

VITEEE 2026 April 28 Shift 2

Question Paper with Solutions

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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 value of k if the lines

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

and

$$\frac{x-4}{5} = \frac{y-1}{2} = \frac{z}{k}$$

are coplanar.

- (A) 0
- (B) 1
- (C) -1
- (D) 2

Correct Answer: (B) 1

Solution:

Step 1: Understanding the Question:

The question asks us to find the unknown value k such that two given straight lines in 3D space lie in the same plane (i.e., they are coplanar).

Two lines are coplanar if the scalar triple product of the vector joining a point on each line and their respective direction vectors is zero.

Step 2: Key Formula or Approach:

If the direction vectors of the two lines are $\vec{d}_1$ and $\vec{d}_2$, and $P_1\vec{P}_2$ is the vector joining points P_1 and P_2 on the two lines, the coplanarity condition is given by the determinant:

$$\begin{vmatrix} x_2 - x_1 & y_2 - y_1 & z_2 - z_1 \\ d_{1x} & d_{1y} & d_{1z} \\ d_{2x} & d_{2y} & d_{2z} \end{vmatrix} = 0$$

Step 3: Detailed Solution:

From the first line's equation:

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

We identify a point on line L_1 : $P_1(1, 2, 3)$.

The direction ratios for L_1 are: $\vec{d}_1 = (2, 3, 4)$.

From the second line's equation:

$$\frac{x-4}{5} = \frac{y-1}{2} = \frac{z}{k}$$

We identify a point on line L_2 : $P_2(4, 1, 0)$.

The direction ratios for L_2 are: $\vec{d}_2 = (5, 2, k)$.

Now, find the vector joining the two points P_1 and P_2 :

$$P_1\vec{P}_2 = (4 - 1, 1 - 2, 0 - 3) = (3, -1, -3)$$

Substitute these into the coplanarity determinant condition:

$$\begin{vmatrix} 3 & -1 & -3 \\ 2 & 3 & 4 \\ 5 & 2 & k \end{vmatrix} = 0$$

Expanding the determinant along the first row gives:

$$3(3k - 8) - (-1)(2k - 20) + (-3)(4 - 15) = 0$$

$$(9k - 24) + (2k - 20) + (-3)(-11) = 0$$

$$9k - 24 + 2k - 20 + 33 = 0$$

$$11k - 11 = 0$$

$$11k = 11$$

$$k = 1$$

Step 4: Final Answer:

The value of k is 1.

Quick Tip: For two lines in 3D to be coplanar, always use the scalar triple product condition:

$$[P_1\vec{P}_2, \vec{d}_1, \vec{d}_2] = 0.$$

Equating the determinant formed by these three vectors to zero is the fastest way to solve for unknown variables.

2. If A is a square matrix of order 3 such that $|\text{adj } A| = 64$, then find the value of $|A|$.

- (A) 4
- (B) ± 4
- (C) 8
- (D) ± 8

Correct Answer: (D) ± 8

Solution:

Step 1: Understanding the Question:

We are given the determinant of the adjoint of a matrix A and its order n .

We need to calculate the determinant of the original matrix A .

Step 2: Key Formula or Approach:

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

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

Step 3: Detailed Solution:

We are given that the order of the matrix is $n = 3$.

Substituting $n = 3$ into the property formula, we get:

$$|adj A| = |A|^{3-1}$$

$$|adj A| = |A|^2$$

We are also given that $|adj A| = 64$.

Substituting this value into our equation yields:

$$|A|^2 = 64$$

Taking the square root on both sides to solve for $|A|$:

$$|A| = \pm \sqrt{64}$$

$$|A| = \pm 8$$

Step 4: Final Answer:

The determinant of matrix A can be either $+8$ or -8 .

Quick Tip: Whenever a problem involves the determinant of an adjoint matrix, immediately recall the identity $|\operatorname{adj} A| = |A|^{n-1}$.

Do not forget to include the $\pm$ sign when taking the square root of an even power.

3. Evaluate the integral

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

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

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

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

The problem asks us to evaluate a definite integral involving trigonometric functions with limits from 0 to $\pi/2$.

This type of integral is classic and is best solved using properties of definite integrals rather than direct integration.

Step 2: Key Formula or Approach:

The most useful property for limits between 0 and a is known as King's Rule:

$$\int_0^a f(x) dx = \int_0^a f(a-x) dx$$

Using this property typically transforms the numerator to match a part of the denominator,

allowing us to add the original and transformed integrals.

Step 3: Detailed Solution:

Let the given integral be denoted as I :

$$I = \int_0^{\pi/2} \frac{\sin x}{\sin x + \cos x} dx \quad \dots \text{(Equation 1)}$$

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

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

Since $\sin(\frac{\pi}{2} - x) = \cos x$ and $\cos(\frac{\pi}{2} - x) = \sin x$, the integral becomes:

$$I = \int_0^{\pi/2} \frac{\cos x}{\cos x + \sin x} dx \quad \dots \text{(Equation 2)}$$

Now, add Equation 1 and Equation 2:

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

The integrand simplifies to 1:

$$\begin{aligned} 2I &= \int_0^{\pi/2} 1 dx \\ 2I &= [x]_0^{\pi/2} \\ 2I &= \frac{\pi}{2} - 0 \\ 2I &= \frac{\pi}{2} \end{aligned}$$

Solving for I :

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

Step 4: Final Answer:

The evaluated integral is $\frac{\pi}{4}$.

Quick Tip: When an integrand features $\sin x$ and $\cos x$ with limits from 0 to $\pi/2$, King's property is your best friend.

Adding the original integral to the modified integral will almost always result in the integrand canceling out to 1.

4. Find the area of the region bounded by the curve $y^2 = 4x$ and the line $x = 3$.

- (A) $4\sqrt{3}$ sq. units
- (B) $6\sqrt{3}$ sq. units
- (C) $8\sqrt{3}$ sq. units
- (D) $12\sqrt{3}$ sq. units

Correct Answer: (C) $8\sqrt{3}$ sq. units

Solution:

Step 1: Understanding the Question:

We need to calculate the area enclosed between a rightward-opening parabola $y^2 = 4x$ and a vertical line $x = 3$.

Because the parabola is symmetric about the x-axis, we can find the area in the first quadrant and double it.

Step 2: Key Formula or Approach:

The total area bounded by a curve symmetric about the x-axis and a vertical line from x_1 to x_2 is given by:

$$\text{Area} = 2 \int_{x_1}^{x_2} y \, dx$$

Step 3: Detailed Solution:

First, express y in terms of x for the upper half of the curve:

$$y^2 = 4x$$

$$y = \sqrt{4x} = 2\sqrt{x} \quad (\text{considering the positive root for the first quadrant})$$

The region is bounded between $x = 0$ (the vertex of the parabola) and the line $x = 3$.

Set up the definite integral for the total area:

$$\text{Area} = 2 \int_0^3 2\sqrt{x} \, dx$$

$$\text{Area} = 4 \int_0^3 x^{1/2} \, dx$$

Now, evaluate the integral:

$$\text{Area} = 4 \left[\frac{x^{3/2}}{3/2} \right]_0^3$$

$$\text{Area} = 4 \left(\frac{2}{3} \right) [x^{3/2}]_0^3$$

$$\text{Area} = \frac{8}{3} (3^{3/2} - 0)$$

Simplify the numeric expression:

$$3^{3/2} = 3\sqrt{3}$$

$$\text{Area} = \frac{8}{3} \times 3\sqrt{3}$$

$$\text{Area} = 8\sqrt{3}$$

Step 4: Final Answer:

The total bounded area is $8\sqrt{3}$ sq. units.

Quick Tip: For parabolas of the form $y^2 = 4ax$, exploit their symmetry about the x-axis. Calculate the area of the upper half using $y = +2\sqrt{ax}$ and simply multiply by 2 to get the final answer.

5. If the sum of the first n terms of an A.P is $S_n = 3n^2 + 5n$, find the 10^{th} term.

- (A) 60
- (B) 61
- (C) 62
- (D) 63

Correct Answer: (C) 62

Solution:

Step 1: Understanding the Question:

The problem provides a formula for the sum of the first n terms (S_n) of an Arithmetic Progression.

We are asked to find the specific value of the 10^{th} term (T_{10}).

Step 2: Key Formula or Approach:

The n^{th} term of any sequence can be found if the sum of the first n terms is known, using the relation:

$$T_n = S_n - S_{n-1}$$

Step 3: Detailed Solution:

To find the 10^{th} term, we substitute $n = 10$ into the formula:

$$T_{10} = S_{10} - S_9$$

First, compute S_{10} by substituting $n = 10$ into the given S_n formula:

$$S_{10} = 3(10)^2 + 5(10)$$

$$S_{10} = 3(100) + 50$$

$$S_{10} = 300 + 50 = 350$$

Next, compute S_9 by substituting $n = 9$:

$$S_9 = 3(9)^2 + 5(9)$$

$$S_9 = 3(81) + 45$$

$$S_9 = 243 + 45 = 288$$

Finally, find T_{10} by subtracting S_9 from S_{10} :

$$T_{10} = 350 - 288$$

$$T_{10} = 62$$

Step 4: Final Answer:

The 10th term of the given Arithmetic Progression is 62.

Quick Tip: To quickly find an individual term from a sum sequence, the formula $T_n = S_n - S_{n-1}$ is universally applicable.

This method avoids the need to find the first term (a) and the common difference (d) explicitly.

6. Calculate the equivalent resistance between two diametrically opposite points of a circular wire of total resistance 12Ω .

- (A) 2Ω
- (B) 3Ω
- (C) 4Ω
- (D) 6Ω

Correct Answer: (B) 3Ω

Solution:

Step 1: Understanding the Question:

A uniform circular wire with a total resistance of 12Ω is connected into a circuit at two diametrically opposite points.

This connection physically divides the circular wire into two equal semicircular arcs.

Step 2: Key Formula or Approach:

The resistance of a uniform wire is directly proportional to its length.

When divided into two halves, each half will have half the total resistance, and they will act as two resistors connected in parallel.

The equivalent resistance R_{eq} for two parallel resistors is given by:

$$R_{eq} = \frac{R_1 R_2}{R_1 + R_2}$$

Step 3: Detailed Solution:

Let the total resistance be $R = 12\ \Omega$.

Since diametrically opposite points divide the circle into two equal semicircles, the resistance of each semicircle is:

$$R_1 = R_2 = \frac{R}{2} = \frac{12}{2} = 6\ \Omega$$

These two semicircular sections are connected across the same two points, making them parallel resistors.

Applying the parallel resistance formula:

$$R_{eq} = \frac{6 \times 6}{6 + 6}$$

$$R_{eq} = \frac{36}{12}$$

$$R_{eq} = 3\ \Omega$$

Step 4: Final Answer:

The equivalent resistance between the two diametrically opposite points is $3\ \Omega$.

Quick Tip: When a uniform wire of resistance R is bent into a circle, the resistance across any two diametrically opposite points is always $R/4$.

Memorizing this shortcut saves valuable calculation time during the exam.

7. A capacitor of $10\ \mu F$ is charged to $50\ V$. Calculate the energy stored in the capacitor.

(A) $0.00125\ J$

- (B) $0.0125 J$
(C) $0.125 J$
(D) $1.25 J$

Correct Answer: (B) $0.0125 J$

Solution:

Step 1: Understanding the Question:

We are given the capacitance of a capacitor and the potential difference it is charged to. The task is to find the total electrical potential energy stored within it.

Step 2: Key Formula or Approach:

The energy (E) stored in a capacitor can be calculated using the formula:

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

where C is the capacitance in Farads (F) and V is the voltage in Volts (V).

Step 3: Detailed Solution:

First, convert the given capacitance from microfarads (μF) to standard SI units (Farads):

$$C = 10 \mu F = 10 \times 10^{-6} F = 10^{-5} F$$

The given voltage is:

$$V = 50 V$$

Substitute the values into the energy equation:

$$E = \frac{1}{2} \times (10^{-5}) \times (50)^2$$

$$E = \frac{1}{2} \times 10^{-5} \times 2500$$

$$E = 1250 \times 10^{-5}$$

To express this in standard decimal format:

$$E = 1250 \times 0.00001$$

$$E = 0.0125 J$$

Step 4: Final Answer:

The energy stored in the capacitor is $0.0125 J$.

Quick Tip: Always ensure your units are consistent before calculating.

Convert μF to Farads by multiplying by 10^{-6} to avoid order-of-magnitude errors in your final answer.

8. If the speed of light in a medium is $2 \times 10^8 \text{ m/s}$, what is the refractive index of the medium?

- (A) 1.2
- (B) 1.3
- (C) 1.5
- (D) 2

Correct Answer: (C) 1.5

Solution:

Step 1: Understanding the Question:

The question provides the speed of light inside a specific optical medium.

We need to determine the refractive index of this medium based on how much it slows down the light.

Step 2: Key Formula or Approach:

The absolute refractive index (n) of a medium is defined as the ratio of the speed of light in a vacuum (c) to the speed of light in that medium (v):

$$n = \frac{c}{v}$$

Step 3: Detailed Solution:

The constant for the speed of light in a vacuum is universally known as:

$$c = 3 \times 10^8 \text{ m/s}$$

The given speed of light in the medium is:

$$v = 2 \times 10^8 \text{ m/s}$$

Substitute these values into the refractive index formula:

$$n = \frac{3 \times 10^8}{2 \times 10^8}$$

The 10^8 terms cancel out completely:

$$n = \frac{3}{2}$$
$$n = 1.5$$

Step 4: Final Answer:

The refractive index of the given medium is 1.5.

Quick Tip: The refractive index is a dimensionless quantity because it is a ratio of two speeds. A higher refractive index simply implies that light travels slower in that particular medium.

9. A proton ($q = 1.6 \times 10^{-19} \text{ C}$) enters a magnetic field of 2 T with a velocity of $3 \times 10^6 \text{ m/s}$ perpendicular to the field. Find the magnetic force acting on the proton.

- (A) $9.6 \times 10^{-14} \text{ N}$
- (B) $9.6 \times 10^{-13} \text{ N}$
- (C) $9.6 \times 10^{-12} \text{ N}$
- (D) $9.6 \times 10^{-11} \text{ N}$

Correct Answer: (B) $9.6 \times 10^{-13} \text{ N}$

Solution:

Step 1: Understanding the Question:

A charged particle (proton) is moving through a magnetic field at a right angle (perpendicular) to the field lines.

We must calculate the magnitude of the magnetic Lorentz force acting on it.

Step 2: Key Formula or Approach:

The magnetic force (F) experienced by a moving charged particle is given by the formula:

$$F = qvB \sin \theta$$

where q is charge, v is velocity, B is magnetic field strength, and θ is the angle between velocity and the magnetic field.

Step 3: Detailed Solution:

Given values from the problem statement are:

Charge of proton, $q = 1.6 \times 10^{-19} \text{ C}$

Velocity, $v = 3 \times 10^6 \text{ m/s}$

Magnetic field strength, $B = 2 \text{ T}$

Since the proton enters perpendicular to the magnetic field, the angle $\theta = 90^\circ$.

We know that $\sin(90^\circ) = 1$.

Substitute these values into the force formula:

$$F = (1.6 \times 10^{-19}) \times (3 \times 10^6) \times (2) \times \sin(90^\circ)$$

$$F = (1.6 \times 3 \times 2) \times (10^{-19} \times 10^6) \times 1$$

$$F = (9.6) \times 10^{-19+6}$$

$$F = 9.6 \times 10^{-13} \text{ N}$$

Step 4: Final Answer:

The magnetic force acting on the proton is $9.6 \times 10^{-13} \text{ N}$.

Quick Tip: When the problem states "perpendicular to the field", immediately simplify the formula to $F = qvB$.

This is because the cross product becomes maximal when the angle is 90° .

10. Determine the de Broglie wavelength of an electron accelerated through 100 V.

- (A) $0.1227 \text{ \AA}$
- (B) $1.227 \text{ \AA}$
- (C) $12.27 \text{ \AA}$
- (D) $0.01227 \text{ \AA}$

Correct Answer: (B) $1.227 \text{ \AA}$

Solution:

Step 1: Understanding the Question:

The question asks for the matter wave (de Broglie wavelength) associated with an electron that has been accelerated from rest through a given electrostatic potential difference.

Step 2: Key Formula or Approach:

The general de Broglie wavelength formula is $\lambda = \frac{h}{p}$.

For an electron specifically, when accelerated through a potential difference V , the formula simplifies to a highly useful standard shortcut:

$$\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$$

where V is measured in volts.

Step 3: Detailed Solution:

We are given the accelerating potential:

$$V = 100 \text{ V}$$

Substitute $V = 100$ directly into the specific electron formula:

$$\lambda = \frac{12.27}{\sqrt{100}} \text{ \AA}$$

Since the square root of 100 is 10:

$$\lambda = \frac{12.27}{10} \text{ \AA}$$

Divide by 10 by shifting the decimal point one place to the left:

$$\lambda = 1.227 \text{ \AA}$$

Step 4: Final Answer:

The de Broglie wavelength of the electron is $1.227 \text{ \AA}$.

Quick Tip: Memorize the specific formula $\lambda = \frac{12.27}{\sqrt{V}} \text{ \AA}$ exclusively for electrons.

It bypasses complex calculations involving Planck's constant, electron mass, and elementary charge.

11. Which compound undergoes Cannizzaro reaction: Formaldehyde, Acetaldehyde, or Benzophenone?

- (A) Formaldehyde
- (B) Acetaldehyde
- (C) Benzophenone
- (D) Both (A) and (B)

Correct Answer: (A) Formaldehyde

Solution:

Step 1: Understanding the Question:

We need to identify which of the given chemical compounds will undergo a Cannizzaro reaction when treated with a strong concentrated base.

Step 2: Key Formula or Approach:

The fundamental requirement for a molecule to undergo a Cannizzaro reaction is that it must be an aldehyde that lacks an α -hydrogen atom.

Molecules lacking α -hydrogens undergo self-oxidation-reduction (disproportionation) instead of an aldol condensation.

Step 3: Detailed Solution:

Let's analyze each of the given options:

1. Formaldehyde ($HCHO$): The carbonyl carbon is attached only to hydrogen atoms. There is no α -carbon, and thus zero α -hydrogens. It fits the criteria perfectly.
2. Acetaldehyde (CH_3CHO): The α -carbon (the CH_3 group) contains three α -hydrogen atoms. Therefore, it will undergo aldol condensation instead of Cannizzaro.
3. Benzophenone ($Ph - CO - Ph$): While it does lack α -hydrogens, it is a ketone, not an aldehyde. The Cannizzaro reaction is a characteristic reaction of aldehydes.

Therefore, only Formaldehyde will undergo the Cannizzaro reaction.

Step 4: Final Answer:

Formaldehyde is the correct compound.

Quick Tip: Always check for two conditions for the Cannizzaro reaction: the compound must be an aldehyde, and it must have no α -hydrogens.

Common examples to memorize include Formaldehyde ($HCHO$) and Benzaldehyde (C_6H_5CHO).

12. What is the coordination number of Fe in the complex $[Fe(C_2O_4)_3]^{3-}$?

- (A) 3
(B) 4
(C) 6
(D) 9

Correct Answer: (C) 6

Solution:

Step 1: Understanding the Question:

The question asks for the coordination number of the central metal ion (Iron, *Fe*) within a specific coordination complex.

Step 2: Key Formula or Approach:

The coordination number is defined as the total number of coordinate covalent bonds formed between the central metal ion and its surrounding ligands.

It is calculated as the number of ligands multiplied by the denticity (number of donor atoms per ligand) of those ligands.

Step 3: Detailed Solution:

First, identify the ligand present in the complex $[Fe(C_2O_4)_3]^{3-}$.

The ligand is the oxalate ion ($C_2O_4^{2-}$).

The oxalate ion is a well-known bidentate ligand, meaning each single oxalate ion donates two pairs of electrons through its two oxygen atoms.

Next, count the number of ligands present:

There are 3 oxalate ligands attached to the iron atom.

Now, calculate the total coordination number:

$$\text{Coordination Number} = (\text{Number of ligands}) \times (\text{Denticity})$$

$$\text{Coordination Number} = 3 \times 2 = 6$$

Step 4: Final Answer:

The coordination number of Fe is 6.

Quick Tip: Do not confuse the number of ligands with the coordination number.

Always check the denticity of the ligand; bidentate ligands like oxalate (*ox*) and ethylenediamine (*en*) contribute 2 to the coordination number per molecule.

13. Calculate the pH of a 0.01 M HCl solution.

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Correct Answer: (B) 2

Solution:

Step 1: Understanding the Question:

We are given the molar concentration of a hydrochloric acid (HCl) solution and need to calculate its pH level.

Step 2: Key Formula or Approach:

The pH of an aqueous solution is defined as the negative base-10 logarithm of the hydrogen ion concentration:

$$pH = -\log_{10}[H^+]$$

Because HCl is a strong acid, it dissociates completely into H^+ and Cl^- ions in water.

Step 3: Detailed Solution:

Since HCl is a strong, monoprotic acid, its complete dissociation means the concentration of hydrogen ions is equal to the initial concentration of the acid:

$$[H^+] = 0.01 M$$

Express this concentration in scientific notation for easier calculation:

$$[H^+] = 10^{-2} M$$

Apply the pH formula:

$$pH = -\log(10^{-2})$$

Using the logarithm power rule ($\log(a^b) = b \cdot \log a$):

$$pH = -(-2)\log(10)$$

Since $\log(10) = 1$:

$$pH = 2$$

Step 4: Final Answer:

The pH of the 0.01 M HCl solution is 2.

Quick Tip: For strong monoprotic acids like HCl , HBr , or HNO_3 , the pH is simply the positive exponent when the molarity is written as 10^{-x} .

If concentration is 10^{-n} , then $pH = n$.

14. Identify the monomers for Nylon-6,6.

- (A) Adipic acid and Hexamethylenediamine
- (B) Ethylene glycol and Terephthalic acid
- (C) Styrene
- (D) Caprolactam

Correct Answer: (A) Adipic acid and Hexamethylenediamine

Solution:

Step 1: Understanding the Question:

The question asks to identify the building blocks (monomers) used to synthesize the synthetic polymer Nylon-6,6.

Step 2: Detailed Solution:

Nylon-6,6 is a type of polyamide formed through a step-growth condensation polymerization process.

The reaction involves two distinct monomer units combining, releasing water molecules as a byproduct.

The "6,6" in its name signifies that each of the two reacting monomers possesses exactly six carbon atoms in their molecular structures.

Let's look at the correct monomers:

1. The diamine monomer is Hexamethylenediamine: $H_2N - (CH_2)_6 - NH_2$ (contains 6 carbon atoms).
2. The dicarboxylic acid monomer is Adipic acid: $HOOC - (CH_2)_4 - COOH$ (contains $4 + 2 = 6$ carbon atoms).

When they react, the amine groups and carboxylic acid groups form strong amide linkages ($-CONH-$).

Let's briefly rule out the other options:

Ethylene glycol and Terephthalic acid form Dacron (PET).

Styrene forms Polystyrene.

Caprolactam is the single monomer used to make Nylon-6.

Step 3: Final Answer:

The correct monomers are Adipic acid and Hexamethylenediamine.

Quick Tip: Polymer names often hold clues: in Nylon-x,y, 'x' is the number of carbons in the diamine, and 'y' is the number of carbons in the diacid.

This helps easily distinguish it from Nylon-6, which is made from a single 6-carbon monomer (Caprolactam).

15. Which group contains the most electronegative elements in the periodic table?

- (A) Group 1
- (B) Group 2
- (C) Group 16
- (D) Group 17

Correct Answer: (D) Group 17

Solution:

Step 1: Understanding the Question:

The question asks us to identify the specific vertical column (group) in the periodic table that hosts the elements with the highest electronegativity.

Step 2: Detailed Solution:

Electronegativity is an atom's ability to attract shared pairs of electrons towards itself in a covalent bond.

The general periodic trend dictates that electronegativity increases as you move from left to right across a period (due to increasing nuclear charge) and decreases as you move down a group (due to increasing atomic size and shielding).

Following these trends, the elements with the highest electronegativity are located at the top right of the periodic table (excluding the noble gases in Group 18, which generally do not form bonds).

Group 17 consists of the halogens (Fluorine, Chlorine, Bromine, Iodine).

Fluorine, located at the top of Group 17, is the most electronegative element in the entire periodic table (value of 4.0 on the Pauling scale).

Consequently, Group 17 as a whole contains the most electronegative elements.

Step 3: Final Answer:

Group 17 contains the most electronegative elements.

Quick Tip: Remember the general rule for non-metals: the closer an element is to Fluorine on the periodic table, the more electronegative it is.

Noble gases (Group 18) are typically excluded from electronegativity trends due to their stable, full valence shells.

16. If 'FRIEND' is coded as 'HUMJTK', how is 'CANDLE' coded?

- (A) EDRIRJ
- (B) EDRJRI
- (C) FESJRL
- (D) DCRHQUI

Correct Answer: (A) EDRIRJ

Solution:

Step 1: Understanding the Question:

This is a standard letter coding-decoding problem.

We need to figure out the mathematical logic or shift pattern used to change 'FRIEND' into 'HUMJTK' and apply that identical pattern to 'CANDLE'.

Step 2: Detailed Solution:

Let us write down the word and its corresponding code to observe the positional shifts in the English alphabet:

F → H (Shift is +2, as F, G, H)

R → U (Shift is +3, as R, S, T, U)

I → M (Shift is +4, as I, J, K, L, M)
E → J (Shift is +5, as E, F, G, H, I, J)
N → T (Shift is +6, as N, O, P, Q, R, S, T)
D → K (Shift is +7, as D, E, F, G, H, I, J, K)

The logic pattern is an incrementing series of shifts: +2, +3, +4, +5, +6, +7.

Now, apply this exact sequence of shifts to the word 'CANDLE':

C +2 → E
A +3 → D
N +4 → R
D +5 → I
L +6 → R
E +7 → J

Combining the derived letters gives us the coded word: EDRIRJ.

Step 3: Final Answer:

'CANDLE' is coded as 'EDRIRJ'.

Quick Tip: Write down the alphabetical position numbers (A=1, B=2, etc.) above the letters if the mental shifts are tricky.

Finding the pattern for just the first two or three letters is often enough to eliminate incorrect options and save time.

17. A man walks 5 km East, then turns right and walks 4 km, and then turns left and walks 5 km. In which direction is he finally moving?

- (A) North
- (B) South
- (C) East

(D) West

Correct Answer: (C) East

Solution:

Step 1: Understanding the Question:

The question describes a sequence of straight-line movements and 90° turns.

We must track the facing direction of the person at each step to determine his final direction of travel.

Step 2: Detailed Solution:

Let's trace the journey step by step using standard map directions (North is Up, South is Down, East is Right, West is Left).

1. Initial movement:

The man starts walking 5 km towards the East. He is now facing East.

2. First turn:

He takes a right turn. If a person is facing East, a right turn is a 90° clockwise rotation.

He is now facing South. He walks 4 km in the South direction.

3. Second turn:

He then takes a left turn. If a person is facing South, a left turn is a 90° anti-clockwise rotation.

He is now facing East again. He walks 5 km in this direction.

4. Final orientation:

After the last movement, he is still walking in the East direction.

Step 3: Final Answer:

The man is finally moving towards the East.

Quick Tip: You can solve this without drawing lines: Right turn = $+90^\circ$ (clockwise), Left turn = -90° (anti-clockwise).

Initial is East. Then $+90^\circ$ (faces South), then -90° (faces East again). Total angular shift is 0° , so he remains facing East.

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

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

Correct Answer: (C) 42

Solution:

Step 1: Understanding the Question:

We are given a sequence of numbers and must identify the underlying mathematical pattern to predict the next number in the series.

Step 2: Detailed Solution:

One of the most effective ways to analyze a number series is to look at the differences between consecutive terms.

Let's calculate the primary differences:

$$6 - 2 = 4$$

$$12 - 6 = 6$$

$$20 - 12 = 8$$

$$30 - 20 = 10$$

The sequence of differences is 4, 6, 8, 10.

We can clearly observe that these differences form an Arithmetic Progression themselves, increasing by 2 each time.

Following this established pattern, the next difference must be:

$$10 + 2 = 12$$

To find the missing number, we add this next difference to the last known term of the series:

$$30 + 12 = 42$$

(Alternative Logic: The sequence can also be seen as $n^2 + n$ where $n = 1, 2, 3, \dots$. For $n = 6$, $6^2 + 6 = 36 + 6 = 42$. Both logics yield the same result.)

Step 3: Final Answer:

The missing number is 42.

Quick Tip: When the numbers in a series increase at a moderate rate, calculating the first and second level differences is the most reliable strategy.

Alternatively, checking for squares or cubes near the given numbers (e.g., $1^2 + 1, 2^2 + 2$) can provide a faster shortcut.

19. Choose the synonym of the word 'ABANDON'.

- (A) Retain
- (B) Forsake
- (C) Protect
- (D) Defend

Correct Answer: (B) Forsake

Solution:

Step 1: Understanding the Question:

The question asks us to identify a synonym, which is a word that shares the same or a very similar meaning with the given word 'ABANDON'.

Step 2: Detailed Solution:

First, let's establish the core meaning of the given word.

"Abandon" means to leave completely and finally, to desert, or to give up entirely.

Now, let us evaluate the meaning of each option provided:

(A) Retain: This means to continue to have something, or keep possession of it. This is an antonym, not a synonym.

(B) Forsake: This means to renounce, leave behind, or abandon someone or something. This matches the target meaning perfectly.

(C) Protect: This means to keep safe from harm or injury. This is unrelated and somewhat opposite in context.

(D) Defend: This means to resist an attack made on someone or something. This is also unrelated.

Therefore, 'Forsake' is the correct synonymous choice.

Step 3: Final Answer:

The synonym of ABANDON is Forsake.

Quick Tip: Use the process of elimination in vocabulary questions.

If you can group two or three options as having similar positive or negative connotations (like Retain, Protect, Defend are all 'keeping safe'), the odd one out (Forsake) is often the correct answer.

20. Fill in the blank: Neither of the two candidates _____ qualified.

- (A) are
- (B) were
- (C) is
- (D) have

Correct Answer: (C) is

Solution:

Step 1: Understanding the Question:

The sentence contains a blank that must be filled with the grammatically correct auxiliary verb.

We must apply standard rules of subject-verb agreement to determine the answer.

Step 2: Detailed Solution:

The subject of this sentence is the pronoun "Neither", not the plural noun "candidates".

In English grammar, words like "neither", "either", "each", "everyone", and "anyone" are distributive pronouns.

Distributive pronouns refer to individuals of a group one at a time, and therefore they are always treated as grammatically singular.

Because the subject "Neither" is singular, the verb that follows must also be in its singular form to maintain correct agreement.

Let's check the given options:

- (A) "are" is plural.
- (B) "were" is plural.
- (C) "is" is singular.
- (D) "have" is plural (except with 'I' or 'you').

The only singular verb among the choices is "is".

Step 3: Final Answer:

The correctly filled sentence reads: "Neither of the two candidates is qualified."

Quick Tip: Do not be distracted by the plural noun closest to the verb (like "candidates").

When a sentence starts with "Neither of...", "Either of...", or "Each of...", the actual subject is always singular, demanding a singular verb.