VITEEE 2026 April 29 Shift 1

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. Find the distance between the planes $2x + 3y + 4z = 4$ and $4x + 6y + 8z = 12$.

(A) $\frac{1}{\sqrt{29}}$

(B) $\frac{2}{\sqrt{29}}$

(C) $\frac{3}{\sqrt{29}}$

(D) $\frac{4}{\sqrt{29}}$

Correct Answer: (B) $\frac{2}{\sqrt{29}}$

Solution:

Concept:

The distance between two parallel planes

$$ax + by + cz + d_1 = 0 \quad \text{and} \quad ax + by + cz + d_2 = 0$$

is given by

$$d = \frac{|d_2 - d_1|}{\sqrt{a^2 + b^2 + c^2}}$$

This formula is applicable when the planes have the same normal vector, meaning the coefficients of x, y, z are proportional.

Step 1: Check whether the planes are parallel.

Given planes:

$$2x + 3y + 4z = 4$$

$$4x + 6y + 8z = 12$$

Divide the second equation by 2:

$$2x + 3y + 4z = 6$$

Since both equations now have the same coefficients, the planes are parallel.

Step 2: Write both equations in standard form.

$$2x + 3y + 4z - 4 = 0$$

$$2x + 3y + 4z - 6 = 0$$

Thus,

$$d_1 = -4, \quad d_2 = -6$$

Step 3: Apply the distance formula.

$$d = \frac{|d_2 - d_1|}{\sqrt{a^2 + b^2 + c^2}}$$

$$d = \frac{|(-6) - (-4)|}{\sqrt{2^2 + 3^2 + 4^2}}$$

$$d = \frac{2}{\sqrt{4 + 9 + 16}}$$

$$d = \frac{2}{\sqrt{29}}$$

Quick Tip: To find the distance between two planes, first confirm that the planes are parallel (their x, y, z coefficients are proportional). Then apply

$$d = \frac{|d_2 - d_1|}{\sqrt{a^2 + b^2 + c^2}}$$

directly.

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2. If A is a square matrix of order 3 and $|A| = 5$, find $|adj(A)|$.

(A) 5

(B) 10

(C) 25

(D) 125

Correct Answer: (C) 25

Solution:

Concept:

For any square matrix A of order n, the determinant of its adjoint is given by:

$$|adj(A)| = |A|^{n-1}$$

This is a standard result from matrix theory.

Step 1: Identify the given values.

Order of matrix: $n = 3$

$$|A| = 5$$

Step 2: Apply the formula.

$$|adj(A)| = |A|^{n-1}$$

$$|adj(A)| = 5^{3-1}$$

$$|adj(A)| = 5^2 = 25$$

Quick Tip: Always remember the identity:

$$|adj(A)| = |A|^{n-1}$$

where n is the order of the square matrix. This formula helps quickly evaluate determinants of adjoint matrices.

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3. Evaluate $\int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}\, dx$.

(A) $\frac{\pi}{2}$

(B) $\frac{\pi}{3}$

(C) $\frac{\pi}{4}$

(D) $\frac{\pi}{6}$

Correct Answer: (C) $\frac{\pi}{4}$

Solution:

Concept:

A useful property of definite integrals is:

$$\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$$

This symmetry property helps simplify integrals when expressions contain complementary trigonometric terms such as $\sin x$ and $\cos x$.

Step 1: Let the given integral be I.

$$I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}\,dx$$

Using the property

$$\int_a^b f(x)\,dx = \int_a^b f(a+b-x)\,dx$$

we write

$$I = \int_0^{\pi/2} \frac{\sin\left(\frac{\pi}{2}-x\right)}{\sin\left(\frac{\pi}{2}-x\right)+\cos\left(\frac{\pi}{2}-x\right)}\,dx$$

Step 2: Use trigonometric identities.

$$\sin\left(\frac{\pi}{2}-x\right) = \cos x$$

$$\cos\left(\frac{\pi}{2}-x\right) = \sin x$$

Thus,

$$I = \int_0^{\pi/2} \frac{\cos x}{\sin x + \cos x}\,dx$$

Step 3: Add the two expressions of I.

$$I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x}\,dx$$

$$I = \int_0^{\pi/2} \frac{\cos x}{\sin x + \cos x}\, dx$$

Adding,

$$2I = \int_0^{\pi/2} \left(\frac{\sin x}{\sin x + \cos x} + \frac{\cos x}{\sin x + \cos x} \right) dx$$

$$2I = \int_0^{\pi/2} 1\, dx$$

$$2I = [x]_0^{\pi/2} = \frac{\pi}{2}$$

Step 4: Solve for I.

$$I = \frac{\pi}{4}$$

Quick Tip: When a definite integral contains symmetric expressions like $\sin x$ and $\cos x$, applying the property

$$\int_a^b f(x)\, dx = \int_a^b f(a+b-x)\, dx$$

often simplifies the integral significantly.

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4. What is the ratio of the de Broglie wavelengths of an electron and a proton moving with the same velocity?

(A) $\frac{m_e}{m_p}$

(B) $\frac{m_p}{m_e}$

(C) 1

(D) $\sqrt{\frac{m_p}{m_e}}$

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

Solution:

Concept:

According to the de Broglie hypothesis, the wavelength associated with a moving particle is given by

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

where h is Planck's constant, m is the mass of the particle, and v is its velocity.

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

Step 1: Write the wavelengths of electron and proton.

For an electron:

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

For a proton:

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

Step 2: Find the ratio.

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

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

Quick Tip: From the de Broglie relation $\lambda = \frac{h}{mv}$, if two particles move with the same velocity, their wavelengths are inversely proportional to their masses.

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5. A capacitor of $10\,\mu F$ is charged to $100V$. Find the energy stored in it.

(A) $0.5\,J$

(B) $0.05\,J$

(C) $5\,J$

(D) $0.005\,J$

Correct Answer: (B) $0.05\,J$

Solution:

Concept:

The energy stored in a capacitor is given by the formula

$$E = \frac{1}{2}CV^2$$

where C is the capacitance and V is the potential difference across the capacitor.

Step 1: Write the given values.

$$C = 10\,\mu F = 10 \times 10^{-6} F$$

$$V = 100V$$

Step 2: Substitute in the energy formula.

$$E = \frac{1}{2}CV^2$$

$$E = \frac{1}{2} \times (10 \times 10^{-6}) \times (100)^2$$

Step 3: Simplify the expression.

$$E = 0.5 \times 10^{-5} \times 10000$$

$$E = 0.05\,J$$

Quick Tip: Energy stored in a capacitor depends on both capacitance and voltage. Use the formula

$$E = \frac{1}{2}CV^2$$

and always convert microfarads to farads before substitution.

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6. If the current in a coil changes from $2A$ to $4A$ in $0.1\,s$, inducing an EMF of $20V$, find the self-inductance.

(A) $0.5\,H$

(B) $1\,H$

(C) $2\,H$

(D) $4\,H$

Correct Answer: (B) $1\,H$

Solution:

Concept:

The induced EMF in an inductor is given by the relation

$$E = L\frac{di}{dt}$$

where $E =$ induced EMF, $L =$ self-inductance, $\frac{di}{dt} =$ rate of change of current.

Step 1: Write the given values.

Initial current $i_1 = 2A$

Final current $i_2 = 4A$

Time interval

$$dt = 0.1\,s$$

Induced EMF

$$E = 20V$$

Step 2: Find the rate of change of current.

$$\frac{di}{dt} = \frac{4-2}{0.1}$$

$$\frac{di}{dt} = \frac{2}{0.1} = 20$$

Step 3: Substitute into the EMF formula.

$$E = L\frac{di}{dt}$$

$$20 = L(20)$$

$$L = 1\,H$$

Quick Tip: Self-inductance measures the opposition of a coil to change in current. Use the formula

$$E = L\frac{di}{dt}$$

where $\frac{di}{dt}$ is the rate of change of current.

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7. Which of the following is the most acidic: Ethanol, Phenol, or *o*-Nitrophenol?

(A) Ethanol

(B) Phenol

(C) *o*-Nitrophenol

(D) All have same acidity

Correct Answer: (C) *o*-Nitrophenol

Solution:

Concept:

Acidity depends on the stability of the conjugate base formed after the loss of a proton. Electron-withdrawing groups increase acidity by stabilizing the negative charge through inductive ($-I$)

and resonance ($-M$) effects.

Step 1: Compare ethanol and phenol.
Phenol is more acidic than ethanol because the phenoxide ion formed after deprotonation is stabilized by resonance over the benzene ring, whereas ethanol does not have such stabilization.

Step 2: Effect of the nitro group in *o*-Nitrophenol.
The nitro group (NO_2) is a strong electron-withdrawing group. It stabilizes the phenoxide ion through both:

$$-I \text{ effect (inductive)}$$

$$-M \text{ effect (resonance)}$$

This withdrawal of electron density from the $O-H$ bond increases the tendency to lose H^+.

Step 3: Conclusion.
Because of the strong electron-withdrawing nitro group, *o*-Nitrophenol is more acidic than both phenol and ethanol.

Quick Tip: Electron-withdrawing groups such as NO_2 increase acidity by stabilizing the conjugate base through inductive and resonance effects.

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8. What is the product of the reaction between Benzene and CH_3Cl in the presence of anhydrous $AlCl_3$?

(A) Toluene

(B) Phenol

(C) Chlorobenzene

(D) Benzaldehyde

Correct Answer: (A) Toluene

Solution:

Concept:

This reaction is known as Friedel–Crafts Alkylation, where an alkyl group substitutes a hydrogen atom of the benzene ring in the presence of a Lewis acid catalyst such as $AlCl_3$.

Step 1: Formation of electrophile.

In the presence of $AlCl_3$, methyl chloride forms a methyl carbocation.

$$CH_3Cl + AlCl_3 \rightarrow CH_3^+ + AlCl_4^-$$

Step 2: Electrophilic substitution on benzene.

The methyl carbocation attacks the benzene ring, replacing one hydrogen atom.

$$C_6H_6 + CH_3^+ \rightarrow C_6H_5CH_3$$

Step 3: Product formation.

The product formed is Toluene.

Quick Tip: Friedel–Crafts alkylation introduces an alkyl group onto a benzene ring using a Lewis acid catalyst like $AlCl_3$.

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9. What is the oxidation state of Nickel in $Ni(CO)_4$?

(A) +2

(B) +1

(C) 0

(D) −2

Correct Answer: (C) 0

Solution:

Concept:

The oxidation state of the central metal atom in a coordination compound depends on the charges of the ligands and the overall charge of the complex.

Carbon monoxide (CO) is a neutral ligand, meaning it contributes no charge.

Step 1: Write the charge balance equation.

Let the oxidation state of Nickel be x.

$$x + 4(0) = 0$$

since each CO ligand has zero charge and the complex is neutral.

Step 2: Solve for x.

$$x = 0$$

Thus, the oxidation state of Nickel is 0.

Quick Tip: Carbon monoxide (CO) is a neutral ligand. When all ligands are neutral and the complex has no overall charge, the metal oxidation state is 0.

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10. Find the missing number: $2, 6, 12, 20, 30, ?$

(A) 38

(B) 40

(C) 42

(D) 44

Correct Answer: (C) 42

Solution:

Concept:

In number series problems, observe the pattern of differences between consecutive terms. If the difference follows a recognizable pattern, the next term can be determined.

Step 1: Find the differences between consecutive terms.

$$6 - 2 = 4$$

$$12 - 6 = 6$$

$$20 - 12 = 8$$

$$30 - 20 = 10$$

Thus the differences are

$$4, 6, 8, 10$$

Step 2: Observe the pattern.

The differences increase by 2 each time.

$$4, 6, 8, 10, 12$$

Step 3: Find the next term.

$$30 + 12 = 42$$

Therefore, the missing number is 42.

Quick Tip: In number series questions, checking the first differences often reveals a simple pattern such as constant increase, arithmetic progression, or multiplication.

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11. Pointing to a photograph, a man says, "I have no brother or sister, but that man's father is my father's son." Who is in the photo?

(A) His father

(B) His son

(C) His nephew

(D) Himself

Correct Answer: (B) His son

Solution:

Concept:

Such reasoning problems require interpreting family relationships logically.

Step 1: Analyze the statement.

The man says he has no brother or sister.

Thus, “my father’s son” must refer to the man himself.

Step 2: Interpret the sentence.

The statement becomes:

That man’s father is me.

Step 3: Conclusion.

If the man in the photograph has the speaker as his father, then the photograph must be of his son.

Quick Tip: When a person says “my father’s son” and he has no siblings, it refers to himself.

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12. Choose the correct synonym for “Diligent.”

(A) Lazy

(B) Careless

(C) Hardworking

(D) Ignorant

Correct Answer: (C) Hardworking

Solution:

Concept:

A synonym is a word that has the same or nearly the same meaning as another word.

Step 1: Understand the meaning of "Diligent".

The word diligent means showing care, persistence, and hard work in performing tasks.

Step 2: Compare with the given options.

Among the options:

- Lazy — opposite meaning
- Careless — opposite meaning
- Hardworking — similar meaning
- Ignorant — unrelated

Step 3: Select the correct synonym.

Therefore, the correct synonym of Diligent is Hardworking.

Quick Tip: When solving synonym questions, first understand the exact meaning of the word, then eliminate options with opposite or unrelated meanings.
