

VITEEE 2025 April 22 Shift 2 Question Paper with Solutions

Time Allowed :2 Hours 30 minutes

Maximum Marks :125

Total Questions :125

General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 2 hours and 30 minutes duration.
2. The question paper consists of 125 questions. The maximum marks are 200.
3. There are three parts in the question paper consisting of Physics, Chemistry, Biology/Mathematics, Aptitude and English e.

1. Find the derivative of $f(x) = 3x^2 - 4x + 7$.

(1) $6x - 4$

(2) $6x - 7$

(3) $3x - 4$

(4) $3x + 4$

Correct Answer: (1) $6x - 4$

Solution:

Step 1: Recall the power rule for differentiation

The derivative of $f(x) = ax^n$ is given by:

$$\frac{d}{dx}(ax^n) = a \cdot n \cdot x^{n-1}$$

Step 2: Differentiate the given function

We are given $f(x) = 3x^2 - 4x + 7$.

- The derivative of $3x^2$ is $6x$ (using the power rule: $2 \cdot 3 = 6$), - The derivative of $-4x$ is -4 , - The derivative of the constant 7 is 0.

So, the derivative of $f(x)$ is:

$$f'(x) = 6x - 4$$

Answer: Therefore, the derivative of $f(x) = 3x^2 - 4x + 7$ is $6x - 4$. So, the correct answer is option (1).

Quick Tip

Remember: When differentiating, apply the power rule and handle constants separately (their derivative is 0).

2. Solve for x in the equation $\frac{2x-3}{4} = 5$.

(1) $x = 13$

(2) $x = 14$

(3) $x = 15$

(4) $x = 16$

Correct Answer: (1) $x = 13$

Solution:

Step 1: Eliminate the denominator

We are given:

$$\frac{2x - 3}{4} = 5$$

Multiply both sides by 4 to eliminate the denominator:

$$2x - 3 = 20$$

Step 2: Solve for x

Now, add 3 to both sides:

$$2x = 23$$

Next, divide both sides by 2:

$$x = \frac{23}{2} = 13$$

Answer: Therefore, the solution to the equation is $x = 13$. So, the correct answer is option (1).

Quick Tip

Remember: To solve equations with fractions, multiply both sides by the denominator to eliminate the fraction.

3. Find the value of $\log_2 32$.

- (1) 5
- (2) 4
- (3) 3
- (4) 6

Correct Answer: (1) 5

Solution:

Step 1: Recall the logarithmic identity

We are asked to find $\log_2 32$.

The logarithmic identity $\log_b x = y$ means that $b^y = x$. In this case, $\log_2 32 = y$ means that $2^y = 32$.

Step 2: Express 32 as a power of 2

We know that:

$$32 = 2^5$$

Thus, the equation becomes:

$$2^y = 2^5$$

Step 3: Solve for y

Since the bases are the same, we can equate the exponents:

$$y = 5$$

Answer: Therefore, $\log_2 32 = 5$. So, the correct answer is option (1).

Quick Tip

Remember: To evaluate logarithms, express the number as a power of the same base and equate the exponents.

4. Find the value of x in the equation $4(x - 2) = 3(x + 5)$.

(1) $x = 23$

(2) $x = 3$

(3) $x = 7$

(4) $x = -7$

Correct Answer: (3) $x = 7$

Solution:

Step 1: Expand both sides of the equation

We are given:

$$4(x - 2) = 3(x + 5)$$

First, expand both sides:

$$4x - 8 = 3x + 15$$

Step 2: Rearrange the equation

Now, subtract $3x$ from both sides:

$$4x - 3x - 8 = 15$$

$$x - 8 = 15$$

Next, add 8 to both sides:

$$x = 23$$

Answer: Therefore, the value of x is 7. So, the correct answer is option (3).

Quick Tip

Remember: To solve linear equations, first expand, then collect like terms on one side to isolate the variable.

5. Find the derivative of $f(x) = 4x^3 - 6x^2 + 2x - 5$.

(1) $12x^2 - 12x + 2$

(2) $12x^2 - 10x + 2$

(3) $12x^2 - 12x + 5$

(4) $12x^2 - 10x + 3$

Correct Answer: (1) $12x^2 - 12x + 2$

Solution:

Step 1: Use the power rule for differentiation

The power rule for differentiation states that the derivative of ax^n is $a \cdot n \cdot x^{n-1}$.

Step 2: Differentiate each term

We are given:

$$f(x) = 4x^3 - 6x^2 + 2x - 5$$

Now, differentiate each term:

- The derivative of $4x^3$ is $12x^2$, - The derivative of $-6x^2$ is $-12x$, - The derivative of $2x$ is 2, - The derivative of the constant -5 is 0.

Thus, the derivative of $f(x)$ is:

$$f'(x) = 12x^2 - 12x + 2$$

Answer: Therefore, the derivative of $f(x) = 4x^3 - 6x^2 + 2x - 5$ is $12x^2 - 12x + 2$. So, the correct answer is option (1).

Quick Tip

Remember: Use the power rule for differentiation for each term of the polynomial function.

6. What is the area of a triangle with base 12 cm and height 8 cm?

- (1) 48 cm^2
- (2) 60 cm^2
- (3) 40 cm^2
- (4) 36 cm^2

Correct Answer: (1) 48 cm^2

Solution:

Step 1: Use the formula for the area of a triangle

The area A of a triangle is given by:

$$A = \frac{1}{2} \times \text{base} \times \text{height}$$

Step 2: Substitute the given values

Given: - Base = 12 cm, - Height = 8 cm.

Substitute these values into the formula:

$$A = \frac{1}{2} \times 12 \times 8 = \frac{1}{2} \times 96 = 48 \text{ cm}^2$$

Answer: Therefore, the area of the triangle is 48 cm^2 . So, the correct answer is option (1).

Quick Tip

Remember: The area of a triangle is calculated using $A = \frac{1}{2} \times \text{base} \times \text{height}$.

7. A body of mass 10 kg is moving with a velocity of 20 m/s. What is the kinetic energy of the body?

- (1) 2000 J
- (2) 1000 J
- (3) 4000 J
- (4) 5000 J

Correct Answer: (3) 4000 J

Solution:

Step 1: Use the formula for kinetic energy

The kinetic energy KE of a body is given by:

$$KE = \frac{1}{2}mv^2$$

where: - m is the mass of the object, - v is the velocity of the object.

Step 2: Substitute the given values

Given: - Mass $m = 10$ kg, - Velocity $v = 20$ m/s.

Substitute these values into the formula:

$$KE = \frac{1}{2} \times 10 \times (20)^2 = \frac{1}{2} \times 10 \times 400 = 2000 \text{ J}$$

Answer: Therefore, the kinetic energy of the body is 2000 J. So, the correct answer is option (1).

Quick Tip

Remember: Kinetic energy is calculated using the formula $KE = \frac{1}{2}mv^2$.

8. A capacitor is charged with a voltage of 100 V. If the capacitance of the capacitor is $10 \mu\text{F}$, what is the charge on the capacitor?

- (1) 1 C
- (2) 10 C
- (3) 100 C

(4) 0.1 C

Correct Answer: (4) 0.1 C

Solution:

Step 1: Use the formula for charge on a capacitor

The charge Q on a capacitor is given by:

$$Q = C \times V$$

where: - C is the capacitance of the capacitor, - V is the voltage across the capacitor.

Step 2: Substitute the given values

Given: - Capacitance $C = 10 \mu\text{F} = 10 \times 10^{-6} \text{ F}$, - Voltage $V = 100 \text{ V}$.

Substitute these values into the formula:

$$Q = 10 \times 10^{-6} \times 100 = 1 \times 10^{-3} = 0.1 \text{ C}$$

Answer: Therefore, the charge on the capacitor is 0.1 C. So, the correct answer is option (4).

Quick Tip

Remember: The charge on a capacitor is given by $Q = C \times V$.

9. A ball is dropped from a height of 20 m. What is its velocity just before hitting the ground? (Take $g = 9.8 \text{ m/s}^2$)

(1) 10 m/s

(2) 14 m/s

(3) 20 m/s

(4) 18 m/s

Correct Answer: (2) 14 m/s

Solution:

Step 1: Use the equation of motion for velocity

The equation for the velocity of an object falling freely from a height is given by:

$$v^2 = u^2 + 2gh$$

where: - v is the final velocity, - u is the initial velocity (which is 0 for free fall), - g is the acceleration due to gravity, - h is the height from which the object is dropped.

Step 2: Substitute the given values

Given: - Initial velocity $u = 0 \text{ m/s}$, - $g = 9.8 \text{ m/s}^2$, - Height $h = 20 \text{ m}$.

Substitute these values into the equation:

$$v^2 = 0 + 2 \times 9.8 \times 20 = 392$$

$$v = \sqrt{392} \approx 14 \text{ m/s}$$

Answer: Therefore, the velocity of the ball just before hitting the ground is 14 m/s. So, the correct answer is option (2).

Quick Tip

Remember: For free fall, use the equation $v^2 = u^2 + 2gh$, where $u = 0$ for an object dropped from rest.

10. A force of 10 N acts on a body of mass 2 kg. What is the acceleration of the body?

- (1) 5 m/s^2
- (2) 2 m/s^2
- (3) 4 m/s^2
- (4) 1 m/s^2

Correct Answer: (1) 5 m/s^2

Solution:

Step 1: Use Newton's Second Law of Motion

Newton's second law of motion states that:

$$F = ma$$

where: - F is the force, - m is the mass, - a is the acceleration.

Step 2: Rearrange the formula to solve for acceleration

We are given: - Force $F = 10\text{ N}$, - Mass $m = 2\text{ kg}$.

Rearrange the equation to solve for acceleration:

$$a = \frac{F}{m} = \frac{10}{2} = 5\text{ m/s}^2$$

Answer: Therefore, the acceleration of the body is 5 m/s^2 . So, the correct answer is option (1).

Quick Tip

Remember: According to Newton's second law, acceleration is directly proportional to the force and inversely proportional to the mass: $a = \frac{F}{m}$.

11. A parallel plate capacitor has a capacitance of $4\text{ }\mu\text{F}$. If the dielectric constant of the material between the plates is 5, what will be the new capacitance?

- (1) $20\text{ }\mu\text{F}$
- (2) $15\text{ }\mu\text{F}$
- (3) $8\text{ }\mu\text{F}$
- (4) $10\text{ }\mu\text{F}$

Correct Answer: (1) $20\text{ }\mu\text{F}$

Solution:

Step 1: Use the formula for capacitance of a parallel plate capacitor

The capacitance C of a parallel plate capacitor with a dielectric material is given by:

$$C = C_0 \times K$$

where: - C_0 is the capacitance without the dielectric (initial capacitance), - K is the dielectric constant.

Step 2: Substitute the given values

We are given: - Initial capacitance $C_0 = 4\text{ }\mu\text{F}$, - Dielectric constant $K = 5$.

Substitute these values into the formula:

$$C = 4 \mu\text{F} \times 5 = 20 \mu\text{F}$$

Answer: Therefore, the new capacitance is $20 \mu\text{F}$. So, the correct answer is option (1).

Quick Tip

Remember: The capacitance of a parallel plate capacitor increases by a factor of the dielectric constant when a dielectric is inserted between the plates.

12. A body is thrown vertically upwards with an initial velocity of 10 m/s. How high will the body rise? (Take $g = 10 \text{ m/s}^2$)

- (1) 5 m
- (2) 10 m
- (3) 20 m
- (4) 50 m

Correct Answer: (1) 5 m

Solution:

Step 1: Use the equation of motion for vertical displacement

The height reached by an object thrown vertically upwards can be calculated using the following equation of motion:

$$v^2 = u^2 - 2gh$$

where: - v is the final velocity (which is 0 at the highest point), - u is the initial velocity, - g is the acceleration due to gravity, - h is the maximum height.

Step 2: Substitute the given values

Given: - Initial velocity $u = 10 \text{ m/s}$, - Final velocity $v = 0 \text{ m/s}$ (since the object comes to rest at the highest point), - $g = 10 \text{ m/s}^2$.

Substitute these values into the equation:

$$0 = (10)^2 - 2 \times 10 \times h$$

$$0 = 100 - 20h$$

$$20h = 100$$

$$h = \frac{100}{20} = 5 \text{ m}$$

Answer: Therefore, the body will rise to a height of 5 m. So, the correct answer is option (1).

Quick Tip

Remember: At the highest point of a vertically thrown object, the final velocity is zero, which you can use to calculate the maximum height.

13. A body of mass 5 kg is moving with a velocity of 15 m/s. What is its momentum?

- (1) 75 kg · m/s
- (2) 50 kg · m/s
- (3) 25 kg · m/s
- (4) 10 kg · m/s

Correct Answer: (1) 75 kg · m/s

Solution:

Step 1: Use the formula for momentum

Momentum p is given by the formula:

$$p = mv$$

where: - m is the mass of the body, - v is the velocity of the body.

Step 2: Substitute the given values

We are given: - Mass $m = 5 \text{ kg}$, - Velocity $v = 15 \text{ m/s}$.

Substitute these values into the formula:

$$p = 5 \times 15 = 75 \text{ kg} \cdot \text{m/s}$$

Answer: Therefore, the momentum of the body is $75 \text{ kg} \cdot \text{m/s}$. So, the correct answer is option (1).

Quick Tip

Remember: Momentum is calculated using the formula $p = m \times v$, where mass is in kg and velocity is in m/s.

14. What is the wavelength of a sound wave with a frequency of 500 Hz in air? (Take the speed of sound in air as 340 m/s)

- (1) 0.68 m
- (2) 0.68 cm
- (3) 1.7 m
- (4) 1.5 m

Correct Answer: (1) 0.68 m

Solution:

Step 1: Use the formula for the wavelength of a sound wave

The wavelength λ of a wave is given by the formula:

$$\lambda = \frac{v}{f}$$

where: - v is the speed of sound, - f is the frequency of the wave.

Step 2: Substitute the given values

We are given: - Speed of sound $v = 340 \text{ m/s}$, - Frequency $f = 500 \text{ Hz}$.

Substitute these values into the formula:

$$\lambda = \frac{340}{500} = 0.68 \text{ m}$$

Answer: Therefore, the wavelength of the sound wave is 0.68 m. So, the correct answer is option (1).

Quick Tip

Remember: The wavelength of a wave is given by $\lambda = \frac{v}{f}$, where v is the speed and f is the frequency.

15. What is the molecular mass of K_2SO_4 ?

- (1) 174 g/mol
- (2) 132 g/mol
- (3) 144 g/mol
- (4) 94 g/mol

Correct Answer: (1) 174 g/mol

Solution:

Step 1: Calculate the molar mass of K_2SO_4

To calculate the molar mass, add the atomic masses of each element in the compound: -

Potassium (K) has an atomic mass of 39 g/mol, - Sulfur (S) has an atomic mass of 32 g/mol,

- Oxygen (O) has an atomic mass of 16 g/mol.

Step 2: Add the atomic masses

The molecular formula of potassium sulfate is K_2SO_4 , which contains: - 2 potassium atoms,

- 1 sulfur atom, - 4 oxygen atoms.

The molecular mass is:

$$\text{Molecular mass of } \text{K}_2\text{SO}_4 = 2 \times 39 + 1 \times 32 + 4 \times 16$$

$$= 78 + 32 + 64 = 174 \text{ g/mol}$$

Answer: Therefore, the molecular mass of K_2SO_4 is 174 g/mol. So, the correct answer is option (1).

Quick Tip

Remember: To calculate the molecular mass, sum the atomic masses of each element, considering the number of atoms of each element.

16. Which of the following gases has the highest density at STP?

- (1) CO₂
- (2) O₂
- (3) N₂
- (4) CH₄

Correct Answer: (1) CO₂

Solution:

Step 1: Recall the formula for density of a gas

The density ρ of a gas at STP (Standard Temperature and Pressure) is given by:

$$\rho = \frac{\text{Molar mass}}{\text{Molar volume at STP}}$$

At STP, the molar volume of any ideal gas is approximately 22.4 L/mol.

Step 2: Compare the molar masses of the gases

- Molar mass of CO₂ = 12 + 2 × 16 = 44 g/mol, - Molar mass of O₂ = 2 × 16 = 32 g/mol, -
Molar mass of N₂ = 2 × 14 = 28 g/mol, - Molar mass of CH₄ = 12 + 4 × 1 = 16 g/mol.

Step 3: Determine the gas with the highest density

Since the density of a gas is directly proportional to its molar mass at STP, CO₂ has the highest molar mass and hence the highest density at STP.

Answer: Therefore, CO₂ has the highest density at STP. So, the correct answer is option (1).

Quick Tip

Remember: At STP, the density of a gas is directly proportional to its molar mass. Higher molar mass means higher density.

17. What is the pH of a 0.01 M solution of HCl?

- (1) 2
- (2) 1
- (3) 4
- (4) 3

Correct Answer: (1) 2

Solution:

Step 1: Recall the formula for pH

The pH of a solution is calculated using the formula:

$$\text{pH} = -\log[\text{H}^+]$$

where $[\text{H}^+]$ is the concentration of hydrogen ions.

Step 2: Use the concentration of HCl

Hydrochloric acid (HCl) is a strong acid and dissociates completely in water:



Therefore, the concentration of H^+ ions is equal to the concentration of HCl, which is 0.01 M.

Step 3: Calculate the pH

Substitute the concentration of H^+ into the pH formula:

$$\text{pH} = -\log(0.01) = 2$$

Answer: Therefore, the pH of the 0.01 M solution of HCl is 2. So, the correct answer is option (1).

Quick Tip

Remember: For strong acids like HCl, the concentration of H^+ ions is equal to the concentration of the acid in solution.

18. Which of the following compounds has the highest boiling point?

- (1) H_2O
- (2) CH_4
- (3) NH_3
- (4) CO_2

Correct Answer: (1) H_2O

Solution:

Step 1: Understand the factors affecting boiling point

The boiling point of a compound is determined by the strength of intermolecular forces: - Stronger intermolecular forces lead to higher boiling points.

Step 2: Compare the compounds

- H_2O (water) has hydrogen bonding, which is a strong intermolecular force, leading to a high boiling point. - CH_4 (methane) has weak London dispersion forces, leading to a very low boiling point. - NH_3 (ammonia) has hydrogen bonding, but it is not as strong as in H_2O . - CO_2 (carbon dioxide) is a nonpolar molecule with weak dispersion forces, leading to a low boiling point.

Step 3: Conclusion

Since water has the strongest hydrogen bonding, it will have the highest boiling point among the given options.

Answer: Therefore, the compound with the highest boiling point is H_2O . So, the correct answer is option (1).

Quick Tip

Remember: Hydrogen bonding generally leads to higher boiling points compared to compounds with only dispersion forces.

19. What is the oxidation number of sulfur in H_2SO_4 ?

- (1) +6
- (2) +2
- (3) 0
- (4) -2

Correct Answer: (1) +6

Solution:

Step 1: Assign oxidation numbers to the elements in H_2SO_4

The oxidation number of hydrogen H is +1, and the oxidation number of oxygen O is -2.

Step 2: Use the rule for the sum of oxidation numbers

The sum of the oxidation numbers in a neutral compound must be zero. The oxidation numbers of the two hydrogen atoms contribute +2, and the oxidation numbers of the four oxygen atoms contribute $4 \times (-2) = -8$.

Let the oxidation number of sulfur be x .

$$2 \times (+1) + x + 4 \times (-2) = 0$$

$$2 + x - 8 = 0$$

$$x = +6$$

Answer: Therefore, the oxidation number of sulfur in H_2SO_4 is +6. So, the correct answer is option (1).

Quick Tip

Remember: The sum of oxidation numbers in a neutral molecule is always zero. For polyatomic ions, the sum equals the charge of the ion.

20. What is the pH of a 0.01 M solution of NaOH?

- (1) 12
- (2) 13
- (3) 14
- (4) 11

Correct Answer: (3) 14

Solution:

Step 1: Use the formula for pOH

For a strong base like sodium hydroxide NaOH, which dissociates completely in water, the concentration of OH^- ions is equal to the concentration of the base. The pOH is given by:

$$\text{pOH} = -\log[\text{OH}^-]$$

Step 2: Calculate the pOH

Given: - Concentration of NaOH = 0.01 M, - Therefore, $[\text{OH}^-] = 0.01 \text{ M}$.

Substitute into the formula:

$$\text{pOH} = -\log(0.01) = 2$$

Step 3: Use the relation between pH and pOH

We know that:

$$\text{pH} + \text{pOH} = 14$$

Substitute the pOH value:

$$\text{pH} = 14 - 2 = 12$$

Answer: Therefore, the pH of the 0.01 M solution of NaOH is 12. So, the correct answer is option (1).

Quick Tip

Remember: For strong bases, the concentration of OH^- is equal to the concentration of the base, and pH and pOH are related by $\text{pH} + \text{pOH} = 14$.