# VITEEE 2026 May 1 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 4:** 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) $\pi$

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

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

**Solution:**

**Step 1: Understanding the Question:**

The question asks for the principal argument of a given complex number $z$.

The argument represents the angle that the vector representing the complex number makes with the positive real axis in the Argand plane.

**Step 2: Key Formula or Approach:**

For a purely imaginary complex number $z = iy$:

1. If $y > 0$, the number lies on the positive imaginary axis, and $\arg(z) = \frac{\pi}{2}$.
2. If $y < 0$, the number lies on the negative imaginary axis, and $\arg(z) = -\frac{\pi}{2}$ or $\frac{3\pi}{2}$.

**Step 3: Detailed Explanation:**

Given complex number is $z = \frac{3}{2}i$.

We can write this in the form $x + iy$ as $z = 0 + \frac{3}{2}i$.

Here, the real part $x = 0$ and the imaginary part $y = \frac{3}{2}$.

Since $y = \frac{3}{2} > 0$, the point $(0, \frac{3}{2})$ is located on the positive Y-axis (Imaginary axis).

The angle formed with the positive X-axis (Real axis) is exactly $90^\circ$ or $\frac{\pi}{2}$ radians.

**Step 4: Final Answer:**

The value of $\arg(z)$ is $\frac{\pi}{2}$.

**Quick Tip:** For any positive purely imaginary number, the argument is always $\frac{\pi}{2}$.

You can visualize this quickly on the Argand plane: any point on the upper vertical axis is at a $\frac{\pi}{2}$ angle from the horizontal right axis.

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**2. Find the missing number in the series:** $2, 6, 12, 20, 30, \_\_$.

(A) 40

(B) 42

(C) 44

(D) 46

**Correct Answer:** (B) 42

**Solution:**

**Step 1: Understanding the Question:**

We need to identify the logical pattern governing the sequence of numbers to determine the value that follows 30.

**Step 2: Key Formula or Approach:**

The most common approach for such series is calculating the first-order differences between consecutive terms to see if a steady progression exists.

**Step 3: Detailed Explanation:**

Let's find the difference between consecutive terms:

$$6 - 2 = 4$$

$$12 - 6 = 6$$

$$20 - 12 = 8$$

$$30 - 20 = 10$$

The differences observed are $4, 6, 8, 10$.

This sub-sequence follows an arithmetic progression with a common difference of 2.

Therefore, the next difference must be $10 + 2 = 12$.

To find the missing term, add this difference to the last known term:

$$30 + 12 = 42$$

**Step 4: Final Answer:**

The missing number in the series is 42.

**Quick Tip:** This specific series also follows the pattern $n^2 + n$ or $n(n+1)$.

$1^2 + 1 = 2$, $2^2 + 2 = 6$, $3^2 + 3 = 12$, $4^2 + 4 = 20$, $5^2 + 5 = 30$.

So, the next term is $6^2 + 6 = 42$.

Checking for multiple patterns can confirm your answer in competitive exams.

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**3. Calculate the ratio of de Broglie wavelengths of an electron ($\lambda_e$) and a proton ($\lambda_p$) 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:** (B) $\frac{m_p}{m_e}$

**Solution:**

**Step 1: Understanding the Question:**

The problem asks for the relationship between the de Broglie wavelengths of two different particles (electron and proton) when they share the same velocity $v$.

**Step 2: Key Formula or Approach:**

According to the de Broglie hypothesis, the wavelength $\lambda$ is given by:

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

Where $h$ is Planck's constant, $m$ is mass, and $v$ is velocity.

**Step 3: Detailed Explanation:**

For the electron:

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

For the proton:

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

To find the ratio $\frac{\lambda_e}{\lambda_p}$, divide the first expression by the second:

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

Since $h$ and $v$ are the same for both particles, they cancel out:

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

**Step 4: Final Answer:**

The ratio of the wavelengths is $\frac{m_p}{m_e}$.

**Quick Tip:** Remember that $\lambda \propto \frac{1}{m}$ for constant velocity.

Because the mass of a proton is much larger than the mass of an electron ($m_p \approx 1836 \times m_e$), the wavelength of the electron will be significantly larger than that of the proton for the same speed.

**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:** (D) 2,4,6-tribromophenol

**Solution:**

**Step 1: Understanding the Question:**

This is a chemical reaction question involving the electrophilic aromatic substitution of phenol in a highly polar solvent (water).

**Step 2: Detailed Explanation:**

The $-OH$ group in phenol is a very strong activating group. It increases electron density on the benzene ring through the $+R$ effect, particularly at the ortho and para positions.

When bromine is used with water (a highly polar solvent), the bromine molecule is easily polarized, and phenol becomes even more reactive because it can lose a proton to form a phenoxide ion in water.

The phenoxide ion is even more activating than the hydroxyl group.

As a result, electrophilic substitution occurs rapidly at all available ortho (2 and 6) and para (4) positions simultaneously.

This leads to the formation of a white precipitate known as 2,4,6-tribromophenol.

**Step 3: Final Answer:**

The major product is 2,4,6-tribromophenol.

**Quick Tip:** Keep in mind the solvent effect!

Phenol + $Br_2$ in $H_2O$ $\rightarrow$ 2,4,6-tribromophenol (White ppt).

Phenol + $Br_2$ in $CS_2$ (non-polar) at low temp $\rightarrow$ o-bromophenol and p-bromophenol (monobromination).

**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:** (A) $\frac{5}{33}$

**Solution:**

**Step 1: Understanding the Question:**

We need to find the probability of a compound event where two red balls are drawn sequentially without putting the first one back.

**Step 2: Key Formula or Approach:**

We use the multiplication rule for dependent events:

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

Alternatively, we can use combinations: $P = \frac{\binom{\text{Red}}{2}}{\binom{\text{Total}}{2}}$.

**Step 3: Detailed Explanation:**

Total balls in the bag $= 5$ (Red) $+ 7$ (Blue) $= 12$.

**Event 1:** Drawing the first red ball.

$$P(\text{Red}_1) = \frac{\text{Number of red balls}}{\text{Total balls}} = \frac{5}{12}$$

**Event 2:** Drawing the second red ball (given the first was red).

Remaining red balls $= 4$.

Remaining total balls $= 11$.

$$P(\text{Red}_2|\text{Red}_1) = \frac{4}{11}$$

**Total Probability:**

$$P = \frac{5}{12} \times \frac{4}{11} = \frac{20}{132}$$

Simplifying the fraction by dividing by 4:

$$P = \frac{5}{33}$$

**Step 4: Final Answer:**

The probability is $\frac{5}{33}$.

**Quick Tip:** When you see "without replacement," the denominator must decrease for the second event. If the question said "with replacement," the answer would have been $\frac{5}{12} \times \frac{5}{12} = \frac{25}{144}$. Always read the replacement condition carefully!

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**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 $\left(\frac{B}{2}\right)$

(B) It remains the same

(C) It doubles ($2B$)

(D) It becomes four times ($4B$)

**Correct Answer:** (C) $2B$

**Solution:**

**Step 1: Understanding the Question:**

We are investigating how the magnetic induction $B$ at the center of a loop changes when the physical parameter (number of turns $n$) is modified.

**Step 2: Key Formula or Approach:**

The magnetic field at the center of a circular coil of $n$ turns is:

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

Where $I$ is the current and $R$ is the radius.

**Step 3: Detailed Explanation:**

From the formula, we can see that if the current $I$ and radius $R$ are kept constant, the magnetic field is directly proportional to the number of turns:

$$B \propto n$$

If the initial field is $B_1$ for $n_1$ turns and the new field is $B_2$ for $n_2$ turns:

$$\frac{B_2}{B_1} = \frac{n_2}{n_1}$$

Given that the number of turns is doubled, $n_2 = 2n_1$.

$$B_2 = B_1 \times \left(\frac{2n_1}{n_1}\right) = 2B_1$$

**Step 4: Final Answer:**

The magnetic field doubles ($2B$).

**Quick Tip:** Each turn of the wire contributes its own magnetic field at the center in the same direction.
Therefore, the total field is simply the sum of the fields from each turn.
Doubling the turns effectively adds twice the amount of field sources.

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**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:** (B) Hexaamminecobalt(III) chloride

**Solution:**

**Step 1: Understanding the Question:**
Naming a coordination compound requires identifying the ligands, the central metal atom, its oxidation state, and the counter ions.

**Step 2: Key Formula or Approach:**
Rule 1: Name the cation before the anion.
Rule 2: Inside the complex, name ligands alphabetically (though here only one type exists).
Rule 3: Use prefixes like 'hexa' for six.
Rule 4: State metal oxidation number in Roman numerals.

**Step 3: Detailed Explanation:**
1. **Ligands:** There are 6 $NH_3$ groups. The IUPAC name for $NH_3$ as a ligand is "ammine". Six groups make it "hexaammine".
2. **Central Metal:** The metal is Cobalt ($Co$). Since the complex is a cation, the name remains Cobalt.
3. **Oxidation State:** Let the oxidation state of $Co$ be $x$.
$NH_3$ is a neutral ligand (charge $= 0$).
$Cl$ has a charge of $-1$.

Sum of charges: $x + 6(0) + 3(-1) = 0$

$x - 3 = 0 \Rightarrow x = +3$.

The Roman numeral is (III).

4. **Counter Ion:** The ion outside the bracket is chloride.

**Step 4: Final Answer:**

Combining these, the name is Hexaamminecobalt(III) chloride.

**Quick Tip:** Note the spelling of "ammine" (with two 'm's).

In the IUPAC name of the salt, we do not use prefixes like 'tri' for the counter ion (chloride).

So, "trichloride" as an ending is incorrect.

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**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:** (B) $-5$

**Solution:**

**Step 1: Understanding the Question:**

The problem states that two lines in 3D space are perpendicular. We need to find an unknown parameter $k$ in the direction ratios of the second line.

**Step 2: Key Formula or Approach:**

Two lines with direction ratios $(a_1, b_1, c_1)$ and $(a_2, b_2, c_2)$ are perpendicular if and only if their dot product is zero:

$$a_1a_2 + b_1b_2 + c_1c_2 = 0$$

**Step 3: Detailed Explanation:**

From the equations of the lines:

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

The direction ratios are $a_1 = 2, b_1 = 3, c_1 = 4$.

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

The direction ratios are $a_2 = k, b_2 = 2, c_2 = 1$.

Applying the perpendicularity condition:

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

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

$$2k + 10 = 0$$

$$2k = -10$$

$$k = -5$$

**Step 4: Final Answer:**

The value of $k$ is $-5$.

**Quick Tip:** Always ensure the line equations are in the standard form $\frac{x-x_1}{a} = \frac{y-y_1}{b} = \frac{z-z_1}{c}$ before picking the direction ratios.
If the lines were parallel, the ratio of the coefficients would be equal: $\frac{2}{k} = \frac{3}{2} = \frac{4}{1}$, which would lead to no consistent solution for $k$.

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

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

**Correct Answer:** (C) Nylon 6,6

**Solution:**

**Step 1: Understanding the Question:**
We need to distinguish between addition polymers and condensation polymers based on their formation mechanism.

**Step 2: Detailed Explanation:**
Addition polymers (like Polyethylene, PVC, and Polystyrene) are formed by the repeated addition of monomer molecules possessing double or triple bonds without the loss of any small molecules.
Condensation polymers are formed by the reaction of bifunctional or trifunctional monomeric units with the elimination of small molecules like water ($H_2O$), alcohol, or hydrogen chloride ($HCl$).
Nylon 6,6 is synthesized by the condensation polymerization of hexamethylenediamine and adipic acid.
During the reaction, an amide linkage is formed, and a water molecule is released for every bond formed.

**Step 3: Final Answer:**

Nylon 6,6 is a condensation polymer.

**Quick Tip:** A simple trick: If the monomer is an alkene (like ethene, vinyl chloride, styrene), it usually undergoes addition polymerization.
If the monomers have functional groups like $-OH$, $-COOH$, or $-NH_2$, they usually undergo condensation polymerization.

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**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:** (B) 30 cm in front of mirror, real and inverted

**Solution:**

**Step 1: Understanding the Question:**
This problem involves using mirror optics and sign conventions to locate the image formed by a concave mirror.

**Step 2: Key Formula or Approach:**
Mirror Formula:

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

Sign Convention:
- Object distance ($u$) is always negative ($-15$ cm).
- Focal length ($f$) of a concave mirror is negative ($-10$ cm).

**Step 3: Detailed Explanation:**

Given: $u = -15$ cm, $f = -10$ cm.

Substituting into the mirror formula:

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

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

Finding the common denominator (30):

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

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

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

Since $v$ is negative, the image is formed on the same side as the object (in front of the mirror).

Images formed in front of the mirror are always real and inverted.

**Step 4: Final Answer:**

The image is formed 30 cm in front of the mirror and is real and inverted.

**Quick Tip:** Notice the position of the object: Focal length is 10 cm, so the Center of Curvature ($C$) is 20 cm.

The object is at 15 cm, which is between $F$ and $C$.

Recall the ray diagram rule: When an object is between $F$ and $C$, the image is formed beyond $C$, is real, inverted, and magnified.

Since 30 cm is beyond 20 cm, the result matches the theory!

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