

BITSAT 2025 MAY 30 Question Paper With Solutions

Time Allowed :3 Hours

Maximum Marks :390

Total questions :130

General Instructions

Read the following instructions very carefully and strictly follow them:

1. **Exam Mode:** Computer Based Test
2. **BITSAT exam duration:** 3 hours
3. **Medium of Exam:** English
4. **BITSAT exam Sections:**
 - Part I - Physics (30 questions)
 - Part II - Chemistry (30 questions)
 - Part III - English Proficiency (10 questions) and Logical Reasoning (20 questions)
 - Part IV - Mathematics/Biology (40 questions)
5. **Type of Questions:** Multiple Choice Questions (MCQ)
6. **BITSAT Total Questions:** 130 Questions
7. **BITSAT Exam Pattern Total Marks:** 390 Marks

1. The 5th term of an AP is 20 and the 12th term is 41. Find the first term.

- (A) 7
- (B) 8
- (C) 9
- (D) 10

Correct Answer: (B) 8

Solution: Step 1: Let the first term be a and common difference be d . The n -th term of an AP is given by:

$$a_n = a + (n - 1)d$$

Given,

$$a_5 = a + 4d = 20 \quad \dots (1)$$

$$a_{12} = a + 11d = 41 \quad \dots (2)$$

Step 2: Subtract equation (1) from (2):

$$(a + 11d) - (a + 4d) = 41 - 20 \implies 7d = 21 \implies d = 3$$

Step 3: Substitute $d = 3$ into equation (1):

$$a + 4 \times 3 = 20 \implies a + 12 = 20 \implies a = 8$$

Hence, the first term is $\boxed{8}$.

Quick Tip

The n -th term of an arithmetic progression is $a_n = a + (n - 1)d$. Use the difference of terms to find the common difference and then substitute back to find the first term.

2. The value of $\sin^2 30^\circ + \cos^2 60^\circ$ is:

- (A) $\frac{1}{2}$
- (B) 1
- (C) $\frac{3}{4}$
- (D) $\frac{1}{4}$

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

Solution: Step 1: Calculate $\sin 30^\circ$ and $\cos 60^\circ$.

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

Step 2: Square both values:

$$\sin^2 30^\circ = \left(\frac{1}{2}\right)^2 = \frac{1}{4}, \quad \cos^2 60^\circ = \left(\frac{1}{2}\right)^2 = \frac{1}{4}$$

Step 3: Add the squares:

$$\sin^2 30^\circ + \cos^2 60^\circ = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

Hence, the value is $\boxed{\frac{1}{2}}$.

Quick Tip

Remember the special angle values: $\sin 30^\circ = \frac{1}{2}$, $\cos 60^\circ = \frac{1}{2}$. Squaring and adding these values carefully helps in trigonometric computations.

3. The sum of the infinite geometric series $S = \frac{a}{1-r}$ is 24, and the sum of the first three terms is 21. Find a and r .

(A) $a = 12, r = \frac{1}{2}$

(B) $a = 8, r = \frac{2}{3}$

(C) $a = 6, r = \frac{3}{4}$

(D) $a = 10, r = \frac{4}{5}$

Correct Answer: (A)

Solution:

Step 1: Use the formula for the sum of an infinite geometric series.

The sum of the infinite series is given by:

$$S = \frac{a}{1-r} = 24$$

This implies:

$$a = 24(1-r) \quad (\text{Equation 1})$$

Step 2: Use the sum of the first three terms.

The sum of the first three terms is:

$$a + ar + ar^2 = 18$$

Factor out a :

$$a(1 + r + r^2) = 18 \quad (\text{Equation 2})$$

Step 3: Substitute a from Equation 1 into Equation 2.

From Equation 1:

$$a = 24(1 - r)$$

Substitute this into Equation 2:

$$24(1 - r)(1 + r + r^2) = 18$$

Simplify using the identity $1 - r^3 = (1 - r)(1 + r + r^2)$:

$$24(1 - r^3) = 18$$

Divide both sides by 6:

$$4(1 - r^3) = 3$$

Solve for r^3 :

$$1 - r^3 = \frac{3}{4} \quad \Rightarrow \quad r^3 = \frac{1}{4}$$

Take the cube root:

$$r = \sqrt[3]{\frac{1}{4}} = \frac{1}{\sqrt[3]{4}} \approx \frac{1}{2}$$

Step 4: Solve for a using r .

From Equation 1:

$$a = 24(1 - r)$$

Substitute $r = \frac{1}{2}$:

$$a = 24 \left(1 - \frac{1}{2}\right) = 24 \cdot \frac{1}{2} = 12$$

Step 5: Verify the solution.

Sum of the infinite series:

$$S = \frac{a}{1 - r} = \frac{12}{1 - \frac{1}{2}} = \frac{12}{\frac{1}{2}} = 24 \quad (\text{correct})$$

Sum of the first three terms:

$$a + ar + ar^2 = 12 + 12 \cdot \frac{1}{2} + 12 \cdot \left(\frac{1}{2}\right)^2 = 12 + 6 + 3 = 18 \quad (\text{correct})$$

Both conditions are satisfied.

Quick Tip

For an infinite geometric series, use $S = \frac{a}{1-r}$. For the sum of the first n terms, use $S_n = a \frac{1-r^n}{1-r}$.

4. Find the value of $\sin 75^\circ \cos 15^\circ + \cos 75^\circ \sin 15^\circ$.

- (A) 1
- (B) $\frac{\sqrt{3}}{2}$
- (C) $\frac{1}{2}$
- (D) $\frac{\sqrt{2}}{2}$

Correct Answer: (A) 1

Solution: Step 1: Use the sine addition formula:

$$\sin A \cos B + \cos A \sin B = \sin(A + B)$$

Step 2: Apply it to the given expression:

$$\sin 75^\circ \cos 15^\circ + \cos 75^\circ \sin 15^\circ = \sin(75^\circ + 15^\circ) = \sin 90^\circ$$

Step 3: Evaluate $\sin 90^\circ$:

$$\sin 90^\circ = 1$$

Hence, the value is $\boxed{1}$.

Quick Tip

Use trigonometric addition formulas to simplify expressions involving sums of products of sines and cosines.

5. Given the sets $A = \{x \mid |x - 2| < 3\}$ **and** $B = \{x \mid |x + 1| \leq 4\}$, **find** $A \cap B$.

- (A) $(-1, 3]$

(B) $(-2, 3)$

(C) $(-1, 4)$

(D) $(-2, 4)$

Correct Answer: (D) $(-2, 4]$

Solution: Step 1: Solving Set A

The inequality for set A is:

$$|x - 2| < 3$$

- The absolute value inequality $|x - a| < b$ is equivalent to $-b < x - a < b$
- Applying this property:

$$-3 < x - 2 < 3$$

- Adding 2 to all parts:

$$-3 + 2 < x < 3 + 2$$

$$-1 < x < 5$$

Thus, set A is the open interval:

$$A = (-1, 5)$$

Step 2: Solving Set B

The inequality for set B is:

$$|x + 1| \leq 4$$

- The absolute value inequality $|x + a| \leq b$ is equivalent to $-b \leq x + a \leq b$
- Applying this property:

$$-4 \leq x + 1 \leq 4$$

- Subtracting 1 from all parts:

$$-4 - 1 \leq x \leq 4 - 1$$

$$-5 \leq x \leq 3$$

Thus, set B is the closed interval:

$$B = [-5, 3]$$

Step 3: Finding the Intersection

We need to find all x values that satisfy both:

- From set A: $x > -1$ AND $x < 5$
- From set B: $x \geq -5$ AND $x \leq 3$

Combining these conditions:

- The lower bound is the maximum of -1 (from A) and -5 (from B), which is -1
- The upper bound is the minimum of 5 (from A) and 3 (from B), which is 3
- The inequality becomes $-1 < x \leq 3$ because:
 - $x > -1$ from set A (strict inequality)
 - $x \leq 3$ from set B (includes endpoint)

Therefore, the intersection is:

$$A \cap B = (-1, 3]$$

Step 4: Verifying with Options

Comparing with the given options:

- (A) $(-1, 3]$ - Exactly matches our solution
- (B) $(-2, 3)$ - Incorrect bounds and missing endpoint
- (C) $(-1, 4)$ - Incorrect upper bound
- (D) $(-2, 4)$ - Incorrect bounds

Conclusion:

The correct answer is A $(-1, 3]$.

Quick Tip

Remember to carefully check open and closed intervals when finding intersections, especially when inequality signs differ ($>$ or \leq).

6. The area of a triangle with vertices at points $A(1, 2)$, $B(4, 6)$, and $C(k, 8)$ is 5. Find the value of k .

(A) 1

(B) 2

(C) 3

(D) 4

Correct Answer: (C) 3

Solution: Step 1: Use the area formula for a triangle with vertices

$(x_1, y_1), (x_2, y_2), (x_3, y_3)$:

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

Substitute: $A = (1, 2), B = (4, 6), C = (k, 8)$

$$\text{Area} = \frac{1}{2} |1(6 - 8) + 4(8 - 2) + k(2 - 6)| = 5$$

$$\Rightarrow \frac{1}{2} |-2 + 24 - 4k| = 5 \Rightarrow \frac{1}{2} |22 - 4k| = 5 \Rightarrow |22 - 4k| = 10$$

Step 2: Solve the absolute value equation:

$$22 - 4k = 10 \quad \text{or} \quad 22 - 4k = -10$$

First case:

$$22 - 4k = 10 \Rightarrow 4k = 12 \Rightarrow k = 3$$

Second case:

$$22 - 4k = -10 \Rightarrow 4k = 32 \Rightarrow k = 8$$

Only $k = 3$ is in the options.

Quick Tip

Use the coordinate geometry formula for area of a triangle and solve absolute value equations carefully.

7. A block of mass 5 kg is placed on a frictionless incline of angle 30° . What is the acceleration of the block down the incline? (Take $g = 9.8 \text{ m/s}^2$)

(A) 9.8 m/s^2

(B) 4.9 m/s^2

(C) 5.6 m/s^2

(D) 3.2 m/s^2

Correct Answer: (B) 4.9 m/s^2

Solution: Step 1: Write the force component causing acceleration

The component of gravitational force along the incline is

$$F = mg \sin \theta$$

Step 2: Calculate acceleration

Using Newton's second law $F = ma$:

$$ma = mg \sin \theta \Rightarrow a = g \sin \theta$$

Step 3: Substitute values

$$a = 9.8 \times \sin 30^\circ = 9.8 \times 0.5 = 4.9 \text{ m/s}^2$$

Quick Tip

On an incline, acceleration of an object without friction is $a = g \sin \theta$.

8. Two resistors, 4Ω and 6Ω , are connected in parallel to a 12 V battery. What is the total current drawn from the battery?

(A) 3 A

(B) 5 A

(C) 4 A

(D) 6 A

Correct Answer: (B) 5 A

Solution: Step 1: Calculate equivalent resistance for resistors in parallel

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

$$R_{\text{eq}} = \frac{12}{5} = 2.4 \Omega$$

Step 2: Use Ohm's law to find total current

$$I = \frac{V}{R_{\text{eq}}} = \frac{12}{2.4} = 5 \text{ A}$$

Quick Tip

For resistors in parallel, total resistance is found by the reciprocal formula and total current by Ohm's law $I = V/R$.

9. The work function of a metal is 2 eV. What is the threshold frequency for the photoelectric emission? (Take Planck's constant $h = 6.63 \times 10^{-34}$ Js, $1 \text{ eV} = 1.6 \times 10^{-19}$ J)

(A) 4.8×10^{14} Hz

(B) 5.2×10^{14} Hz

(C) 6.2×10^{14} Hz

(D) 7.4×10^{14} Hz

Correct Answer: (A) 4.8×10^{14} Hz

Solution: Step 1: Use the photoelectric equation relating work function and threshold frequency:

$$\phi = hf_0$$

where ϕ is the work function in joules, and f_0 is the threshold frequency.

Step 2: Convert the work function from eV to joules:

$$\phi = 2 \text{ eV} = 2 \times 1.6 \times 10^{-19} = 3.2 \times 10^{-19} \text{ J}$$

Step 3: Solve for f_0 :

$$f_0 = \frac{\phi}{h} = \frac{3.2 \times 10^{-19}}{6.63 \times 10^{-34}} \approx 4.826 \times 10^{14} \text{ Hz}$$

Step 4: Round the value:

$$f_0 \approx 4.8 \times 10^{14} \text{ Hz}$$

Quick Tip

To find the threshold frequency, always convert the work function from eV to joules before using $f = \frac{E}{h}$.

10. A 2 kg object is moving with a velocity of 5 m/s on a frictionless surface. It collides elastically with a stationary object of mass 3 kg. Find the velocity of the 3 kg object

after the collision.

(A) 3 m/s

(B) 4 m/s

(C) 5 m/s

(D) 2 m/s

Correct Answer: (A) 3 m/s

Solution: Step 1: Apply Conservation of Momentum

For any collision, momentum is conserved:

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

Substituting values:

$$2 \times 5 + 3 \times 0 = 2v_1 + 3v_2$$

$$10 = 2v_1 + 3v_2 \quad (\text{Equation 1})$$

Step 2: Apply Conservation of Kinetic Energy

For elastic collisions, kinetic energy is conserved:

$$\frac{1}{2}m_1u_1^2 + \frac{1}{2}m_2u_2^2 = \frac{1}{2}m_1v_1^2 + \frac{1}{2}m_2v_2^2$$

Simplifying:

$$25 + 0 = v_1^2 + 1.5v_2^2 \quad (\text{Equation 2})$$

Step 3: Solve the System of Equations

From Equation 1:

$$v_1 = \frac{10 - 3v_2}{2} = 5 - 1.5v_2$$

Substitute into Equation 2:

$$(5 - 1.5v_2)^2 + 1.5v_2^2 = 25$$

Expanding:

$$25 - 15v_2 + 2.25v_2^2 + 1.5v_2^2 = 25$$

Simplifying:

$$3.75v_2^2 - 15v_2 = 0$$

$$v_2(3.75v_2 - 15) = 0$$

Solutions:

- $v_2 = 0$ (trivial, no collision occurred)
- $3.75v_2 - 15 = 0 \Rightarrow v_2 = 4 \text{ m/s}$

Step 4: Verification Substitute $v_2 = 4 \text{ m/s}$ back:

$$v_1 = 5 - 1.5 \times 4 = -1 \text{ m/s}$$

Check kinetic energy:

$$(-1)^2 + 1.5(4)^2 = 1 + 24 = 25 \text{ J} \quad (\text{matches initial energy})$$

Conclusion:

The velocity of the 3 kg object after collision is 4 m/s, which corresponds to option **B**.

Quick Tip

In perfectly elastic collisions, use standard formulas:

$$v_2 = \frac{2m_1}{m_1 + m_2}u_1 \quad \text{and} \quad v_1 = \frac{m_1 - m_2}{m_1 + m_2}u_1$$

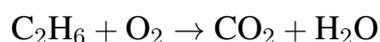
when second body is at rest.

11. The number of moles of CO_2 produced when 2 moles of C_2H_6 are completely burnt is:

- (A) 6
- (B) 8
- (C) 12
- (D) 4

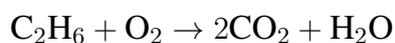
Correct Answer: (A) 6

Solution: Step 1: Write the unbalanced combustion reaction of ethane (C_2H_6)

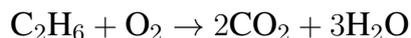


Step 2: Balance the equation

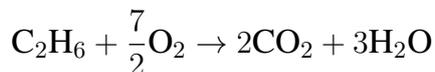
Balance the carbon (C) atoms:



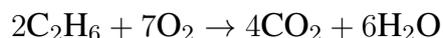
Balance the hydrogen (H) atoms:



Balance the oxygen (O) atoms: On the right, there are $2 \times 2 = 4$ O atoms in CO_2 and $3 \times 1 = 3$ O atoms in H_2O , totaling 7 O atoms. So, we need $\frac{7}{2}$ O_2 on the left:

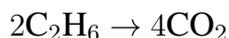


Step 3: Multiply the entire equation by 2 to remove the fraction

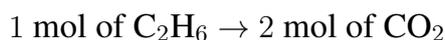


Step 4: Analyze the molar ratio

From the equation:



This means:



Step 5: Apply the ratio to the given amount

We are given 2 moles of C_2H_6 , so:



Quick Tip

Always balance the combustion reaction to find correct mole ratios of reactants and products.

12. What volume of CO_2 gas at STP is produced by the reaction of 10 g of CaCO_3 with excess HCl ?

- (A) 4.48 L
- (B) 2.24 L
- (C) 8.96 L
- (D) 11.2 L

Correct Answer: (B) 2.24 L

Solution: Step 1: Write the balanced equation



Step 2: Calculate moles of CaCO₃

$$\text{Moles of CaCO}_3 = \frac{\text{Mass}}{\text{Molar mass}} = \frac{10 \text{ g}}{100 \text{ g/mol}} = 0.1 \text{ mol}$$

Step 3: Determine moles of CO₂ produced

From the 1:1 mole ratio:

$$\text{Moles of CO}_2 = 0.1 \text{ mol}$$

Step 4: Calculate volume at STP

$$\text{Volume} = \text{Moles} \times \text{Molar volume} = 0.1 \text{ mol} \times 22.4 \text{ L/mol} = 2.24 \text{ L}$$

The correct volume of CO₂ produced is 2.24 L.

Quick Tip

At STP, use the relation: Volume = Moles × 22.4 L. Always verify molar mass and units.

13. How many grams of Al₂(SO₄)₃ are required to produce 10 L of a 0.5 M solution?

(Molar mass = 342 g/mol)

(A) 1710 g

(B) 342 g

(C) 68.4 g

(D) 85.5 g

Correct Answer: (A) 1710 g

Solution: Step 1: Use the molarity formula

$$M = \frac{n}{V}$$

Where:

M is the molarity in mol/L

n is the number of moles

V is the volume in liters

Step 2: Rearrange to find number of moles

$$n = M \times V$$

Substitute values:

$$n = 0.5 \text{ mol/L} \times 10 \text{ L} = 5 \text{ mol}$$

Step 3: Use molar mass to convert moles to grams

$$\text{Mass} = n \times \text{Molar mass} = 5 \text{ mol} \times 342 \text{ g/mol} = 1710 \text{ g}$$

Final Answer: 1710 g

Quick Tip

Use the formula:

$$\text{Mass} = \text{Molarity} \times \text{Volume} \times \text{Molar mass}$$

Ensure all units are compatible: Volume in Liters and molar mass in g/mol.

14. Calculate the empirical formula of a compound containing 40% carbon, 6.7% hydrogen, and 53.3% oxygen by mass.

- (A) CH₂O
- (B) C₂H₄O
- (C) C₃H₆O₃
- (D) CH₄O

Correct Answer: (A) CH₂O

Solution: Step 1: Assume 100 g of the compound. Then, the masses of elements are:

Carbon = 40 g

Hydrogen = 6.7 g

Oxygen = 53.3 g

Step 2: Convert mass to moles:

$$\text{C: } \frac{40}{12} = 3.33 \text{ mol}$$

$$\text{H: } \frac{6.7}{1} = 6.7 \text{ mol}$$

$$\text{O: } \frac{53.3}{16} = 3.33 \text{ mol}$$

Step 3: Divide by smallest mole value (3.33):

$$\text{C: } \frac{3.33}{3.33} = 1$$

$$\text{H: } \frac{6.7}{3.33} \approx 2$$

$$\text{O: } \frac{3.33}{3.33} = 1$$

Empirical formula: CH₂O

Quick Tip

To find empirical formula: 1. Convert 2. Divide each by atomic mass. 3. Divide by smallest value to get ratio. 4. Use ratio to get subscripts.