

BITSAT 2025 June 25 Shift 1 Question Paper with Solutions

Time Allowed :3 Hours	Maximum Marks :390	Total Questions :130
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General Instructions

1. The **BITSAT 2025** (Birla Institute of Technology and Science Admission Test) is conducted in **Computer-Based Test (CBT)** mode.
2. The duration of the test is **3 hours (180 minutes)**.
3. The question paper consists of **130 multiple-choice questions (MCQs)** divided into four sections:
 - **Physics – 30 Questions**
 - **Chemistry – 30 Questions**
 - **English Proficiency and Logical Reasoning – 20 Questions**
 - **Mathematics/Biology – 50 Questions**
4. Each correct answer carries **3 marks**, and each incorrect answer leads to a **penalty of 1 mark**.
5. After attempting all 130 questions, candidates can attempt up to **12 additional questions** (4 each from Physics, Chemistry, and Mathematics/Biology) — only if time permits.
6. The language of the question paper is **English only**.
7. Candidates must reach the test center **at least 1 hour before** the commencement of the examination.
8. Candidates must carry:
 - **BITSAT 2025 Hall Ticket**
 - **Valid Photo ID Proof** (Aadhaar, Passport, PAN, Driving Licence, etc.)
9. Rough work must be done only on the provided sheets. Additional sheets will not be supplied.
10. Use of **calculators, mobile phones, smart watches, or any other electronic devices** is strictly prohibited.
11. Follow all **invigilator's instructions** carefully. Any malpractice will result in **cancellation of candidature**.

1. A ball is thrown vertically upward with a speed of 49 m/s. How long will it take to return to the thrower's hand?

- (A) 5 s
- (B) 7 s
- (C) 10 s
- (D) 14 s

Correct Answer: (C) 10 s

Solution:

Step 1: Understanding the Concept:

This problem involves the vertical motion of an object under the influence of gravity.

When a ball is thrown upward, its speed decreases due to gravity until it reaches the maximum height, where its velocity becomes zero for an instant.

Then, it falls back down, and its speed increases. The total time of flight is the time it takes for the ball to go up and come back down to the initial position.

In the absence of air resistance, the time taken to go up (time of ascent) is equal to the time taken to come down (time of descent).

Step 2: Key Formula or Approach:

We can use the first equation of motion:

$$v = u + at$$

Where:

v = final velocity

u = initial velocity

a = acceleration (in this case, acceleration due to gravity, g)

t = time

Step 3: Detailed Explanation:

First, let's calculate the time it takes for the ball to reach its maximum height.

At the maximum height, the final velocity v of the ball is 0 m/s.

The initial upward velocity is given as $u = 49$ m/s.

The acceleration due to gravity g acts downward, so we take it as $a = -9.8$ m/s².

Using the formula $v = u + at$:

$$0 = 49 + (-9.8) \times t_{\text{ascent}}$$

$$9.8 \times t_{\text{ascent}} = 49$$

$$t_{\text{ascent}} = \frac{49}{9.8} = 5 \text{ s}$$

This is the time taken to reach the maximum height.

The total time to return to the thrower's hand is the sum of the time of ascent and the time of descent.

Since the time of ascent is equal to the time of descent:

$$t_{\text{total}} = t_{\text{ascent}} + t_{\text{descent}} = 5 \text{ s} + 5 \text{ s} = 10 \text{ s}$$

Alternatively, using the formula for total time of flight, $T = \frac{2u}{g}$:

$$T = \frac{2 \times 49}{9.8} = \frac{98}{9.8} = 10 \text{ s}$$

Step 4: Final Answer:

The total time it will take for the ball to return to the thrower's hand is 10 seconds.

💡 Quick Tip

For vertical motion problems, remember that the time of ascent equals the time of descent. If you calculate the time to reach the peak, simply double it to find the total time of flight back to the starting level. Also, note that values like 49 m/s are often chosen in problems because they are multiples of 9.8 m/s², leading to integer answers for time.

2. The escape velocity from the surface of a planet is v_e . What will be the escape velocity from a planet whose mass and radius are twice that of the original planet?

- (A) v_e
- (B) $2v_e$
- (C) $\sqrt{2}v_e$
- (D) $4v_e$

Correct Answer: (A) v_e

Solution:

Step 1: Understanding the Concept:

Escape velocity is the minimum speed needed for a free, non-propelled object to escape from the gravitational influence of a massive body, such as a planet. It depends on the mass (M) and radius (R) of the planet.

Step 2: Key Formula or Approach:

The formula for escape velocity (v_e) from the surface of a planet is given by:

$$v_e = \sqrt{\frac{2GM}{R}}$$

Where:

G is the universal gravitational constant.

M is the mass of the planet.

R is the radius of the planet.

Step 3: Detailed Explanation:

Let the mass and radius of the original planet be M and R respectively. The escape velocity is:

$$v_e = \sqrt{\frac{2GM}{R}}$$

Now, consider the new planet. Its mass and radius are twice that of the original planet.

Let the new mass be M' and the new radius be R' .

Given:

$$M' = 2M$$

$$R' = 2R$$

The escape velocity from the new planet, let's call it v'_e , will be:

$$v'_e = \sqrt{\frac{2GM'}{R'}}$$

Substitute the values of M' and R' into the formula:

$$v'_e = \sqrt{\frac{2G(2M)}{(2R)}}$$

The '2' in the numerator and denominator cancels out:

$$v'_e = \sqrt{\frac{2GM}{R}}$$

We can see that this is the same formula as the escape velocity of the original planet.

$$v'_e = v_e$$

Step 4: Final Answer:

The escape velocity from the new planet will be the same as the original planet, which is v_e .

💡 Quick Tip

When analyzing how a change in variables affects a formula, focus on the proportionality. Here, $v_e \propto \sqrt{M/R}$. If both M and R are multiplied by the same factor (in this case, 2), the ratio M/R remains unchanged, and thus the escape velocity also remains unchanged.

3. Which of the following compounds will give a positive Iodoform test?

- (A) Ethanol
- (B) Propanol
- (C) Methanol
- (D) Methanal

Correct Answer: (A) Ethanol

Solution:

Step 1: Understanding the Concept:

The Iodoform test (also known as the haloform reaction with iodine) is a chemical test used to detect the presence of a methyl ketone group ($\text{CH}_3\text{C}(=\text{O})-$) or a secondary alcohol with a methyl group on the alpha carbon ($\text{CH}_3\text{CH}(\text{OH})-$). These compounds react with iodine in the presence of a base (like NaOH) to form a yellow precipitate of iodoform (CHI_3).

Ethanol is a primary alcohol, but it is a special case that gives a positive iodoform test.

Step 2: Key Formula or Approach:

The general reaction for a positive iodoform test involves the following steps:

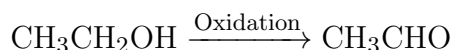
1. Oxidation of the alcohol (if present) to a carbonyl compound by the hypoiodite (formed from I_2 and $NaOH$).
2. Halogenation of the methyl group of the carbonyl compound.
3. Cleavage of the tri-iodomethyl ketone by the hydroxide ion to form iodoform (CHI_3) and a carboxylate salt.

Step 3: Detailed Explanation:

Let's analyze each option:

(A) Ethanol (CH_3CH_2OH):

Ethanol is a primary alcohol. In the presence of $I_2/NaOH$, it first gets oxidized to acetaldehyde (CH_3CHO).



Acetaldehyde has the required methyl ketone-like structure ($CH_3C(=O)-$). It reacts further to give iodoform. Therefore, Ethanol gives a positive iodoform test.

(B) Propanol ($CH_3CH_2CH_2OH$ or $CH_3CH(OH)CH_3$):

If it is 1-Propanol ($CH_3CH_2CH_2OH$), it oxidizes to Propanal (CH_3CH_2CHO), which does not have a methyl group attached to the carbonyl carbon. So, 1-Propanol gives a negative test.

If it is 2-Propanol ($CH_3CH(OH)CH_3$), it has the $CH_3CH(OH)-$ group. It will be oxidized to Propanone (acetone, $CH_3C(=O)CH_3$), which gives a positive test.

However, Ethanol is always a correct choice, and without specification, "Propanol" can be ambiguous. Given Ethanol is an option, it is the most certain correct answer.

(C) Methanol (CH_3OH):

Methanol is oxidized to Methanal ($HCHO$). Neither methanol nor methanal has the required $CH_3C(=O)-$ or $CH_3CH(OH)-$ group. So, Methanol gives a negative test.

(D) Methanal ($HCHO$):

Methanal (formaldehyde) does not have a methyl group attached to the carbonyl carbon. It gives a negative test.

Step 4: Final Answer:

Among the given options, only Ethanol is guaranteed to give a positive Iodoform test.

💡 Quick Tip

To quickly identify compounds that give a positive iodoform test, look for the $CH_3C(=O)-$ group or a structure that can be oxidized to it, like $CH_3CH(OH)-$. Remember that acetaldehyde and ethanol are the only aldehyde and primary alcohol, respectively, that give a positive test.

4. Which of the following is not a colligative property?

- (A) Osmotic pressure
- (B) Depression of freezing point
- (C) Elevation of boiling point
- (D) Refractive index

Correct Answer: (D) Refractive index

Solution:

Step 1: Understanding the Concept:

Colligative properties are properties of solutions that depend on the ratio of the number of solute particles to the number of solvent molecules in a solution, and not on the nature of the chemical species present.

In simpler terms, they depend on the concentration or quantity of solute particles, not their identity.

Step 2: Key Formula or Approach:

The four main colligative properties are:

1. Relative lowering of vapor pressure.
2. Elevation of boiling point (ΔT_b).
3. Depression of freezing point (ΔT_f).
4. Osmotic pressure (Π).

Step 3: Detailed Explanation:

Let's examine each option:

(A) Osmotic pressure: This is a colligative property. It is the pressure required to prevent the inward flow of water across a semipermeable membrane and is directly proportional to the molar concentration of the solute ($\Pi = iMRT$).

(B) Depression of freezing point: This is a colligative property. The freezing point of a solution is lower than that of the pure solvent, and the depression is proportional to the molal concentration of the solute ($\Delta T_f = iK_f m$).

(C) Elevation of boiling point: This is a colligative property. The boiling point of a solution is higher than that of the pure solvent, and the elevation is proportional to the molal concentration of the solute ($\Delta T_b = iK_b m$).

(D) Refractive index: This is an optical property of a substance. It measures how much the path of light is bent, or refracted, when entering a material. It depends on the nature of the substance (its chemical composition and structure) and the wavelength of light, not just on the number of particles. Therefore, it is not a colligative property.

Step 4: Final Answer:

Refractive index is not a colligative property; it is an intrinsic physical property of a substance.

 Quick Tip

Memorize the four main colligative properties: osmotic pressure, elevation of boiling point, depression of freezing point, and relative lowering of vapor pressure. Any property outside this list, such as refractive index, viscosity, or density, is generally not a colligative property.

5. If the roots of the quadratic equation $ax^2 + bx + c = 0$ are real and equal, then:

- (A) $b^2 - 4ac < 0$
(B) $b^2 - 4ac = 0$
(C) $b^2 - 4ac > 0$

(D) $a + b + c = 0$

Correct Answer: (B) $b^2 - 4ac = 0$

Solution:

Step 1: Understanding the Concept:

The nature of the roots of a quadratic equation $ax^2 + bx + c = 0$ is determined by its discriminant, which is denoted by D or Δ . The discriminant provides information about whether the roots are real or complex, and whether they are equal or distinct.

Step 2: Key Formula or Approach:

The formula for the discriminant (D) of a quadratic equation $ax^2 + bx + c = 0$ is:

$$D = b^2 - 4ac$$

The conditions for the nature of the roots are:

- If $D > 0$, the roots are real and distinct (unequal).
- If $D = 0$, the roots are real and equal.
- If $D < 0$, the roots are complex (not real) and are conjugate pairs.

Step 3: Detailed Explanation:

The problem states that the roots of the quadratic equation are **real and equal**.

Based on the conditions determined by the discriminant, this corresponds to the case where the discriminant is equal to zero.

Therefore, we must have:

$$D = b^2 - 4ac = 0$$

Step 4: Final Answer:

The condition for the roots of the quadratic equation $ax^2 + bx + c = 0$ to be real and equal is $b^2 - 4ac = 0$.

 Quick Tip

Remember the discriminant and its three conditions as a fundamental concept in algebra. The term "discriminant" itself means "a distinguisher" because it distinguishes between the possible types of roots. A quadratic equation with real and equal roots is a perfect square trinomial, e.g., $(px + q)^2 = 0$.

6. Let $A = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$. The determinant of A^3 is:

- (A) 216
(B) 27
(C) 8
(D) 1

Correct Answer: (A) 216

Solution:**Step 1: Understanding the Concept:**

This problem involves finding the determinant of a power of a matrix. There is a key property of determinants that simplifies this calculation significantly.

Step 2: Key Formula or Approach:

There are two main properties we can use:

1. The determinant of a 2x2 matrix $A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$ is $\det(A) = ad - bc$.
2. For any square matrix A and any positive integer n , the determinant of A^n is equal to the determinant of A raised to the power of n .

$$\det(A^n) = (\det(A))^n$$

Step 3: Detailed Explanation:

First, we need to find the determinant of the given matrix A .

The matrix is $A = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$.

Using the formula for a 2x2 determinant:

$$\det(A) = (2)(3) - (0)(0)$$

$$\det(A) = 6 - 0 = 6$$

Now, we need to find the determinant of A^3 . Using the property $\det(A^n) = (\det(A))^n$:

$$\det(A^3) = (\det(A))^3$$

Substitute the value of $\det(A)$:

$$\det(A^3) = (6)^3$$

$$\det(A^3) = 6 \times 6 \times 6 = 216$$

Step 4: Final Answer:

The determinant of A^3 is 216.

💡 Quick Tip

Calculating A^3 first and then finding its determinant would be much more time-consuming. Always look for properties of matrices and determinants to simplify calculations. For a diagonal or triangular matrix, the determinant is simply the product of the diagonal elements.

7. Choose the correct word to complete the sentence: "She was so tired that she could keep her eyes open."

- (A) hardly
- (B) hard
- (C) barely
- (D) clearly

Correct Answer: (A) hardly

Solution:

Step 1: Understanding the Concept:

This question tests the understanding of adverbs and their appropriate use in context. The sentence structure "so... that..." indicates a cause and effect relationship. The cause is "so tired," and we need an adverb that describes the resulting difficulty in keeping her eyes open.

Step 2: Key Formula or Approach:

Analyze the meaning of each option and see how it fits into the sentence.

- **hardly:** An adverb meaning 'scarcely', 'almost not at all'. It has a negative connotation.
- **hard:** An adverb meaning 'with a lot of effort'. While it might seem plausible, "could hard keep" is grammatically incorrect. The correct form would be "found it hard to keep".
- **barely:** An adverb meaning 'only just', 'almost not'. It is very similar in meaning to 'hardly'.
- **clearly:** An adverb meaning 'in a way that is easy to see or understand'. This is the opposite of the intended meaning.

Step 3: Detailed Explanation:

The sentence "She was so tired..." implies that it was very difficult for her to perform the action of keeping her eyes open. We need an adverb that conveys this difficulty or inability.

- "She could **hardly** keep her eyes open." This means she was almost unable to keep her eyes open. This fits the context perfectly.

- "She could **hard** keep her eyes open." This is grammatically awkward and incorrect.

- "She could **barely** keep her eyes open." This also fits the context well and has almost the same meaning as 'hardly'. In many contexts, they are interchangeable. However, 'hardly' is a very common and standard choice for this particular expression.

- "She could **clearly** keep her eyes open." This contradicts the first part of the sentence. If she was so tired, she wouldn't be able to keep her eyes open clearly.

Both (A) hardly and (C) barely are semantically correct. In multiple-choice questions, when two options are very close, one is often considered the 'best' fit or the more common usage. "Hardly" is a very standard choice in this phrasal context. Therefore, it is the most appropriate answer.

Step 4: Final Answer:

The correct word to complete the sentence is 'hardly'.

 Quick Tip

Remember that adverbs like 'hardly', 'scarcely', and 'barely' carry a negative meaning. They are often used to indicate that something is almost not possible or true. Don't confuse the adverb 'hard' (meaning with effort) with 'hardly'.

8. Statement: All flowers are beautiful. Some beautiful things are fragile.

Conclusion I: Some flowers are fragile. Conclusion II: All beautiful things are flowers.

- (A) Only I follows
- (B) Only II follows
- (C) Both follow
- (D) Neither follows

Correct Answer: (D) Neither follows

Solution:

Step 1: Understanding the Concept:

This is a syllogism problem in logical reasoning. We need to determine if the given conclusions logically and necessarily follow from the given statements. Using Venn diagrams is an effective way to analyze such problems.

Step 2: Key Formula or Approach:

Represent the statements using Venn diagrams.

Statement 1: All flowers are beautiful. This means the set of 'Flowers' is a subset of the set of 'Beautiful things'. We draw a circle for 'Flowers' completely inside a larger circle for 'Beautiful things'.

Statement 2: Some beautiful things are fragile. This means the set of 'Beautiful things' and the set of 'Fragile things' must have a non-empty intersection. We draw a circle for 'Fragile things' that overlaps with the 'Beautiful things' circle.

Step 3: Detailed Explanation:

Let's analyze the conclusions based on the Venn diagram.

Conclusion I: Some flowers are fragile.

From the statements, we know the 'Fragile' circle must overlap with the 'Beautiful' circle. However, it is possible for this overlap to occur completely outside the 'Flowers' circle. There is no information that forces an overlap between the 'Flowers' and 'Fragile' circles. Since it's not a necessary conclusion, Conclusion I does not follow.

(Imagine a Venn Diagram where the 'Fragile' circle overlaps with 'Beautiful' but not with the inner 'Flowers' circle.)

Conclusion II: All beautiful things are flowers.

Statement 1 says "All flowers are beautiful," not the other way around. The Venn diagram clearly shows that there can be parts of the 'Beautiful' circle that are not in the 'Flowers' circle. This means there can be beautiful things that are not flowers. This conclusion is the converse of the first statement, which is a common logical fallacy. Therefore, Conclusion II does not follow.

Since neither conclusion necessarily follows from the statements, the correct option is that neither follows.

Step 4: Final Answer:

Neither Conclusion I nor Conclusion II follows from the given statements.

💡 Quick Tip

In syllogisms, a conclusion is only valid if it is true in all possible scenarios that satisfy the premises. If you can draw even one Venn diagram that follows the statements but contradicts the conclusion, then the conclusion is invalid. Always check for necessary connections, not just possible ones.

9. Which number comes next in the series? 3, 6, 11, 18, 27, ?

- (A) 36
- (B) 38
- (C) 40
- (D) 48

Correct Answer: (B) 38

Solution:

Step 1: Understanding the Concept:

This problem requires identifying the pattern or rule that governs the given sequence of numbers in order to find the next term.

Step 2: Key Formula or Approach:

A common method for finding patterns in number series is to calculate the difference between consecutive terms. If the first set of differences is not constant, we can calculate the differences of the differences (second-order differences).

Step 3: Detailed Explanation:

Let's write down the series and find the difference between each consecutive term.

Series: 3, 6, 11, 18, 27, ?

First-level differences:

$$6 - 3 = 3$$

$$11 - 6 = 5$$

$$18 - 11 = 7$$

$$27 - 18 = 9$$

The differences are 3, 5, 7, 9. We can see a clear pattern here: these are consecutive odd numbers, increasing by 2 each time.

The next difference in this sequence of odd numbers should be $9 + 2 = 11$.

To find the next term in the original series, we add this next difference (11) to the last term of the series (27).

$$\text{Next term} = 27 + 11 = 38$$

Alternative Method (Formula):

Another pattern can be observed. The terms can be represented by the formula $n^2 + 2$, starting with $n = 1$.

$$\text{For } n=1: 1^2 + 2 = 1 + 2 = 3$$

$$\text{For } n=2: 2^2 + 2 = 4 + 2 = 6$$

$$\text{For } n=3: 3^2 + 2 = 9 + 2 = 11$$

$$\text{For } n=4: 4^2 + 2 = 16 + 2 = 18$$

$$\text{For } n=5: 5^2 + 2 = 25 + 2 = 27$$

The next term would be for $n=6$:

$$\text{For } n=6: 6^2 + 2 = 36 + 2 = 38$$

Both methods yield the same result.

Step 4: Final Answer:

The next number in the series is 38.

 Quick Tip

When faced with a number series, always start by checking the differences between consecutive terms. If that doesn't reveal a simple pattern, check the second-level differences. Also, look for patterns related to squares (n^2), cubes (n^3), or simple arithmetic operations.
