related groups of organisms are called variations.

Quick Tip

Variation refers to the differences in characteristics among individuals of the same species.

---

137. Bacterium that is responsible for the formation of curd is:

(A) Lactobacillus

(B) Bacillus subtilis

(C) Escherichia coli

(D) Clostridium

Correct Answer: (A) Lactobacillus

Solution: Step 1: Role of Bacteria in Curd Formation.

The bacterium responsible for the formation of curd is Lactobacillus. This bacterium ferments the lactose in milk, producing lactic acid, which causes the milk proteins to coagulate and form curd.

Step 2: Other Bacteria.

Bacillus subtilis and Escherichia coli are not involved in curd formation.

Clostridium is a genus of bacteria that causes diseases like botulism.

Step 3: Conclusion.

Thus, the bacterium responsible for the formation of curd is Lactobacillus.

Quick Tip

Lactobacillus bacteria are used in the fermentation process that produces curd from milk.

---

138. _____ is a means of reproduction without involvement of gametes or involving a single parent:

(A) Sexual Reproduction

(B) Asexual Reproduction

(C) Biparental Reproduction

(D) Genetic Recombination

Correct Answer: (B) Asexual Reproduction

Solution: Step 1: Definition of Asexual Reproduction.

Asexual reproduction is a method of reproduction that involves only one parent and does not involve the fusion of gametes (sperm and egg).

Step 2: Types of Asexual Reproduction.

This type of reproduction includes processes such as binary fission, budding, and regeneration, where offspring are genetically identical to the parent.

Step 3: Conclusion.

Therefore, asexual reproduction is the process that occurs without the involvement of gametes or when a single parent is involved.

Quick Tip

Asexual reproduction is a method of reproduction involving a single parent and no gametes.

---

139. _____ in the forebrain and vagus nerve play an important role in carrying signals of hunger to the brain:

(A) Insulin

(B) Leptin

(C) Ghrelin

(D) Adrenaline

Correct Answer: (C) Ghrelin

Solution: Step 1: Role of Ghrelin.

Ghrelin, often referred to as the ”hunger hormone,” is produced in the stomach and plays a key role in stimulating appetite by sending hunger signals to the brain.

Step 2: Other Hormones.

Insulin helps regulate blood sugar levels and is not involved in hunger signaling. Leptin signals satiety or fullness, reducing hunger. Adrenaline is involved in the body’s fight or flight response, not in hunger regulation.

Step 3: Conclusion.

Thus, ghrelin in the forebrain and vagus nerve plays an important role in carrying signals of hunger to the brain.

Quick Tip

Ghrelin stimulates hunger by sending signals to the brain to promote appetite.

---

140. Algae, fungi, and many land plants commonly reproduce by _____:

(A) Binary Fission

(B) Spore Formation

(C) Budding

(D) Regeneration

Correct Answer: (B) Spore Formation

Solution: Step 1: Definition of Spore Formation.

Spore formation is a method of reproduction in which an organism produces spores, which are capable of developing into new individuals without fertilization.

Step 2: Reproduction in Algae, Fungi, and Plants.

Algae and fungi commonly reproduce by producing spores.

Many land plants (like mosses and ferns) also reproduce through spores, especially in their non-flowering stages.

Step 3: Conclusion.

Therefore, algae, fungi, and many land plants commonly reproduce by spore formation.

Quick Tip

Spore formation is a common method of reproduction in algae, fungi, and non-flowering plants.

---

141. In which form is energy stored in the mitochondria?

(1) ATP

(2) Glucose

(3) NADH

(4) ADP

Correct Answer: (1) ATP

Solution: 1. Function of mitochondria:

Mitochondria are known as the ”powerhouses” of the cell because they generate energy through cellular respiration.

2. Energy storage form:

The energy produced in mitochondria is stored in the form of Adenosine Triphosphate (ATP), which serves as the main energy currency of the cell.

3. ATP role:

ATP provides energy for various cellular processes by releasing energy when its phosphate bonds are broken.

Quick Tip

Mitochondria convert biochemical energy from nutrients into ATP, which cells use for energy-requiring activities.

---

142. What is the blood pressure in a healthy adult human?

(1) 90/60 mm Hg

(2) 120/80 mm Hg

(3) 140/90 mm Hg

(4) 100/70 mm Hg

Correct Answer: (2) 120/80 mm Hg

Solution: 1. Blood pressure definition:

Blood pressure is the force exerted by circulating blood on the walls of blood vessels.

2. Normal blood pressure values:

In a healthy adult, normal blood pressure is approximately 120/80 mm Hg, where 120 mm Hg is the systolic pressure (pressure during heartbeats) and 80 mm Hg is the diastolic pressure (pressure between heartbeats).

3. Importance of normal blood pressure:

Maintaining normal blood pressure is essential for proper blood flow and organ function.

Quick Tip

Normal blood pressure is typically around 120/80 mm Hg, but can vary slightly based on age and health conditions.

---

143. Deficiency of which vitamin delays blood clotting in man?

(1) Vitamin A

(2) Vitamin C

(3) Vitamin K

(4) Vitamin D

Correct Answer: (3) Vitamin K

Solution: 1. Role of vitamin K:

Vitamin K is essential for the synthesis of prothrombin and other clotting factors in the liver.

2. Effect of deficiency:

Deficiency of vitamin K leads to delayed blood clotting and increased bleeding time because clotting factors are not produced efficiently.

3. Clinical significance:

Vitamin K deficiency can result in bleeding disorders and is often treated with vitamin K supplements.

Quick Tip

Vitamin K plays a critical role in blood coagulation and preventing excessive bleeding.

---

144. Which process is summarized by the following equation?

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light energy}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

(1) Respiration.

(2) Photosynthesis.

(3) Fermentation.

(4) Combustion.

Correct Answer: (2) Photosynthesis.

Solution: Step 1: Understanding the equation.

The given equation shows carbon dioxide and water reacting in the presence of light energy and chlorophyll to produce glucose, water, and oxygen.

Step 2: Identifying the process.

This process is known as photosynthesis, carried out by plants, algae, and some bacteria to convert light energy into chemical energy stored in glucose.

Step 3: Conclusion.

Thus, the equation summarizes the photosynthesis process.

Quick Tip

Photosynthesis uses light energy to convert carbon dioxide and water into glucose and oxygen, sustaining most life on Earth.

---

145. For absorbing plant juices an Aphid pierces its proboscis into which part of the plant?

(A) Xylem

(B) Phloem

(C) Root hairs

(D) Leaf epidermis

Correct Answer: (B) Phloem

Solution: Step 1: Aphid's Feeding Mechanism.

Aphids are small insects that feed on the nutrient-rich sap of plants by inserting their proboscis into plant tissues.

Step 2: Function of Phloem.

Phloem is responsible for the transport of organic nutrients, primarily sucrose, from the leaves to other parts of the plant.

Step 3: Conclusion.

Aphids target the phloem to absorb plant juices.

Quick Tip

Phloem transports sugars in plants, and sap-sucking insects like aphids tap into it for nutrition.

---

146. What is the liquid portion that forms after the blood clot?

(A) Plasma

(B) Serum

(C) Lymph

(D) Platelets

Correct Answer: (B) Serum

Solution: Step 1: Blood Composition.

Whole blood contains plasma, red and white blood cells, and platelets.

Step 2: After Clotting.

When blood clots, fibrin and clotting factors are removed. The remaining liquid is called serum.

Step 3: Conclusion.

Serum is the fluid part of blood left after coagulation.

Quick Tip

Serum is plasma without clotting factors. It is used in diagnostic tests.

---

147. What is the % of carbon dioxide in the inhaled and exhaled air?

(A) 0.03% and 4.4% respectively

(B) 0.04% and 3.5% respectively

(C) 0.04% and 5% respectively

(D) 0.03% and 3.8% respectively

Correct Answer: (A) 0.03% and 4.4% respectively

Solution: Step 1: Inhaled Air.

In atmospheric air, the concentration of carbon dioxide is approximately 0.03%.

Step 2: Exhaled Air.

During respiration, carbon dioxide concentration increases in exhaled air and reaches around 4.4%.

Step 3: Conclusion.

Hence, inhaled air contains 0.03% CO_2 and exhaled air contains 4.4%.

Quick Tip

Inhaled air contains very little carbon dioxide, while exhaled air has much more due to respiration.

---

148. Which of the following are water soluble vitamins?

(A) Vitamin A and D

(B) B-complex and C

(C) Vitamin E and K

(D) Vitamin D and B

Correct Answer: (B) B-complex and C

Solution: Step 1: Vitamin Classification.

Vitamins are classified into water-soluble and fat-soluble types.

Step 2: Water-Soluble Vitamins.

B-complex vitamins and Vitamin C are water soluble and are not stored in the body.

Step 3: Conclusion.

Hence, the water-soluble vitamins are B-complex and C.

Quick Tip

Water-soluble vitamins must be taken regularly through diet since they are not stored in the body.

---

149. The process of mastication of the food in the mouth leads to the formation of which substance?

(1) Bolus

(2) Chyme

(3) Bile

(4) Chyle

Correct Answer: (1) Bolus

Solution: 1. Mastication process:

Mastication is the process of chewing food in the mouth which breaks down food into smaller pieces and mixes it with saliva.

2. Formation of bolus:

The chewed food mixed with saliva forms a soft, moist, and rounded mass called the bolus which is easy to swallow.

3. Subsequent digestion:

The bolus is then pushed down the esophagus into the stomach for further digestion.

Quick Tip

Bolus is the soft mass of chewed food formed in the mouth during mastication.

---

150. In a chloroplast, which of the following sites trap solar energy?

(1) Thylakoid membranes

(2) Stroma

(3) Outer membrane

(4) Inner membrane

Correct Answer: (1) Thylakoid membranes

Solution: 1. Structure of chloroplast:

Chloroplasts contain stacked membranous structures called thylakoids, which are arranged in stacks known as grana, surrounded by stroma.

2. Site of solar energy trapping:

The thylakoid membranes contain chlorophyll and other pigments that absorb solar energy for photosynthesis.

3. Role in photosynthesis:

The absorbed light energy is used to drive the light-dependent reactions of photosynthesis occurring in the thylakoid membranes.

Quick Tip

Thylakoid membranes in chloroplasts are the primary sites where light energy is captured during photosynthesis.
