

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 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. 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:

Step 1: Understanding the Question:

The problem asks for the shortest distance between two planes in three-dimensional space. Two planes are parallel if their normal vectors are proportional, i.e., the coefficients of x , y , and z can be made identical.

Step 2: Key Formula or Approach:

For two parallel planes given by $ax + by + cz + d_1 = 0$ and $ax + by + cz + d_2 = 0$, the distance d is:

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

Step 3: Detailed Explanation:

First, we express both equations in a comparable form.

Plane 1: $2x + 3y + 4z - 4 = 0$

Plane 2: $4x + 6y + 8z - 12 = 0$

Dividing the second equation by 2, we get:

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

Now, both equations have the same coefficients $a = 2, b = 3, c = 4$.

Comparing with the standard form:

$d_1 = -4$ and $d_2 = -6$.

Substituting these values into the distance formula:

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

$$d = \frac{|-4 + 6|}{\sqrt{4 + 9 + 16}}$$

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

Step 4: Final Answer:

The distance between the two planes is $\frac{2}{\sqrt{29}}$.

Quick Tip: Always ensure the coefficients of x , y , and z are exactly the same in both plane equations before using the distance formula $d = \frac{|d_1 - d_2|}{\sqrt{a^2 + b^2 + c^2}}$. This prevents errors related to scaling factors.

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:

Step 1: Understanding the Question:

The question requires calculating the determinant of the adjoint of a matrix A , given the determinant of the matrix itself and its order.

Step 2: Key Formula or Approach:

For any square matrix A of order n , the relationship between the determinant of the matrix and its adjoint is:

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

Step 3: Detailed Explanation:

Given:

Order of the matrix, $n = 3$

Determinant of the matrix, $|A| = 5$

Using the formula:

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

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

$$|adj(A)| = 25$$

Step 4: Final Answer:

The value of $|adj(A)|$ is 25.

Quick Tip: For competitive exams, remember the general property $|adj(adj(A))| = |A|^{(n-1)^2}$.

These power-based identities for determinants are frequent in VITEEE.

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

- (A) $\frac{\pi}{2}$
- (B) $\frac{3\pi}{4}$
- (C) $\frac{\pi}{4}$
- (D) $\frac{\pi}{6}$

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

Solution:

Step 1: Understanding the Question:

We need to evaluate a definite integral with limits from 0 to $\pi/2$.

The integrand involves trigonometric functions that exhibit symmetry around the midpoint of the interval.

Step 2: Key Formula or Approach:

Use the "King's Property" of definite integrals:

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

Step 3: Detailed Explanation:

Let $I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx$ — (Eq. 1)

Applying the property $\int_0^a f(x) dx = \int_0^a f(a-x) dx$:

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

Since $\sin(\pi/2 - x) = \cos x$ and $\cos(\pi/2 - x) = \sin x$:

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

— (Eq. 2)

Adding (Eq. 1) and (Eq. 2):

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

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

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

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

Step 4: Final Answer:

The value of the integral is $\frac{\pi}{4}$.

Quick Tip: Whenever you see an integral of the form $\int_0^{\pi/2} \frac{f(\sin x)}{f(\sin x) + f(\cos x)} dx$, the answer is always $\frac{1}{2}(\text{Upper Limit} - \text{Lower Limit})$, which is $\frac{\pi}{4}$.

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:

Step 1: Understanding the Question:

The question asks for the ratio of de Broglie wavelengths for two different particles (electron and proton) given that they share the same velocity v .

Step 2: Key Formula or Approach:

The de Broglie wavelength λ is given by the formula:

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

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

Step 3: Detailed Explanation:

Let m_e be the mass of the electron and m_p be the mass of the proton.

Since both move with the same velocity v :

Wavelength of electron: $\lambda_e = \frac{h}{m_e v}$

Wavelength of proton: $\lambda_p = \frac{h}{m_p v}$

Taking the ratio:

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

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

Step 4: Final Answer:

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

Quick Tip: At constant velocity, the de Broglie wavelength is inversely proportional to the mass ($\lambda \propto 1/m$).

Since a proton is much heavier than an electron, the electron will have a significantly longer wavelength.

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:

Step 1: Understanding the Question:

We are required to calculate the electrical potential energy stored in a capacitor when its capacitance and the potential difference across it are known.

Step 2: Key Formula or Approach:

The energy U stored in a capacitor is calculated using:

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

Step 3: Detailed Explanation:

Given values:

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

Voltage, $V = 100\ V$

Plugging the values into the formula:

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

$$U = \frac{1}{2} \times 10^{-5} \times 10^4$$

$$U = 0.5 \times 10^{-1}$$

$$U = 0.05 J$$

Step 4: Final Answer:

The energy stored in the capacitor is $0.05 J$.

Quick Tip: Always convert units to SI (e.g., μF to F) before calculation.

Note that 100^2 is 10^4 , which simplifies the exponent math significantly.

6. If the current in a coil changes from $2A$ to $4A$ in $0.1s$, 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:

Step 1: Understanding the Question:

The problem involves Faraday's Law of Induction applied to self-inductance, where a changing current induces an electromotive force (EMF) in the same coil.

Step 2: Key Formula or Approach:

The magnitude of induced EMF (E) is given by:

$$E = L \left| \frac{di}{dt} \right|$$

where L is the self-inductance and $\frac{di}{dt}$ is the rate of change of current.

Step 3: Detailed Explanation:

Given:

Initial current, $i_1 = 2A$

Final current, $i_2 = 4A$

Change in current, $\Delta i = 4 - 2 = 2A$

Time taken, $\Delta t = 0.1s$

Induced EMF, $E = 20V$

Using the formula:

$$20 = L \times \frac{2}{0.1}$$

$$20 = L \times 20$$

$$L = 1H$$

Step 4: Final Answer:

The self-inductance of the coil is 1 H .

Quick Tip: Self-inductance L is always a positive quantity.

The formula $E = L \frac{\Delta i}{\Delta t}$ is derived from $N\phi = Li$.

Remember that $1\text{ H} = 1\text{ V} \cdot \text{s/A}$.

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:**Step 1: Understanding the Question:**

Acidity in organic compounds is determined by the stability of the conjugate base formed after losing a proton (H^+).

Step 2: Key Formula or Approach:

Acidity $\propto$ Stability of conjugate base.

Stability is increased by:

1. Resonance (delocalization of negative charge).
2. Electron-Withdrawing Groups (EWG) via $-I$ and $-M$ effects.

Step 3: Detailed Explanation:

1. **Ethanol:** The conjugate base is the ethoxide ion ($\text{CH}_3\text{CH}_2\text{O}^-$). The alkyl group has a $+I$

effect, which destabilizes the negative charge. Hence, it is the least acidic.

2. **Phenol:** The conjugate base is the phenoxide ion. The negative charge is delocalized over the benzene ring via resonance, making it much more stable than ethoxide.

3. ***o*-Nitrophenol:** Here, the nitro group ($-\text{NO}_2$) is present at the ortho position. It is a strong EWG that exerts both $-I$ and $-M$ effects. This further stabilizes the phenoxide ion by pulling electron density away from the oxygen.

Conclusion: *o*-Nitrophenol forms the most stable conjugate base.

Step 4: Final Answer:

o-Nitrophenol is the most acidic among the choices.

Quick Tip: Remember the order of acidity for phenols:

Phenols with EWG (like $-\text{NO}_2$, $-\text{CN}$, $-\text{Cl}$) > Phenol > Phenols with ERG (like $-\text{CH}_3$, $-\text{OCH}_3$).

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:

Step 1: Understanding the Question:

The reaction describes the treatment of an aromatic ring with an alkyl halide in the presence of a Lewis acid catalyst.

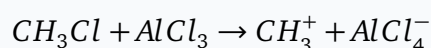
Step 2: Key Formula or Approach:

This is a **Friedel-Crafts Alkylation** reaction, which is a type of Electrophilic Aromatic Substitution (EAS).

Step 3: Detailed Explanation:

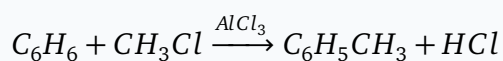
The reaction proceeds in three main steps:

1. **Generation of Electrophile:** The Lewis acid $AlCl_3$ reacts with CH_3Cl to form a methyl carbocation (CH_3^+).



2. **Electrophilic Attack:** The CH_3^+ carbocation attacks the electron-rich benzene ring, forming an arenium ion intermediate.

3. **Deprotonation:** The $AlCl_4^-$ ion removes a proton from the ring to restore aromaticity, yielding methylbenzene.



The common name for methylbenzene is Toluene.

Step 4: Final Answer:

The product formed is Toluene.

Quick Tip: Friedel-Crafts Alkylation can lead to "polyalkylation" because the product (Toluene) is more reactive than the starting material (Benzene).

Anhydrous $AlCl_3$ is essential as a Lewis acid catalyst to generate the carbocation.

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:

Step 1: Understanding the Question:

The goal is to determine the formal charge (oxidation state) assigned to the Nickel atom within the metal carbonyl complex.

Step 2: Key Formula or Approach:

The sum of the oxidation states of all atoms in a neutral molecule is zero.

Sum of charges = (Oxidation state of Metal) + (Total charge of Ligands).

Step 3: Detailed Explanation:

In the complex $Ni(CO)_4$:

1. The complex is neutral (no charge on the coordination sphere).
2. The ligand is Carbon Monoxide (CO). CO is a neutral molecule, so its charge is 0.

Let x be the oxidation state of Ni .

$$x + 4 \times (\text{charge of } CO) = 0$$

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

$$x = 0$$

Step 4: Final Answer:

The oxidation state of Nickel is 0.

Quick Tip: Metal carbonyls (like $Fe(CO)_5$, $Cr(CO)_6$) typically feature the metal in a zero oxidation state because CO is a neutral ligand and the resulting complexes are neutral.

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

- (A) 38
- (B) 40
- (C) 42
- (D) 44

Correct Answer: (C) 42

Solution:

Step 1: Understanding the Question:

This is a number series completion problem where we need to identify the underlying mathematical pattern governing the sequence.

Step 2: Key Formula or Approach:

Examine the differences between consecutive terms to check for an arithmetic progression of the differences.

Step 3: Detailed Explanation:

Let's find the differences between the numbers:

$$6 - 2 = 4$$

$$12 - 6 = 6$$

$$20 - 12 = 8$$

$$30 - 20 = 10$$

The differences are 4, 6, 8, 10.

Observe that these differences are consecutive even numbers, increasing by 2 each time.

The next difference should be $10 + 2 = 12$.

Next term = $30 + 12 = 42$.

Alternatively, the pattern can be seen as $n^2 + n$:

$$1^2 + 1 = 2$$

$$2^2 + 2 = 6$$

$$3^2 + 3 = 12$$

$$4^2 + 4 = 20$$

$$5^2 + 5 = 30$$

The next term is $6^2 + 6 = 36 + 6 = 42$.

Step 4: Final Answer:

The missing number is 42.

Quick Tip: If the first layer of differences is not clear, calculate the "difference of differences".

In this case, the second-layer difference is constant (2), indicating a quadratic relationship.

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:

Step 1: Understanding the Question:

This is a logical reasoning problem involving family relations. We must decode the identities mentioned in the statement step-by-step.

Step 2: Key Formula or Approach:

Break the sentence into two parts:

1. Identify "my father's son".
2. Relate that identity to "that man's father".

Step 3: Detailed Explanation:

The man states: "I have no brother or sister".

Therefore, "my father's son" can only be **the man himself**.

Substituting this back into the original sentence:

"That man's father is **me**."

If the father of the person in the photograph is the speaker, then the person in the photograph is the speaker's **son**.

Step 4: Final Answer:

The person in the photo is his son.

Quick Tip: In blood relation riddles, always start solving from the "my" part of the sentence and work your way outwards.

"Only son of my father" = Myself.

12. Choose the correct synonym for "Diligent."

- (A) Lazy
- (B) Careless
- (C) Hardworking

(D) Ignorant

Correct Answer: (C) Hardworking

Solution:

Step 1: Understanding the Question:

The question asks for a synonym, which is a word with the same or a very similar meaning to "Diligent".

Step 2: Detailed Explanation:

The definition of "Diligent" is: showing care and conscientiousness in one's work or duties.

Evaluating the options:

- **Lazy:** This is an antonym (opposite meaning).
- **Careless:** This is also an antonym.
- **Hardworking:** This aligns perfectly with the definition of being industrious and careful.
- **Ignorant:** This refers to a lack of knowledge, which is unrelated to effort or care.

Step 3: Final Answer:

The correct synonym is Hardworking.

Quick Tip: When you find multiple options that seem plausible, use them in a sentence.

"He is a diligent student" means the same as "He is a hardworking student."