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 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. A bag contains 4 red and 6 black balls. A ball is drawn at random, its colour is noted and it is returned to the bag. Moreover, 2 additional balls of the colour drawn are put in the bag and then a ball is drawn at random. What is the probability that the second ball is red?

(A) $\frac{1}{3}$

(B) $\frac{2}{5}$

(C) $\frac{3}{5}$

(D) $\frac{4}{5}$

Correct Answer: (B) $\frac{2}{5}$

Solution:

Step 1: Understanding the Question:

The problem describes a two-stage experiment where the outcome of the second draw depends on the result of the first draw.

We need to find the total probability of drawing a red ball in the second attempt, considering two mutually exclusive cases: the first ball was red or the first ball was black.

Step 2: Key Formula or Approach:

We use the **Law of Total Probability**:

$$P(R_2) = P(R_1) \cdot P(R_2|R_1) + P(B_1) \cdot P(R_2|B_1)$$

where:

R_1, B_1 are events of drawing a red or black ball first.

R_2 is the event of drawing a red ball second.

Step 3: Detailed Explanation:

Initial composition: 4 Red (R) and 6 Black (B). Total $= 10$ balls.

Probabilities of the first draw:

$$P(R_1) = \frac{4}{10}, \quad P(B_1) = \frac{6}{10}$$

Case 1: First ball is Red (R_1)

The ball is returned, and 2 more red balls are added.

New composition: $4 + 2 = 6$ Red, 6 Black. Total $= 12$ balls.

$$P(R_2|R_1) = \frac{6}{12}$$

Case 2: First ball is Black (B_1)

The ball is returned, and 2 more black balls are added.

New composition: 4 Red, $6 + 2 = 8$ Black. Total $= 12$ balls.

$$P(R_2|B_1) = \frac{4}{12}$$

Total Probability calculation:

$$P(R_2) = \left(\frac{4}{10} \times \frac{6}{12}\right) + \left(\frac{6}{10} \times \frac{4}{12}\right)$$

$$P(R_2) = \frac{24}{120} + \frac{24}{120} = \frac{48}{120}$$

Simplifying the fraction:

$$P(R_2) = \frac{2}{5}$$

Step 4: Final Answer:

The probability that the second ball drawn is red is $\frac{2}{5}$.

Quick Tip: In problems where an action is taken based on a previous outcome, always draw a tree diagram or list mutually exclusive cases.

The Law of Total Probability $P(A) = \sum P(E_i)P(A|E_i)$ is the standard tool for such sequential events.

2. Find the integrating factor (I.F.) for the differential equation

$$\frac{dy}{dx} + y \sec x = \tan x.$$

(A) $\sec x - \tan x$

(B) $\sec x + \tan x$

(C) $\tan x$

(D) $\sec x$

Correct Answer: (B) $\sec x + \tan x$

Solution:

Step 1: Understanding the Question:

The goal is to find the Integrating Factor (I.F.) for a first-order linear differential equation. This factor, when multiplied by the original equation, makes the left-hand side a perfect derivative.

Step 2: Key Formula or Approach:

For a linear differential equation of the form $\frac{dy}{dx} + Py = Q$, where P and Q are functions of x:

$$I.F. = e^{\int P\,dx}$$

Step 3: Detailed Explanation:

Comparing the given equation $\frac{dy}{dx} + y \sec x = \tan x$ with the standard form:

We identify $P = \sec x$.

Now, calculate the integral of P:

$$\int P\,dx = \int \sec x\,dx$$

The standard integral of $\sec x$ is:

$$\int \sec x\, dx = \ln|\sec x + \tan x|$$

Substitute this into the I.F. formula:

$$I.F. = e^{\ln(\sec x + \tan x)}$$

Using the property $e^{\ln(f(x))} = f(x)$:

$$I.F. = \sec x + \tan x$$

Step 4: Final Answer:

The integrating factor for the given differential equation is $\sec x + \tan x$.

Quick Tip: Always ensure the coefficient of $\frac{dy}{dx}$ is 1 before identifying P.

Quick integration results to remember:

$\int \sec x\, dx = \ln|\sec x + \tan x|$

$\int \tan x\, dx = \ln|\sec x|$

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3. If ω is an imaginary cube root of unity, find the value of $(1 + \omega - \omega^2)^7$.

(A) $128\omega^2$

(B) $-128\omega^2$

(C) 64ω

(D) $-64\omega^2$

Correct Answer: (B) $-128\omega^2$

Solution:

Step 1: Understanding the Question:

The question asks to evaluate an algebraic expression involving the complex cube root of unity ω.

Step 2: Key Formula or Approach:

The fundamental properties of cube roots of unity are:

1. $1 + \omega + \omega^2 = 0$ (Sum of roots)

2. $\omega^3 = 1$ (Product of roots)

Step 3: Detailed Explanation:

From the property $1 + \omega + \omega^2 = 0$, we can derive:

$$1 + \omega = -\omega^2$$

Substitute this into the given expression $(1 + \omega - \omega^2)^7$:

$$((-\omega^2) - \omega^2)^7 = (-2\omega^2)^7$$

Expand the power:

$$(-2)^7 \cdot (\omega^2)^7 = -128 \cdot \omega^{14}$$

Now, simplify ω^{14} using $\omega^3 = 1$:

$$\omega^{14} = \omega^{12} \cdot \omega^2 = (\omega^3)^4 \cdot \omega^2$$

$$\omega^{14} = (1)^4 \cdot \omega^2 = \omega^2$$

Substituting this back:

$$-128\omega^{14} = -128\omega^2$$

Step 4: Final Answer:

The value of the expression is $-128\omega^2$.

Quick Tip: Whenever you see $1+\omega$, $1+\omega^2$, or $\omega+\omega^2$, immediately substitute using $1+\omega+\omega^2 = 0$. For large powers of ω, divide the exponent by 3 and use the remainder: $\omega^n = \omega^{n \pmod 3}$.

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4. In an LCR series circuit, the resonance frequency is f. If the capacitance is made 4 times, what will be the new resonance frequency?

(A) $4f$

(B) $2f$

(C) $f/2$

(D) $f/4$

Correct Answer: (C) $f/2$

Solution:

Step 1: Understanding the Question:

We need to determine how the resonance frequency of an AC circuit changes when the physical parameters of the components (specifically capacitance) are altered.

Step 2: Key Formula or Approach:

The resonance frequency f of a series LCR circuit is:

$$f = \frac{1}{2\pi\sqrt{LC}}$$

This shows that $f \propto \frac{1}{\sqrt{C}}$ when inductance L remains constant.

Step 3: Detailed Explanation:

Let the initial frequency be $f_1 = \frac{1}{2\pi\sqrt{LC}}$.

The new capacitance is $C_2 = 4C$.

The new frequency f_2 will be:

$$f_2 = \frac{1}{2\pi\sqrt{L(4C)}}$$

$$f_2 = \frac{1}{2\pi \cdot 2\sqrt{LC}}$$

$$f_2 = \frac{1}{2}\left(\frac{1}{2\pi\sqrt{LC}}\right)$$

$$f_2 = \frac{f_1}{2}$$

Step 4: Final Answer:

The new resonance frequency will be $f/2$.

Quick Tip: Resonance occurs when $X_L = X_C$.
Since frequency is inversely proportional to the square root of C and L, a four-fold increase in either will always halve the frequency.

5. A circular coil of radius R carries a current I. The magnetic field at its centre is B. At what distance from the centre on the axis of the coil will the magnetic field be $B/8$?

(A) R

(B) $2R$

(C) $\sqrt{3}R$

(D) $4R$

Correct Answer: (C) $\sqrt{3}R$

Solution:

Step 1: Understanding the Question:

We are comparing the magnetic field strength at the center of a circular loop with the field strength at a point along its axial line.

Step 2: Key Formula or Approach:

Magnetic field at the center (B_c):

$$B_c = \frac{\mu_0 I}{2R}$$

Magnetic field on the axis at distance x (B_x):

$$B_x = \frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}}$$

Step 3: Detailed Explanation:

Given that $B_x = \frac{B_c}{8}$.

Substitute the formulas:

$$\frac{\mu_0 I R^2}{2(R^2 + x^2)^{3/2}} = \frac{1}{8}\left(\frac{\mu_0 I}{2R}\right)$$

Cancel common terms $(\frac{\mu_0 I}{2})$ from both sides:

$$\frac{R^2}{(R^2+x^2)^{3/2}} = \frac{1}{8R}$$

Rearranging the equation:

$$8R^3 = (R^2+x^2)^{3/2}$$

Taking the cube root (raising to power $1/3$) on both sides:

$$(8R^3)^{1/3} = ((R^2+x^2)^{3/2})^{1/3}$$

$$2R = (R^2+x^2)^{1/2}$$

Squaring both sides:

$$4R^2 = R^2 + x^2$$

$$3R^2 = x^2$$

$$x = \sqrt{3}R$$

Step 4: Final Answer:

The magnetic field becomes $B/8$ at a distance of $\sqrt{3}R$ from the center.

Quick Tip: A useful ratio to remember is $\frac{B_{axis}}{B_{center}} = \left(\frac{R^2}{R^2+x^2}\right)^{3/2}$.
Solving this ratio directly saves time during competitive exams like VITEEE.

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6. In a common emitter transistor amplifier, the audio signal voltage across the collector resistance of $2\,k\Omega$ is $2V$. If the current amplification factor (β) is 100 and the base resistance is $1\,k\Omega$, find the input signal voltage.

(A) $0.1\,V$
(B) $0.01\,V$
(C) $0.02\,V$
(D) $0.005\,V$

Correct Answer: (B) $0.01\,V$ $(10\,mV)$

Solution:

Step 1: Understanding the Question:
We need to find the input voltage for a transistor operating in Common Emitter (CE) configuration, given the output voltage and gain parameters.

Step 2: Key Formula or Approach:
Voltage Gain (A_v) is defined as the ratio of output voltage to input voltage:

$$A_v = \frac{V_{out}}{V_{in}}$$

For a CE amplifier, it is also expressed as:

$$A_v = \beta \times \frac{R_c}{R_b}$$

Step 3: Detailed Explanation:

Identify given values:

Collector Resistance $(R_c) = 2\,k\Omega$

Base Resistance $(R_b) = 1\,k\Omega$

Current Gain $(\beta) = 100$

Output Voltage $(V_{out}) = 2\,V$

Calculate Voltage Gain (A_v):

$$A_v = 100 \times \left(\frac{2000}{1000}\right) = 100 \times 2 = 200$$

Now, calculate Input Voltage (V_{in}):

$$V_{in} = \frac{V_{out}}{A_v}$$

$$V_{in} = \frac{2}{200} = \frac{1}{100}$$

$$V_{in} = 0.01\,V$$

Step 4: Final Answer:

The input signal voltage is $0.01\,V$.

Quick Tip: Voltage gain in CE configuration is the product of current gain and resistance gain. Always ensure units for R_c and R_b are the same so that the ratio is dimensionless.

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7. Which of the following electrolytes is most effective in the coagulation of a negative sol like

As_2S_3?

(A) $NaCl$
(B) $MgCl_2$
(C) $AlCl_3$
(D) KCl

Correct Answer: (C) $AlCl_3$

Solution:

Step 1: Understanding the Question:
The question relates to the coagulation (precipitation) of colloidal solutions by the addition of electrolytes.

Step 2: Key Formula or Approach:
The **Hardy-Schulze Rule** states:
1. Coagulation is caused by ions having a charge opposite to that of the colloidal particles.
2. The greater the valency of the flocculating ion, the greater is its power to cause coagulation.

Step 3: Detailed Explanation:
The given sol As_2S_3 (Arsenious sulphide) is a **negative sol**.
To coagulate a negative sol, we need **cations** (positively charged ions).
Let's look at the cations provided by the options:
(A) $NaCl \rightarrow Na^+$ (Valency = +1)
(B) $MgCl_2 \rightarrow Mg^{2+}$ (Valency = +2)
(C) $AlCl_3 \rightarrow Al^{3+}$ (Valency = +3)
(D) $KCl \rightarrow K^+$ (Valency = +1)
According to the rule, higher the charge, higher the effectiveness.
Since Al^{3+} has the highest charge among the choices, it will be the most effective.

Step 4: Final Answer:
$AlCl_3$ is the most effective electrolyte because it provides the trivalent Al^{3+} ion.

Quick Tip: Coagulating Power $\propto$ (Valency)^n.
For a negative sol, effectiveness order is: $Al^{3+} > Mg^{2+} > Na^+$.
For a positive sol, effectiveness order is: $[Fe(CN)_6]^{4-} > PO_4^{3-} > SO_4^{2-} > Cl^-$.

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8. Which linkage joins the monosaccharide units in sucrose?

(A) $C_1 - C_4$ glycosidic linkage
(B) $C_1 - C_2$ glycosidic linkage
(C) $C_1 - C_6$ glycosidic linkage
(D) $C_2 - C_4$ glycosidic linkage

Correct Answer: (B) $C_1 - C_2$ glycosidic linkage

Solution:

Step 1: Understanding the Question:
Sucrose is a disaccharide (table sugar). We need to identify the specific carbons involved in the bond between its component sugar molecules.

Step 2: Detailed Explanation:
Sucrose is formed by the condensation of two monosaccharides:
1. α-D-glucose
2. β-D-fructose
The linkage is formed between the anomeric carbon C_1 of the glucose molecule and the anomeric carbon C_2 of the fructose molecule.
Because both anomeric carbons are involved in the glycosidic bond, sucrose does not have a free aldehyde or ketone group.
This makes sucrose a **non-reducing sugar**.

Step 3: Final Answer:

The monosaccharide units in sucrose are joined by a $C_1 - C_2$ glycosidic linkage.

Quick Tip: To identify if a sugar is reducing or non-reducing, check the glycosidic bond.
If the bond involves both anomeric carbons (like C_1 of glucose and C_2 of fructose in sucrose), it is non-reducing.
Maltose ($C_1 - C_4$) and Lactose ($C_1 - C_4$) are reducing sugars.

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9. A compound is formed by two elements X and Y. Atoms of Y make ccp and those of element X occupy all the octahedral voids. What is the formula of the compound?

(A) XY_2
(B) X_2Y
(C) XY
(D) X_2Y_3

Correct Answer: (C) XY

Solution:

Step 1: Understanding the Question:

In crystal lattices, atoms can form a main framework, and smaller atoms occupy the "voids" or gaps in that framework. We need to determine the ratio of atoms X to Y.

Step 2: Key Formula or Approach:

In a CCP (Cubic Close Packed) or FCC lattice:
If the number of atoms in the packing is N:
- Number of Octahedral Voids $= N$
- Number of Tetrahedral Voids $= 2N$

Step 3: Detailed Explanation:

Let the number of atoms of element Y (forming the CCP lattice) be N.

According to the rules of lattice geometry, the number of octahedral voids generated will also be N.

Since element X occupies **all** the octahedral voids:

Number of atoms of $X = N$.

The ratio of atoms $X : Y$ is:

$$X : Y = N : N = 1 : 1$$

Thus, the empirical formula of the compound is XY.

Step 4: Final Answer:

The formula of the compound is XY.

Quick Tip: Memory aid for crystal voids:

O-voids = Same as number of atoms (N)

T-voids = Twice the number of atoms $(2N)$

In FCC/CCP, there are 4 atoms per unit cell, so there are 4 Octahedral and 8 Tetrahedral voids.

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10. Complete the series: 285, 253, 221, 189, ?

(A) 165

(B) 157

(C) 169

(D) 145

Correct Answer: (B) 157

Solution:

Step 1: Understanding the Question:

The problem is a numerical sequence where we need to identify the pattern of change between consecutive terms to find the next value.

Step 2: Detailed Explanation:

Let's find the difference between consecutive terms in the series:

$$285 - 253 = 32$$

$$253 - 221 = 32$$

$$221 - 189 = 32$$

We observe a constant decrease of 32 between each term. This is an Arithmetic Progression (AP).

To find the next term, subtract 32 from the last given term:

$$189 - 32 = 157$$

Step 3: Final Answer:

The missing number in the series is 157.

Quick Tip: When solving number series, always start by checking the "first-order difference" (subtracting neighbors).

If the difference is constant, it is an AP. If the difference of differences is constant, it is a quadratic series.
