BITSAT 2025 June 25 Shift 1 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. Duration of Exam: 3 Hours
2. Total Number of Questions: 130 Questions
3. Section-wise Distribution of Questions:
    - Physics - 40 Questions
    - Chemistry - 40 Questions
    - Mathematics - 50 Questions
4. Type of Questions: Multiple Choice Questions (Objective)
5. Marking Scheme: Three marks are awarded for each correct response
6. Negative Marking: One mark is deducted for every incorrect answer.
7. Each question has four options; only one is correct.
8. Questions are designed to test analytical thinking and problem-solving skills.

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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?

(1) 5 s

(2) 7 s

(3) 10 s

(4) 14 s

Correct Answer: (3) 10 s

Solution:

Step 1: Identify given values

- Initial velocity, $u = 49$ m/s (upward)
- Acceleration due to gravity, $g = 9.8$ m/s^2 (downward, so we take g as positive in the downward direction)
- Final velocity at the highest point, $v = 0$ m/s

Step 2: Calculate time to reach the highest point

Using the kinematic equation:

$$v = u - gt$$

Since the ball is moving upward, we take u as positive and g as positive (downward acceleration):

$$0 = 49 - 9.8 \cdot t$$

$$t = \frac{49}{9.8} = 5 \text{ seconds}$$

So, it takes 5 seconds to reach the highest point.

Step 3: Calculate total time

The time to go up equals the time to come down, so the total time is:

$$\text{Total time} = 2 \times 5 = 10 \text{ seconds}$$

Quick Tip

Use the formula $t = \frac{u}{g}$ for vertical motion to calculate time to peak, and double it for total time.

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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?

(1) v_e

(2) $2v_e$

(3) $\sqrt{2}v_e$

(4) $4v_e$

Correct Answer: (1) v_e

Solution:

Step 1: Formula for escape velocity

The escape velocity from a planet is given by:

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

where: - G is the gravitational constant

- M is the mass of the planet

- R is the radius of the planet

Step 2: Original planet's escape velocity

Let the original planet have mass M and radius M and radius R. Its escape velocity is:

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

Step 2: New planet's parameters

The new planet has: - Mass = $M' = 2M$

- Radius = $R' = 2R$

Step 3: Calculate new escape velocity

Substitute $M' = M'' = 2M$ and $R' = R' = 2R$ into the escape velocity formula:

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

$$= \sqrt{\frac{4GM}{2R}}$$

$$= \sqrt{\frac{4GM}{2R}} = \sqrt{2 \cdot \frac{2GM}{R}}$$

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

The new escape velocity $v_e' = v_e$, so it remains unchanged.

Step 4: Alternative approach

Notice that escape velocity depends on the ratio $\frac{M}{R}$:

$$v_e \propto \sqrt{\frac{M}{R}}$$

For the new planet:

$$\frac{M'}{R'} = \frac{2M}{2R} = \frac{M}{R}$$

Since the ratio is unchanged, the escape velocity remains v_e. Thus, the correct answer is option (1) v_e.

Quick Tip

Escape velocity is proportional to $\sqrt{\frac{M}{R}}$. If both mass and radius double, the ratio remains unchanged.

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

(1) Ethanol

(2) Propanol

(3) Methanol

(4) Methanal

Correct Answer: (1) Ethanol

Solution:

Step 1: Understand the Iodoform test

Compounds that give a positive Iodoform test include:

- Methyl ketones ($R - CO - CH_3$)

- Acetaldehyde (CH_3CHO)

- Alcohols that oxidize to methyl ketones or acetaldehyde (e.g., ethanol, secondary alcohols like 2-propanol)

Step 2: Analyze each option

- **Ethanol (**CH_3CH_2OH**)**: A primary alcohol. Under Iodoform test conditions (with iodine and a base), ethanol oxidizes to acetaldehyde (CH_3CHO), which has the structure $CH_3 - C(=O) - H$. Acetaldehyde reacts further to give iodoform. Thus, ethanol gives a positive test.

- **Propanol**: This could refer to 1-propanol ($CH_3CH_2CH_2OH$) or 2-propanol ($CH_3CH(OH)CH_3$).

- 1-Propanol oxidizes to propanal (CH_3CH_2CHO), which lacks the methyl ketone structure, so it gives a negative test.

- 2-Propanol, a secondary alcohol, oxidizes to acetone (CH_3COCH_3), a methyl ketone, which gives a positive test. However, since the question doesn't specify and "propanol" typically implies 1-propanol in such contexts, we assume it's 1-propanol, which gives a negative test.

- **Methanol (**CH_3OH**)**: A primary alcohol that oxidizes to formaldehyde ($HCHO$), which lacks the required structure. Negative test.

- **Methanal (**$HCHO$**)**: Formaldehyde does not have the methyl ketone or acetaldehyde structure. Negative test.

Step 3: Conclusion

Only ethanol consistently gives a positive Iodoform test among the options.

Quick Tip

Ethanol is the only primary alcohol that gives the iodoform test because it oxidizes to acetaldehyde.

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

(1) Osmotic pressure

(2) Depression of freezing point

(3) Elevation of boiling point

(4) Refractive index

Correct Answer: (4) Refractive index

Solution:

Step 1: Define colligative properties

Colligative properties include:

- Osmotic pressure: Pressure required to prevent osmosis, proportional to solute concentration.

- Depression of freezing point: Lowering of freezing point, proportional to molality.

- Elevation of boiling point: Increase in boiling point, proportional to molality.

- Vapor pressure lowering: Decrease in vapor pressure due to solute particles.

Step 2: Analyze each option

- **Osmotic pressure**: Depends on the number of solute particles (van't Hoff factor times concentration). Colligative.

- **Depression of freezing point**: Depends on molality and the number of solute particles. Colligative.

- **Elevation of boiling point**: Depends on molality and solute particle concentration. Colligative.

- **Refractive index**: Measures how light bends in a medium. It depends on the chemical nature of both solute and solvent, not just the number of particles. Not colligative.

Step 3: Conclusion

Refractive index is not a colligative property.

Quick Tip

Colligative properties are independent of solute type and depend on solute particle concentration.

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

(1) $b^2 - 4aclt; 0$

(2) $b^2 - 4ac = 0$

(3) $b^2 - 4acgt; 0$

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

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

Solution:

Step 1: Define the discriminant

The discriminant is:

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

The value of D determines the roots:

- $D > 0$: Two distinct real roots

- $D = 0$: Two real and equal roots (one repeated root)

- $D < 0$: Two complex conjugate roots

Step 2: Apply to the question

The question states the roots are real and equal, so:

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

Step 3: Check other options

- Option (1): $b^2 - 4ac < 0$: Gives complex roots, incorrect.

- Option (3): $b^2 - 4ac > 0$: Gives two distinct real roots, incorrect.

- Option (4): $a + b + c = 0$: This is the sum of the coefficients, which equals the value of the quadratic at $x = 1$. It's unrelated to the condition for equal roots unless specific values are given. Incorrect.

Step 4: Conclusion

The condition for real and equal roots is $b^2 - 4ac = 0$.

Quick Tip

Remember: Discriminant zero means the quadratic has a repeated (equal) real root.

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

(1) 216

(2) 27

(3) 8

(4) 1

Correct Answer: (1) 216

Solution:

Step 1: Determinant of matrix A

For a 2x2 matrix $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$, the determinant is $ad - bc$. For:

$$A = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix}$$

$$\det A = (2)(3) - (0)(0) = 6$$

Since A is diagonal, the determinant is the product of diagonal elements: $2 \times 3 = 6$.

Step 2: Determinant of A^3

Using the property of determinants, for any square matrix A:

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

So:

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

Calculate:

$$6^3 = 6 \times 6 \times 6 = 216$$

Step 3: Alternative approach

Compute A^3:

$$A^2 = A \cdot A = \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix} = \begin{bmatrix} 4 & 0 \\ 0 & 9 \end{bmatrix}$$

$$A^3 = A^2 \cdot A = \begin{bmatrix} 4 & 0 \\ 0 & 9 \end{bmatrix} \cdot \begin{bmatrix} 2 & 0 \\ 0 & 3 \end{bmatrix} = \begin{bmatrix} 8 & 0 \\ 0 & 27 \end{bmatrix}$$

Determinant of A^3:

$$\det(A^3) = 8 \times 27 = 216$$

Both methods agree.

Step 4: Check options

Option (1) 216 matches our result.

Quick Tip

The determinant of matrix power is the determinant raised to that power: $\det(A^n) = (\det A)^n$

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

(1) hardly

(2) hard

(3) barely

(4) clearly

Correct Answer: (1) hardly

Solution:

Step 1: Understand the sentence

The sentence implies extreme tiredness, making it difficult to keep eyes open. We need an adverb that conveys "almost not" or "with great difficulty."

Step 2: Analyze each option

- **Hardly**: An adverb meaning "almost not" or "scarcely."

Sentence: "She was so tired that she could hardly keep her eyes open."

This means she could barely manage to keep her eyes open, which fits perfectly.

- **Hard**: An adverb meaning "with effort" or an adjective.

Sentence: "She was so tired that she could hard keep her eyes open."

Grammatically incorrect as "hard" doesn't modify "could" appropriately here.

- **Barely**: An adverb meaning "only just" or "almost not."

Sentence: "She was so tired that she could barely keep her eyes open."

This is grammatically correct and similar to "hardly." However, "hardly" is more common in this context

- **Clearly**: An adverb meaning "in a clear manner."

Sentence: "She was so tired that she could clearly keep her eyes open."

This implies she could easily keep her eyes open, which contradicts the meaning.

Step 3: Conclusion

“Hardly” and “barely” both fit

Quick Tip

Use “hardly” to express very limited ability or action due to tiredness, confusion, or weakness.

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

(1) Only I follows

(2) Only II follows

(3) Both follow

(4) Neither follows

Correct Answer: (4) Neither follows

Solution:

Step 1: Translate statements

- Statement 1: “All flowers are beautiful.”

In logic: All F are B (where F = flowers, B = beautiful things).

- Statement 2: “Some beautiful things are fragile.”

In logic: Some B are Fr (where Fr = fragile things).

Step 2: Evaluate Conclusion I

- Conclusion I: “Some flowers are fragile.”

In logic: Some F are Fr.

From “All F are B” and “Some B are Fr,” we cannot conclude that the fragile beautiful things (B that are Fr) include flowers (F). The fragile beautiful things could be non-flowers (e.g., glass vases). Thus, Conclusion I does not necessarily follow.

Step 3: Evaluate Conclusion II

- Conclusion II: “All beautiful things are flowers.”

In logic: All B are F.

The first statement says all flowers are beautiful (All F are B), not that all beautiful things are flowers. Many beautiful things (e.g., paintings) may not be flowers. This reverses the logic and is false. Conclusion II does not follow.

Step 4: Conclusion

Neither conclusion follows logically.

> **Quick Tip**
>
> Avoid assuming overlaps in logical reasoning unless explicitly stated.

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

(1) 36

(2) 38

(3) 40

(4) 48

Correct Answer: (2) 38

Solution:

Step 1: List the series

The numbers are: 3, 6, 11, 18, 27, ?

Step 2: Calculate differences

Find the differences between consecutive terms:

$$6 - 3 = 3$$

$$11 - 6 = 5$$

$$18 - 11 = 7$$

$$27 - 18 = 9$$

The differences are: 3, 5, 7, 9.

Step 3: Identify the pattern in differences

The differences increase by 2 each time:

$$5 - 3 = 2, \quad 7 - 5 = 2, \quad 9 - 7 = 2$$

The next difference should be:

$$9 + 2 = 11$$

Step 4: Find the next term

Add the next difference to the last term:

$$27 + 11 = 38$$

So, the next number is 38.

Quick Tip

Check differences between terms for increasing arithmetic or geometric patterns in number series.
