BITSAT 2025 May 30 Shift 2 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. If $x + \frac{1}{x} = 4$, find the value of $x^4 + \frac{1}{x^4}$.

(A) 194

(B) 1945

(C) 190

(D) 1940

Correct Answer: (A) 194

Solution:

Step 1: Use the identity to find $x^2 + \frac{1}{x^2}$.

We are given:

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

Squaring both sides:

$$\left(x + \frac{1}{x}\right)^2 = x^2 + 2 + \frac{1}{x^2} = 16 \Rightarrow x^2 + \frac{1}{x^2} = 16 - 2 = 14$$

Step 2: Use identity to find $x^4 + \frac{1}{x^4}$.

We now square again:

$$\left(x^2 + \frac{1}{x^2}\right)^2 = x^4 + 2 + \frac{1}{x^4} \Rightarrow 14^2 = x^4 + \frac{1}{x^4} + 2 \Rightarrow 196 = x^4 + \frac{1}{x^4} + 2 \Rightarrow x^4 + \frac{1}{x^4} = 196 - 2 = 194$$

Quick Tip

To evaluate powers like $x^4 + \frac{1}{x^4}$, start with known identities: - $(x + \frac{1}{x})^2 = x^2 + \frac{1}{x^2} + 2$ - $(x^2 + \frac{1}{x^2})^2 = x^4 + \frac{1}{x^4} + 2$

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2. The equation of the line passing through the point $(2, 3)$ and making equal intercepts on the coordinate axes is:

(A) $x + y = 5$

(B) $3x + 2y = 12$

(C) $2x + 3y = 12$

(D) $5x + 5y = 25$

Correct Answer: (A) $x + y = 5$

Solution:

Step 1: General equation of a line with equal intercepts on both axes.

The line making equal intercepts a on x- and y-axis has the form:

$$\frac{x}{a} + \frac{y}{a} = 1 \Rightarrow \frac{x+y}{a} = 1 \Rightarrow x + y = a$$

Step 2: Use the given point to find the intercept a.

Substitute point $(2, 3)$ into $x + y = a$:

$$2 + 3 = a \Rightarrow a = 5 \Rightarrow \text{So the line equation is } x + y = 5$$

Step 3: Verify the line passes through (2, 3).

$$x + y = 2 + 3 = 5 \Rightarrow \text{True}$$

Quick Tip

Lines with equal intercepts on x- and y-axes follow the form:

$$x + y = \text{constant}$$

Use the given point to find that constant.

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3. If $\tan\theta + \cot\theta = 4$, then find the value of $\tan^3\theta + \cot^3\theta$.

(A) 52

(B) 44

(C) 46

(D) 54

Correct Answer: (C) 46

Solution:

Step 1: Use the identity for sum of cubes.

We know:

$$\tan^3\theta + \cot^3\theta = (\tan\theta + \cot\theta)^3 - 3\tan\theta\cot\theta(\tan\theta + \cot\theta)$$

Given:

$$\tan\theta + \cot\theta = 4$$

Let us compute:

$$(\tan\theta + \cot\theta)^3 = 4^3 = 64$$

Now, we need to find $\tan\theta\cot\theta$. But:

$$\tan\theta\cot\theta = \tan\theta \cdot \frac{1}{\tan\theta} = 1$$

Step 2: Plug into the identity.

$$\tan^3\theta + \cot^3\theta = 64 - 3(1)(4) = 64 - 12 = 52$$

Step 3: Let $x = \tan\theta$, then $\cot\theta = \frac{1}{x}$.

Given:

$$x + \frac{1}{x} = 4 \Rightarrow x^2 + \frac{1}{x^2} = (x + \frac{1}{x})^2 - 2 = 16 - 2 = 14$$

Now,

$$x^3 + \frac{1}{x^3} = (x + \frac{1}{x})^3 - 3(x + \frac{1}{x}) = 64 - 12 = 52$$

So:

$$\tan^3\theta + \cot^3\theta = 52$$

Correction: The correct answer is (A) 52

Quick Tip

To evaluate $\tan^3\theta + \cot^3\theta$, use the identity:

$$a^3 + b^3 = (a+b)^3 - 3ab(a+b)$$

Also, convert to a single variable using substitution like $\tan\theta = x \Rightarrow \cot\theta = \frac{1}{x}$.

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4. If $y = \ln(x^2 + 1)$, then find $\frac{dy}{dx}$ at $x = 1$.

A) $\frac{1}{2}$

B) $\frac{1}{3}$

C) 1

D) $\frac{2}{3}$

Correct Answer: C) 1

Solution:

Step 1: Differentiate $y = \ln(x^2 + 1)$.

The function is:

$$y = \ln(x^2 + 1).$$

Using the chain rule, the derivative is:

$$\frac{dy}{dx} = \frac{d}{dx}\left[\ln(x^2+1)\right] = \frac{1}{x^2+1} \cdot \frac{d}{dx}(x^2+1).$$

Compute $\frac{d}{dx}(x^2+1)$:

$$\frac{d}{dx}(x^2+1) = 2x.$$

Substitute this back:

$$\frac{dy}{dx} = \frac{1}{x^2+1} \cdot 2x = \frac{2x}{x^2+1}.$$

Step 2: Evaluate $\frac{dy}{dx}$ at $x = 1$.

Substitute $x = 1$ into the derivative:

$$\left.\frac{dy}{dx}\right|_{x=1} = \frac{2(1)}{1^2+1} = \frac{2}{1+1} = \frac{2}{2} = 1.$$

Conclusion: The value of $\frac{dy}{dx}$ at $x = 1$ is:

$$\boxed{\text{C) 1}}$$

Quick Tip

When differentiating a logarithmic function, use the chain rule: $\frac{d}{dx}[\ln(u)] = \frac{1}{u} \cdot \frac{du}{dx}$.

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5. If a, b are roots of the equation $x^2 - 5x + 6 = 0$, find the value of $a^3 + b^3$.

(A) 125

(B) 215

(C) 98

(D) 35

Correct Answer: (D) 35

Solution: Step 1: Identify the roots of the quadratic. The quadratic equation is:

$$x^2 - 5x + 6 = 0$$

Factoring:

$$x^2 - 5x + 6 = (x-2)(x-3) \Rightarrow a = 2, \quad b = 3$$

Step 2: Compute the cube of each root.

$$a^3 = 2^3 = 8, \quad b^3 = 3^3 = 27$$

Step 3: Add the cubes.

$$a^3 + b^3 = 8 + 27 = \boxed{35}$$

Quick Tip

Use the identity $a^3 + b^3 = (a + b)^3 - 3ab(a + b)$ or directly compute if roots are simple.

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6. In triangle ABC, the length of sides are $AB = 7$, $BC = 10$, and $AC = 5$. What is the length of the median drawn from vertex B?

(A) 6

(B) 5

(C) 7

(D) 8

Correct Answer: (A) 6

Solution:

To find the length of the median from vertex B to side AC, we use Apollonius's theorem:

$$m_b = \frac{1}{2}\sqrt{2AB^2 + 2BC^2 - AC^2}$$

Substituting the given values:

$$m_b = \frac{1}{2}\sqrt{2(7)^2 + 2(10)^2 - (5)^2}$$

$$m_b = \frac{1}{2}\sqrt{2 \times 49 + 2 \times 100 - 25}$$

$$m_b = \frac{1}{2}\sqrt{98 + 200 - 25}$$

$$m_b = \frac{1}{2}\sqrt{273}$$

Calculating the numerical value:

$$\sqrt{273} \approx 16.52 \quad \Rightarrow \quad m_b \approx \frac{16.52}{2} = 8.26$$

The closest integer value is $\boxed{8}$, which corresponds to option (D).

Quick Tip

The median from vertex A to side BC in triangle is:

$$m_a = \frac{1}{2}\sqrt{2b^2 + 2c^2 - a^2}$$

Use correct labeling of triangle sides to avoid confusion.

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7. If $f(x) = e^{2x}\sin x$, find $f'(x)$.

(A) $e^{2x}(2\sin x + \cos x)$

(B) $e^{2x}(2\sin x - \cos x)$

(C) $e^{2x}(2\cos x + \sin x)$

(D) $e^{2x}(\sin x - 2\cos x)$

Correct Answer: (A) $e^{2x}(2\sin x + \cos x)$

Step 1: Use the product rule.

Given: $f(x) = e^{2x}\sin x$

Let $u = e^{2x}$, $v = \sin x$

Then by product rule,

$$f'(x) = u'v + uv' = \frac{d}{dx}(e^{2x}) \cdot \sin x + e^{2x} \cdot \frac{d}{dx}(\sin x)$$

Step 2: Differentiate both parts.

$$\frac{d}{dx}(e^{2x}) = 2e^{2x}, \quad \frac{d}{dx}(\sin x) = \cos x$$

$$\Rightarrow f'(x) = 2e^{2x}\sin x + e^{2x}\cos x = e^{2x}(2\sin x + \cos x)$$

Quick Tip

For differentiation of a product of two functions, use the product rule: $(uv)' = u'v + uv'$.

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8. The half-life of a radioactive substance is 4 hours. If initially there are 256 grams, how much remains after 10 hours?

(A) 45.26 g

(B) 16 g

(C) 64 g

(D) 8 g

Correct Answer: (A) 45.26 g

Solution: Using the radioactive decay formula:

$$N(t) = N_0 \times \left(\frac{1}{2}\right)^{\frac{t}{t_{1/2}}}$$

Given:

- Initial amount (N_0) = 256 g
- Half-life ($t_{1/2}$) = 4 h
- Elapsed time (t) = 10 h

Calculation Steps

1. Compute the exponent:

$$\frac{t}{t_{1/2}} = \frac{10}{4} = 2.5$$

2. Calculate the decay factor:

$$\left(\frac{1}{2}\right)^{2.5} = 2^{-2.5} \approx 0.1768$$

3. Determine remaining quantity:

$$N(10) = 256 \times 0.1768 \approx 45.26\, g$$

Verification

After each 4 h half-life:

- At 4 h: $256/2 = 128\, g$
- At 8 h: $128/2 = 64\, g$
- At 12 h: $64/2 = 32\, g$

Since 10 h is 2.5 half-lives, the exact calculation shows:

$$256 \times (0.5)^{2.5} \approx 45.26\, g$$

Conclusion

The exact amount remaining after 10 h is $\boxed{45.26\,g}$.

Quick Tip

Each half-life reduces the quantity to half. Use the formula: $A = A_0\left(\frac{1}{2}\right)^{t/T}$, where T is the half-life.

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9. A fluid flows through a pipe with varying cross-section. If the velocity at the narrow section is 3 m/s and the cross-sectional area is half of the wider section, what is the velocity in the wider section?

(A) 1.5 m/s

(B) 6 m/s

(C) 0.5 m/s

(D) 3 m/s

Correct Answer: (A) 1.5 m/s

Solution:

Use the equation of continuity.

The equation of continuity states:

$$A_1v_1 = A_2v_2$$

Let the area of the wider section be A, then area of the narrow section is $\frac{A}{2}$. Velocity in the narrow section $v_1 = 3\,\text{m/s}$, area $A_1 = \frac{A}{2}$ Area of the wider section $A_2 = A$, velocity = $v_2 =?$ Substitute into the equation:

$$\frac{A}{2}\cdot 3 = A\cdot v_2 \Rightarrow \frac{3A}{2} = Av_2 \Rightarrow v_2 = \frac{3}{2} = 1.5\,\text{m/s}$$

Quick Tip

In fluid flow, the equation of continuity ensures that $A_1v_1 = A_2v_2$ when the fluid is incompressible and steady.

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10. The escape velocity from the surface of a planet is 11.2 km/s. If the radius of the planet is doubled but the mass remains the same, what will be the new escape velocity?

(A) 22.4 km/s

(B) 7.9 km/s

(C) 15.8 km/s

(D) 5.6 km/s

Correct Answer: (B) 7.9 km/s

Solution:

Step 1: Recall the escape velocity formula.

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

Step 2: When radius is doubled (i.e., $R \to 2R$) and mass remains the same:

$$v_e' = \sqrt{\frac{2GM}{2R}} = \sqrt{\frac{1}{2}} \cdot \sqrt{\frac{2GM}{R}} = \frac{v_e}{\sqrt{2}}$$

Step 3: Compute new velocity:

$$v_e' = \frac{11.2}{\sqrt{2}} \approx \frac{11.2}{1.414} \approx 7.92\,\text{km/s} \approx 7.9\,\text{km/s}$$

Quick Tip

Escape velocity is inversely proportional to the square root of the radius if the mass is constant:

$$v_e \propto \frac{1}{\sqrt{R}}$$

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11. Two identical charges q are placed 1 m apart. The electrostatic force between them is 9×10^{-9} N. What is the magnitude of each charge? (Take $k = 9 \times 10^9$ Nm^2/C^2)

(A) 1×10^{-9} C

(B) 3×10^{-9} C

(C) 1×10^{-9} C

(D) 3×10^{-9} C

Correct Answer: (A) 1×10^{-9} C

Step 1: Use Coulomb's Law.

The electrostatic force between two point charges is given by:

$$F = \frac{kq_1q_2}{r^2}$$

Here, since the charges are identical, we take $q_1 = q_2 = q$. So the formula becomes:

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

Step 2: Substitute the known values.

Given:

$$F = 9 \times 10^{-9}\,\text{N}, \quad r = 1\,\text{m}, \quad k = 9 \times 10^{9}\,\text{Nm}^2/\text{C}^2$$

Substitute into the formula:

$$9 \times 10^{-9} = \frac{9 \times 10^{9} \cdot q^2}{1^2}$$

Step 3: Solve for q^2.

$$q^2 = \frac{9 \times 10^{-9}}{9 \times 10^{9}} = 10^{-18}$$

Step 4: Take square root to find q.

$$q = \sqrt{10^{-18}} = 10^{-9}\,\text{C}$$

Therefore, the magnitude of each charge is $\boxed{1 \times 10^{-9}\,\text{C}}$.

Quick Tip

To find the magnitude of identical charges when the force and separation are known, use Coulomb's law:

$$F = \frac{kq^2}{r^2} \Rightarrow q = \sqrt{\frac{Fr^2}{k}}$$

Always isolate q^2 and then take the square root.

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12. A charged particle moves in a magnetic field with velocity v perpendicular to the field B. The radius of the circular path is r. Which of the following expressions gives the charge q of the particle?

A) $q = \frac{mv}{Br}$

B) $q = \frac{mvB}{r}$

C) $q = \frac{mB}{vr}$

D) $q = \frac{Bvr}{m}$

Correct Answer: A) $q = \frac{mv}{Br}$

Solution:

Step 1: Understand the Motion.

When a charged particle moves perpendicular to a magnetic field, it experiences a centripetal force due to the Lorentz force:

$$F = qvB,$$

where: - q is the charge of the particle, - v is the velocity of the particle, - B is the magnetic field strength.

This force provides the necessary centripetal acceleration for the particle to move in a circular path. The centripetal force is given by:

$$F_{\text{centripetal}} = \frac{mv^2}{r},$$

where: - m is the mass of the particle, - r is the radius of the circular path.

Equating the Lorentz force to the centripetal force:

$$qvB = \frac{mv^2}{r}.$$

Step 2: Solve for q.

Rearrange the equation to solve for q:

$$q = \frac{mv^2}{Br}.$$

Step 3: Verify the Options.

The options provided are: A) $q = \frac{mv}{Br}$

B) $q = \frac{mvB}{r}$

C) $q = \frac{mB}{vr}$

D) $q = \frac{Bvr}{m}$.

From our derivation:

$$q = \frac{mv}{Br}.$$

Thus, the correct answer is:

$$\boxed{\text{A}}$$

Quick Tip

Use the relationship between the Lorentz force and centripetal force to derive the charge of the particle.

13. How much water must be added to 500 mL of 2 M H_2SO_4 solution to make it 0.5 M?

(A) 1.5 L

(B) 2.0 L

(C) 1.0 L

(D) 0.75 L

Correct Answer: (C) 1.0 L

13. How much water must be added to 500 mL of 2 M H_2SO_4 solution to make it 0.5 M?

(A) 1.5 L

(B) 2.0 L

(C) 1.0 L

(D) 0.75 L

Correct Answer: (A) 1.5 L

Solution:

Step 1: Use the dilution formula

$$M_1V_1 = M_2V_2$$

where

$M_1 = 2\,\text{M}$,

$V_1 = 500\,\text{mL} = 0.5\,\text{L}$,

$M_2 = 0.5\,\text{M}$,

$V_2 =$ final volume after dilution in liters.

Step 2: Calculate final volume V_2

$$2 \times 0.5 = 0.5 \times V_2 \implies 1 = 0.5V_2 \implies V_2 = \frac{1}{0.5} = 2\,\text{L}$$

Step 3: Calculate volume of water to be added

$$V_{\text{water}} = V_2 - V_1 = 2 - 0.5 = 1.5\,\text{L}$$

Quick Tip

Use the dilution formula $M_1V_1 = M_2V_2$ for problems involving changing concentrations by adding solvent. Always convert volumes to consistent units.

Quick Tip

For dilution problems, always use:

$$M_1V_1 = M_2V_2$$

and remember that volume units must be consistent. The volume of water added is the difference between final and initial volumes.

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14. Question 14 How many grams of CO_2 are produced when 10 g of C_2H_6 (ethane) is completely combusted? Reaction: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

(A) 29.3 g

(B) 44.0 g

(C) 58.6 g

(D) 88.0 g

Correct Answer: (A) 29.3 g

Solution:

Step 1: Calculate the molar masses of the relevant compounds. The balanced chemical equation for the combustion of ethane is given: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

We need the molar mass of ethane (C_2H_6) and carbon dioxide (CO_2). Using approximate atomic masses: C = 12.0 g/mol, H = 1.0 g/mol, O = 16.0 g/mol.

Molar mass of C_2H_6: $M(C_2H_6) = (2 \times 12.0) + (6 \times 1.0) = 24.0 + 6.0 = 30.0$ g/mol

Molar mass of CO_2: $M(CO_2) = (1 \times 12.0) + (2 \times 16.0) = 12.0 + 32.0 = 44.0$ g/mol

Step 2: Convert the given mass of C_2H_6 to moles. Mass of $C_2H_6 = 10$ g Moles of $C_2H_6 = \frac{\text{Mass}}{\text{Molar mass}} = \frac{10 \text{ g}}{30.0 \text{ g/mol}} = \frac{1}{3}$ mol

Step 3: Use the stoichiometric ratio from the balanced equation to find the moles of CO_2 produced. From the balanced equation, 2 moles of C_2H_6 produce 4 moles of CO_2. The mole ratio of C_2H_6 to CO_2 is $2:4$, which simplifies to $1:2$. So, for every 1 mole of C_2H_6 consumed, 2 moles of CO_2 are produced.

Moles of $CO_2 = (\text{Moles of } C_2H_6) \times \frac{4 \text{ mol } CO_2}{2 \text{ mol } C_2H_6}$ Moles of $CO_2 = \left(\frac{1}{3} \text{ mol}\right) \times 2 = \frac{2}{3}$ mol

Step 4: Convert the moles of CO_2 to grams. Mass of CO_2 = Moles × Molar mass Mass of $CO_2 = \left(\frac{2}{3}\text{ mol}\right) \times 44.0$ g/mol Mass of $CO_2 = \frac{88}{3}$ g Mass of $CO_2 \approx 29.33$ g
Comparing this result with the given options, 29.3 g is the closest and matches option (A).

Quick Tip

To solve stoichiometry problems involving mass-to-mass conversions:

1. **Balance the Chemical Equation:** Ensure the reaction is correctly balanced to determine the correct mole ratios between reactants and products.
2. **Calculate Molar Masses:** Determine the molar mass of the given substance and the substance you need to find.
3. **Convert Given Mass to Moles:** Use the molar mass to convert the given mass of the substance into moles.
4. **Use Mole Ratio (Stoichiometry):** From the balanced equation, use the stoichiometric coefficients to find the mole ratio between the given substance and the desired substance. Use this ratio to convert moles of the given substance to moles of the desired substance.
5. **Convert Moles to Desired Mass:** Use the molar mass of the desired substance to convert its moles back into grams.

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15. A 2 L container holds oxygen gas at 300 K and 2 atm pressure. If the temperature is increased to 600 K and the volume is doubled, what is the final pressure?

(A) 1 atm
(B) 2 atm
(C) 0.5 atm
(D) 4 atm

Correct Answer: (B) 2 atm

Solution: Step 1: Write down the initial conditions:

$$P_1 = 2\text{ atm}, \quad V_1 = 2\text{ L}, \quad T_1 = 300\text{ K}$$

Step 2: Write down the final conditions:

$$V_2 = 2 \times V_1 = 4 \text{ L}, \quad T_2 = 600 \text{ K}, \quad P_2 = ?$$

Step 3: Use the combined gas law:

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

Step 4: Substitute the known values:

$$\frac{2 \times 2}{300} = \frac{P_2 \times 4}{600}$$

$$\frac{4}{300} = \frac{4P_2}{600} \implies \frac{4}{300} = \frac{4P_2}{600}$$

Step 5: Simplify and solve for P_2:

$$\frac{4}{300} = \frac{4P_2}{600} \implies \frac{4}{300} \times \frac{600}{4} = P_2 \implies \frac{600}{300} = P_2 \implies 2 = P_2$$

Step 6: Check for calculation correctness.

Note: The previous calculation shows $P_2 = 2$ atm, but let's carefully re-check the algebra.

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \implies P_2 = \frac{P_1 V_1 T_2}{T_1 V_2}$$

$$P_2 = \frac{2 \times 2 \times 600}{300 \times 4} = \frac{2400}{1200} = 2 \text{ atm}$$

Final answer: $P_2 = 1$ atm or 2 atm?

Actually, the volume is doubled and temperature doubled, so

$$P_2 = \frac{P_1 V_1 T_2}{T_1 V_2} = \frac{2 \times 2 \times 600}{300 \times 4} = \frac{2400}{1200} = 2 \text{ atm}$$

So $P_2 = 2$ atm.

Hence, the correct answer is (B) 2 atm.

Quick Tip

Use the combined gas law $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$ when pressure, volume, and temperature all change.

16. For the reaction $N_2 + 3H_2 \rightleftharpoons 2NH_3$, if initially 1 mole of N_2 and 3 moles of H_2 are taken and at equilibrium 0.4 moles of NH_3 are formed, find the equilibrium concentration of H_2.

(A) 2.4 moles

(B) 2.8 moles

(C) 3.4 moles

(D) 3.0 moles

Correct Answer: (A) 2.4 moles

Solution:

Given:

- Chemical equation: $\mathrm{N_2 + 3H_2 \rightleftharpoons 2NH_3}$
- Initial moles:
  - $\mathrm{N_2}$: 1 mole
  - $\mathrm{H_2}$: 3 moles
  - $\mathrm{NH_3}$: 0 moles (initially)
- At equilibrium: 0.4 moles of $\mathrm{NH_3}$ formed

Step 1: Establish the Change in Moles

Let x be the moles of $\mathrm{N_2}$ that react. According to the stoichiometry:

$$\begin{array}{lccc} & \mathrm{N_2} & +3\mathrm{H_2} \rightleftharpoons & 2\mathrm{NH_3} \\ \text{Initial (moles):} & 1 & 3 & 0 \\ \text{Change (moles):} & -x & -3x & +2x \\ \text{Equilibrium (moles):} & 1-x & 3-3x & 2x \end{array}$$

Step 2: Solve for x

Given that at equilibrium, 0.4 moles of $\mathrm{NH_3}$ are present:

$$2x = 0.4 \implies x = 0.2 \text{ moles}$$

Step 3: Calculate Equilibrium Moles of $\mathrm{H_2}$

Substitute $x = 0.2$ into the equilibrium expression for H_2:

$$\text{Moles of } H_2 = 3 - 3x = 3 - 3(0.2) = 3 - 0.6 = 2.4 \text{ moles}$$

Step 4: Verification

- N_2 at equilibrium: $1 - 0.2 = 0.8$ moles
- H_2 at equilibrium: $3 - 0.6 = 2.4$ moles
- NH_3 at equilibrium: $2 \times 0.2 = 0.4$ moles

Conclusion

The equilibrium concentration of H_2 is $\boxed{2.4 \text{ moles}}$.

Final Answer

Based on standard equilibrium calculations, the correct equilibrium concentration of H_2 is:

$$\boxed{2.4 \text{ moles}}$$

Quick Tip

Always use mole ratios from the balanced equation to compute changes in moles at equilibrium.
