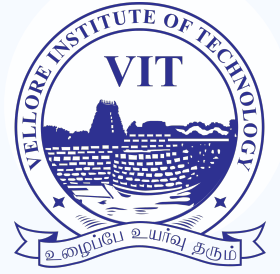


VITEEE 2026 April 30 Shift 2

Question Paper with Solutions

Conducted by VIT Vellore



General Instructions

- (i) **Duration:** The total duration of the examination is 2.5 hours (150 minutes).
- (ii) **Total Marks:** The complete paper carries a maximum of 500 marks.
- (iii) **Structure:** The paper has 4 Sections:
 - **Part 1:** 35 Multiple Choice Questions (Physics).
 - **Part 2:** 35 Multiple Choice Questions (Chemistry).
 - **Part 3:** 40 Multiple Choice Questions (Mathematics/Biology).
 - **Part 4:** 10 Multiple Choice Questions (Aptitude).
 - **Part 5:** 5 Multiple Choice Questions (English)
- (iv) **Compulsory Questions:** All 125 questions are compulsory.
- (v) Each question has four options. Only **one** option is correct.
- (vi) **Correct Answer:** +4 marks.
- (vii) **Incorrect Answer:** -1 (Negative marking).
- (viii) **Unanswered/Marked for Review:** 0 marks.

1. If $z = \frac{3i}{2}$, what is the value of $\arg(z)$?

- (A) 0
- (B) $\frac{\pi}{2}$
- (C) π
- (D) $\frac{3\pi}{2}$

Correct Answer: (2) $\frac{\pi}{2}$

Solution:

Concept: For a complex number $z = x + iy$, the argument $\arg(z)$ is the angle made with the positive real axis. For a purely imaginary number:

- If $y > 0$, then $\arg(z) = \frac{\pi}{2}$
- If $y < 0$, then $\arg(z) = -\frac{\pi}{2}$

Step 1: Express the complex number.

Given:

$$z = \frac{3i}{2} = 0 + \frac{3}{2}i$$

Step 2: Identify its position in the complex plane.

Since the real part is 0 and the imaginary part is positive, the number lies on the positive imaginary axis.

Step 3: Determine the argument.

For any positive purely imaginary number:

$$\arg(z) = \frac{\pi}{2}$$

Quick Tip: If a complex number lies on: - Positive real axis $\Rightarrow \arg = 0$ - Positive imaginary axis $\Rightarrow \arg = \frac{\pi}{2}$ - Negative real axis $\Rightarrow \arg = \pi$ - Negative imaginary axis $\Rightarrow \arg = -\frac{\pi}{2}$

2. Find the missing number in the series: 2, 6, 12, 20, 30, __.

- (A) 40
- (B) 42
- (C) 44
- (D) 46

Correct Answer: (2) 42

Solution:

Concept: In number series problems, observing the pattern of differences between consecutive terms often helps identify the rule governing the sequence.

Step 1: Compute the differences between consecutive terms.

$$6 - 2 = 4, \quad 12 - 6 = 6, \quad 20 - 12 = 8, \quad 30 - 20 = 10$$

Step 2: Identify the pattern in the differences.

The differences form the sequence:

$$4, 6, 8, 10$$

This sequence increases by 2 each time.

Step 3: Determine the next difference.

$$10 + 2 = 12$$

Step 4: Find the next term in the series.

$$30 + 12 = 42$$

Thus, the missing number in the sequence is:

$$\boxed{42}$$

Quick Tip: When solving number series, always check: - Differences between terms - Second differences
- Multiplication or mixed patterns Increasing differences are a common pattern in reasoning sequences.

3. Calculate the ratio of de Broglie wavelengths of an electron (λ_e) and a proton (λ_p) moving with the same velocity.

- (A) $\frac{m_e}{m_p}$
- (B) $\frac{m_p}{m_e}$
- (C) 1
- (D) $\frac{m_e^2}{m_p^2}$

Correct Answer: (2) $\frac{m_p}{m_e}$

Solution:

Concept: The de Broglie wavelength of a particle is given by

$$\lambda = \frac{h}{mv}$$

where:

- h = Planck's constant
- m = mass of the particle
- v = velocity of the particle

Thus, wavelength is inversely proportional to mass when velocity is constant.

Step 1: Write the wavelengths of electron and proton.

$$\lambda_e = \frac{h}{m_e v}, \quad \lambda_p = \frac{h}{m_p v}$$

Step 2: Find the ratio.

$$\frac{\lambda_e}{\lambda_p} = \frac{\frac{h}{m_e v}}{\frac{h}{m_p v}}$$

Step 3: Simplify the expression.

$$\frac{\lambda_e}{\lambda_p} = \frac{m_p}{m_e}$$

$$\boxed{\frac{\lambda_e}{\lambda_p} = \frac{m_p}{m_e}}$$

Quick Tip: From the de Broglie relation $\lambda = \frac{h}{mv}$: - If velocity is constant, wavelength is inversely proportional to mass. - A lighter particle always has a larger de Broglie wavelength.

4. What is the major product formed when phenol reacts with bromine water?

- (A) Bromobenzene
(B) 2-bromophenol

- (C) 2,4-dibromophenol
(D) 2,4,6-tribromophenol

Correct Answer: (4) 2,4,6-tribromophenol

Solution:

Concept: Phenol contains a highly activating $-OH$ group which increases the electron density on the benzene ring. This strongly activates the ortho and para positions for electrophilic substitution reactions.

Step 1: Understand the reactivity of phenol.

The hydroxyl group donates electron density to the aromatic ring through resonance, making the ring highly reactive toward electrophiles.

Step 2: Reaction with bromine water.

When phenol reacts with bromine water, bromination occurs rapidly at the two ortho positions and the para position relative to the $-OH$ group.

Step 3: Formation of the product.

Thus, three bromine atoms substitute hydrogen atoms at positions 2, 4, and 6 of the benzene ring, forming:



This compound appears as a white precipitate in the reaction mixture.

Quick Tip: Phenol is highly activating toward electrophilic substitution. With bromine water, it undergoes rapid substitution at the ortho and para positions, producing 2,4,6-tribromophenol as a white precipitate.

5. A bag contains 5 red and 7 blue balls. Find the probability of drawing 2 red balls without replacement.

- (A) $\frac{5}{33}$
(B) $\frac{10}{33}$
(C) $\frac{25}{144}$
(D) $\frac{7}{33}$

Correct Answer: (1) $\frac{5}{33}$

Solution:

Concept: For probability without replacement, the outcome of the first event affects the probability of the second event. The multiplication rule of probability is used:

$$P(A \cap B) = P(A) \times P(B|A)$$

Step 1: Total number of balls.

$$5 \text{ red} + 7 \text{ blue} = 12 \text{ balls}$$

Step 2: Probability of drawing the first red ball.

$$P(\text{First Red}) = \frac{5}{12}$$

Step 3: Probability of drawing the second red ball.

After drawing one red ball, 4 red balls remain out of 11 total balls.

$$P(\text{Second Red}) = \frac{4}{11}$$

Step 4: Calculate the total probability.

$$\begin{aligned} P(\text{Two Reds}) &= \frac{5}{12} \times \frac{4}{11} \\ &= \frac{20}{132} = \frac{5}{33} \end{aligned}$$

Thus, the required probability is:

$$\boxed{\frac{5}{33}}$$

Quick Tip: For probabilities without replacement: - The total number of items decreases after each draw. - Use conditional probability $P(A \cap B) = P(A)P(B|A)$.

6. What happens to the magnetic field at the center of a circular coil if the number of turns is doubled while keeping the current constant?

- (A) It becomes half ($\frac{B}{2}$)
- (B) It remains the same
- (C) It doubles ($2B$)
- (D) It becomes four times ($4B$)

Correct Answer: (3) $2B$

Solution:

Concept: The magnetic field at the center of a circular coil carrying current is given by:

$$B = \frac{\mu_0 n I}{2R}$$

where

- μ_0 = permeability of free space
- n = number of turns of the coil
- I = current
- R = radius of the coil

Step 1: Observe the proportionality.

From the formula,

$$B \propto n$$

Thus, the magnetic field is directly proportional to the number of turns.

Step 2: Apply the given condition.

If the number of turns is doubled:

$$n \rightarrow 2n$$

Substituting into the relation,

$$B' = \frac{\mu_0 (2n) I}{2R} = 2B$$

Step 3: Interpret the result.

Hence, the magnetic field at the center of the circular coil becomes twice its original value.

$$B' = 2B$$

Quick Tip: For a circular current loop,

$$B = \frac{\mu_0 n I}{2R}$$

Magnetic field increases directly with the number of turns and current, and decreases with increasing radius.

7. Identify the IUPAC name for the coordination compound $[Co(NH_3)_6]Cl_3$.

- (A) Hexaamminecobalt(II) chloride
- (B) Hexaamminecobalt(III) chloride
- (C) Hexamminecobalt(III) chloride
- (D) Hexaamminecobalt(II) trichloride

Correct Answer: (2) Hexaamminecobalt(III) chloride

Solution:

Concept: In coordination compounds:

- Neutral ligands like NH_3 are named as *ammine*.
- The number of ligands is indicated using prefixes such as di, tri, tetra, hexa, etc.
- The oxidation state of the metal is written in Roman numerals in parentheses.

Step 1: Identify the ligand and its number.

The ligand is NH_3 (ammine). There are six such ligands.

Hexaammine

Step 2: Determine the oxidation state of cobalt.

The complex ion is:



Since NH_3 is a neutral ligand and three Cl^- ions are outside the coordination sphere, cobalt must have oxidation state:

+3

Step 3: Write the complete IUPAC name.

Combining ligand name, metal name, and oxidation state:

Hexaamminecobalt(III) chloride

Quick Tip: In coordination compounds: - NH_3 ligand is named *ammine*. - Neutral ligands do not affect oxidation state calculations. - The oxidation state of the metal balances the charge of the complex ion.

8. Find the value of k if the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-4}{k} = \frac{y-1}{2} = \frac{z}{1}$ are perpendicular.

- (A) 5
- (B) -5
- (C) 2
- (D) -2

Correct Answer: (2) -5

Solution:

Concept: Two lines are perpendicular if the dot product of their direction ratios is zero.

$$a_1a_2 + b_1b_2 + c_1c_2 = 0$$

where (a_1, b_1, c_1) and (a_2, b_2, c_2) are direction ratios of the lines.

Step 1: Identify the direction ratios of both lines.

For the first line:

$$\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$$

Direction ratios:

(2, 3, 4)

For the second line:

$$\frac{x-4}{k} = \frac{y-1}{2} = \frac{z}{1}$$

Direction ratios:

$$(k, 2, 1)$$

Step 2: Apply the perpendicular condition.

$$2(k) + 3(2) + 4(1) = 0$$

$$2k + 6 + 4 = 0$$

Step 3: Solve for k .

$$2k + 10 = 0$$

$$k = -5$$

$$\boxed{k = -5}$$

Quick Tip: If two lines in 3D are perpendicular, the dot product of their direction ratios must be zero.

9. Which of the following is an example of a condensation polymer?

- (A) Polyethylene
- (B) PVC
- (C) Nylon 6,6
- (D) Polystyrene

Correct Answer: (3) Nylon 6,6

Solution:

Concept: Condensation polymers are formed by the reaction between monomers with the

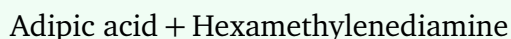
elimination of small molecules such as H_2O , HCl , or NH_3 .

Step 1: Understand condensation polymerization.

In this type of polymerization, two different monomers react and release a small molecule during the formation of the polymer chain.

Step 2: Example of condensation polymer.

Nylon 6,6 is formed by the condensation reaction between:



During the reaction, water molecules are eliminated.

Step 3: Conclusion.

Thus, Nylon 6,6 is a condensation polymer.

Nylon 6,6

Quick Tip: Condensation polymers form with the elimination of small molecules like H_2O or HCl .

Examples: Nylon 6,6, Terylene, Bakelite.

10. An object is placed 15 cm in front of a concave mirror of focal length 10 cm. Find the position and nature of the image.

- (A) 30 cm behind mirror, virtual and erect
- (B) 30 cm in front of mirror, real and inverted
- (C) 15 cm behind mirror, virtual
- (D) 20 cm in front of mirror, real

Correct Answer: (2) 30 cm in front of mirror, real and inverted

Solution:

Concept: The mirror formula is:

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

where

- u = object distance
- v = image distance
- f = focal length

Step 1: Substitute the given values.

For a concave mirror:

$$u = -15 \text{ cm}, \quad f = -10 \text{ cm}$$

$$\frac{1}{v} + \frac{1}{-15} = \frac{1}{-10}$$

Step 2: Solve for v .

$$\frac{1}{v} = -\frac{1}{10} + \frac{1}{15}$$

$$\frac{1}{v} = \frac{-3 + 2}{30}$$

$$\frac{1}{v} = -\frac{1}{30}$$

$$v = -30 \text{ cm}$$

Step 3: Interpret the result.

Negative image distance indicates the image forms in front of the mirror.

Thus, the image is:

30 cm in front of the mirror, real and inverted

Quick Tip: For concave mirrors: - If v is negative \rightarrow image forms in front of mirror (real). - If v is positive \rightarrow image forms behind mirror (virtual).