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| Paper: | B.E_B.Tech |
| SET:   | Item21     |

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| Topic:         | Mathematics-Section A                                                                                                                    |
| Item No:       | 1                                                                                                                                        |
| Question ID:   | <b>100001</b>                                                                                                                            |
| Question Type: | MCQ                                                                                                                                      |
| Question:      | The total number of functions,<br>$f: \{1, 2, 3, 4\} \rightarrow \{1, 2, 3, 4, 5, 6\}$<br>such that $f(1) + f(2) = f(3)$ , is equal to : |
| A:             | 60                                                                                                                                       |
| B:             | 90                                                                                                                                       |
| C:             | 108                                                                                                                                      |
| D:             | 126                                                                                                                                      |

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| Topic:         | Mathematics-Section A                                                                                                                                                              |
| Item No:       | 2                                                                                                                                                                                  |
| Question ID:   | <b>100002</b>                                                                                                                                                                      |
| Question Type: | MCQ                                                                                                                                                                                |
| Question:      | If $\alpha, \beta, \gamma, \delta$ are the roots of the equation $x^4 + x^3 + x^2 + x + 1 = 0$ , then $\alpha^{2021} + \beta^{2021} + \gamma^{2021} + \delta^{2021}$ is equal to : |
| A:             | -4                                                                                                                                                                                 |
| B:             | -1                                                                                                                                                                                 |
| C:             | 1                                                                                                                                                                                  |
| D:             | 4                                                                                                                                                                                  |

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| Topic:         | Mathematics-Section A |
| Item No:       | 3                     |
| Question ID:   | <b>100003</b>         |
| Question Type: | MCQ                   |

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| Question: | For $n \in \mathbf{N}$ , let $S_n = \left\{z \in \mathbf{C} :  z - 3 + 2i  = \frac{n}{4}\right\}$ and $T_n = \left\{z \in \mathbf{C} :  z - 2 + 3i  = \frac{1}{n}\right\}$ . Then the number of elements in the set $\{n \in \mathbf{N} : S_n \cap T_n = \phi\}$ is : |
| A:        | 0                                                                                                                                                                                                                                                                     |
| B:        | 2                                                                                                                                                                                                                                                                     |
| C:        | 3                                                                                                                                                                                                                                                                     |
| D:        | 4                                                                                                                                                                                                                                                                     |

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| Topic:         | Mathematics-Section A                                                                                                                                                                                                                                  |
| Item No:       | 4                                                                                                                                                                                                                                                      |
| Question ID:   | 100004                                                                                                                                                                                                                                                 |
| Question Type: | MCQ                                                                                                                                                                                                                                                    |
| Question:      | <p>The number of <math>\theta \in (0, 4\pi)</math> for which the system of linear equations</p> $\begin{aligned} 3 (\sin 3\theta) x - y + z &= 2 \\ 3 (\cos 2\theta) x + 4y + 3z &= 3 \\ 6x + 7y + 7z &= 9 \end{aligned}$ <p>has no solution, is :</p> |
| A:             | 6                                                                                                                                                                                                                                                      |
| B:             | 7                                                                                                                                                                                                                                                      |
| C:             | 8                                                                                                                                                                                                                                                      |
| D:             | 9                                                                                                                                                                                                                                                      |

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| Topic:         | Mathematics-Section A                                                                                                             |
| Item No:       | 5                                                                                                                                 |
| Question ID:   | 100005                                                                                                                            |
| Question Type: | MCQ                                                                                                                               |
| Question:      | If $\lim_{n \rightarrow \infty} \left( \sqrt{n^2 - n - 1} + n\alpha + \beta \right) = 0$ , then $8(\alpha + \beta)$ is equal to : |
| A:             | 4                                                                                                                                 |
| B:             | -8                                                                                                                                |
| C:             | -4                                                                                                                                |
| D:             | 8                                                                                                                                 |

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| Topic:         | Mathematics-Section A                                                                                                                                  |
| Item No:       | 6                                                                                                                                                      |
| Question ID:   | <b>100006</b>                                                                                                                                          |
| Question Type: | MCQ                                                                                                                                                    |
| Question:      | If the absolute maximum value of the function $f(x) = (x^2 - 2x + 7) e^{(4x^3 - 12x^2 - 180x + 31)}$ in the interval $[-3, 0]$ is $f(\alpha)$ , then : |
| A:             | $\alpha = 0$                                                                                                                                           |
| B:             | $\alpha = -3$                                                                                                                                          |
| C:             | $\alpha \in (-1, 0)$                                                                                                                                   |
| D:             | $\alpha \in (-3, -1]$                                                                                                                                  |

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| Topic:         | Mathematics-Section A                                                                                                                                                                                 |
| Item No:       | 7                                                                                                                                                                                                     |
| Question ID:   | <b>100007</b>                                                                                                                                                                                         |
| Question Type: | MCQ                                                                                                                                                                                                   |
| Question:      | The curve $y(x) = ax^3 + bx^2 + cx + 5$ touches the $x$ -axis at the point $P(-2, 0)$ and cuts the $y$ -axis at the point $Q$ , where $y'$ is equal to 3. Then the local maximum value of $y(x)$ is : |
| A:             | $\frac{27}{4}$                                                                                                                                                                                        |
| B:             | $\frac{29}{4}$                                                                                                                                                                                        |
| C:             | $\frac{37}{4}$                                                                                                                                                                                        |
| D:             | $\frac{9}{2}$                                                                                                                                                                                         |

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| Topic:       | Mathematics-Section A |
| Item No:     | 8                     |
| Question ID: | <b>100008</b>         |

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| Question Type: | MCQ                                                                                               |
| Question:      | The area of the region given by<br>$A = \{(x, y) : x^2 \leq y \leq \min \{x + 2, 4 - 3x\}\}$ is : |
| A:             | $\frac{31}{8}$                                                                                    |
| B:             | $\frac{17}{6}$                                                                                    |
| C:             | $\frac{19}{6}$                                                                                    |
| D:             | $\frac{27}{8}$                                                                                    |

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| Topic:         | Mathematics-Section A                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Item No:       | 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Question ID:   | <b>100009</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Question:      | <p>For any real number <math>x</math>, let <math>[x]</math> denote the largest integer less than equal to <math>x</math>. Let <math>f</math> be a real valued function defined on the interval <math>[-10, 10]</math> by <math>f(x) = \begin{cases} x - [x], &amp; \text{if } [x] \text{ is odd} \\ 1 + [x] - x, &amp; \text{if } [x] \text{ is even.} \end{cases}</math></p> <p>Then the value of <math>\frac{\pi^2}{10} \int_{-10}^{10} f(x) \cos \pi x \, dx</math> is :</p> |
| A:             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| B:             | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| C:             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| D:             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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| Topic:       | Mathematics-Section A |
| Item No:     | 10                    |
| Question ID: | <b>100010</b>         |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                                                 |
| Question:      | <p>The slope of the tangent to a curve <math>C : y = y(x)</math> at any point <math>(x, y)</math> on it is <math>\frac{2e^{2x} - 6e^{-x} + 9}{2 + 9e^{-2x}}</math>.</p> <p>If <math>C</math> passes through the points <math>\left(0, \frac{1}{2} + \frac{\pi}{2\sqrt{2}}\right)</math> and <math>\left(\alpha, \frac{1}{2} e^{2\alpha}\right)</math>, then <math>e^\alpha</math> is equal to :</p> |
| A:             | $\frac{3 + \sqrt{2}}{3 - \sqrt{2}}$                                                                                                                                                                                                                                                                                                                                                                 |
| B:             | $\frac{3}{\sqrt{2}} \left( \frac{3 + \sqrt{2}}{3 - \sqrt{2}} \right)$                                                                                                                                                                                                                                                                                                                               |
| C:             | $\frac{1}{\sqrt{2}} \left( \frac{\sqrt{2} + 1}{\sqrt{2} - 1} \right)$                                                                                                                                                                                                                                                                                                                               |
| D:             | $\frac{\sqrt{2} + 1}{\sqrt{2} - 1}$                                                                                                                                                                                                                                                                                                                                                                 |

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| Topic:         | Mathematics-Section A                                                                    |
| Item No:       | 11                                                                                       |
| Question ID:   | <b>100011</b>                                                                            |
| Question Type: | MCQ                                                                                      |
| Question:      | The general solution of the differential equation $(x - y^2)dx + y(5x + y^2)dy = 0$ is : |
| A:             | $(y^2 + x)^4 = C (y^2 + 2x)^3 $                                                          |
| B:             | $(y^2 + 2x)^4 = C (y^2 + x)^3 $                                                          |
| C:             | $ (y^2 + x)^3  = C (2y^2 + x)^4$                                                         |
| D:             | $ (y^2 + 2x)^3  = C (2y^2 + x)^4$                                                        |

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| Topic:       | Mathematics-Section A |
| Item No:     | 12                    |
| Question ID: | <b>100012</b>         |

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| Question Type: | MCQ                                                                                                                                                                                                                              |
| Question:      | A line, with the slope greater than one, passes through the point A(4, 3) and intersects the line $x - y - 2 = 0$ at the point B. If the length of the line segment AB is $\frac{\sqrt{29}}{3}$ , then B also lies on the line : |
| A:             | $2x + y = 9$                                                                                                                                                                                                                     |
| B:             | $3x - 2y = 7$                                                                                                                                                                                                                    |
| C:             | $x + 2y = 6$                                                                                                                                                                                                                     |
| D:             | $2x - 3y = 3$                                                                                                                                                                                                                    |

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| Topic:         | Mathematics-Section A                                                                                                                                                                                                           |
| Item No:       | 13                                                                                                                                                                                                                              |
| Question ID:   | <b>100013</b>                                                                                                                                                                                                                   |
| Question Type: | MCQ                                                                                                                                                                                                                             |
| Question:      | Let the locus of the centre $(\alpha, \beta)$ , $\beta > 0$ , of the circle which touches the circle $x^2 + (y - 1)^2 = 1$ externally and also touches the $x$ -axis be L. Then the area bounded by L and the line $y = 4$ is : |
| A:             | $\frac{32\sqrt{2}}{3}$                                                                                                                                                                                                          |
| B:             | $\frac{40\sqrt{2}}{3}$                                                                                                                                                                                                          |
| C:             | $\frac{64}{3}$                                                                                                                                                                                                                  |
| D:             | $\frac{32}{3}$                                                                                                                                                                                                                  |

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| Topic:       | Mathematics-Section A |
| Item No:     | 14                    |
| Question ID: | <b>100014</b>         |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                     |
| Question:      | Let P be the plane containing the straight line $\frac{x-3}{9} = \frac{y+4}{-1} = \frac{z-7}{-5}$ and perpendicular to the plane containing the straight lines $\frac{x}{2} = \frac{y}{3} = \frac{z}{5}$ and $\frac{x}{3} = \frac{y}{7} = \frac{z}{8}$ . If d is the distance of P from the point (2, -5, 11), then $d^2$ is equal to : |
| A:             | $\frac{147}{2}$                                                                                                                                                                                                                                                                                                                         |
| B:             | 96                                                                                                                                                                                                                                                                                                                                      |
| C:             | $\frac{32}{3}$                                                                                                                                                                                                                                                                                                                          |
| D:             | 54                                                                                                                                                                                                                                                                                                                                      |

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| Topic:         | Mathematics-Section A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Item No:       | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Question ID:   | <b>100015</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Question:      | <p>Let ABC be a triangle such that <math>\vec{BC} = \vec{a}</math>, <math>\vec{CA} = \vec{b}</math>, <math>\vec{AB} = \vec{c}</math>, <math> \vec{a}  = 6\sqrt{2}</math>, <math> \vec{b}  = 2\sqrt{3}</math> and <math>\vec{b} \cdot \vec{c} = 12</math>. Consider the statements :</p> <p>(S1) : <math>\left  \left( \vec{a} \times \vec{b} \right) + \left( \vec{c} \times \vec{b} \right) \right  -  \vec{c}  = 6(2\sqrt{2} - 1)</math></p> <p>(S2) : <math>\angle ACB = \cos^{-1} \left( \sqrt{\frac{2}{3}} \right)</math></p> <p>Then</p> |
| A:             | both (S1) and (S2) are true                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| B:             | only (S1) is true                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| C:             | only (S2) is true                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| D:             | both (S1) and (S2) are false                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| Topic:         | Mathematics-Section A                                                                                                                                     |
| Item No:       | 16                                                                                                                                                        |
| Question ID:   | <b>100016</b>                                                                                                                                             |
| Question Type: | MCQ                                                                                                                                                       |
| Question:      | If the sum and the product of mean and variance of a binomial distribution are 24 and 128 respectively, then the probability of one or two successes is : |
| A:             | $\frac{33}{2^{32}}$                                                                                                                                       |
| B:             | $\frac{33}{2^{29}}$                                                                                                                                       |
| C:             | $\frac{33}{2^{28}}$                                                                                                                                       |
| D:             | $\frac{33}{2^{27}}$                                                                                                                                       |

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| Topic:         | Mathematics-Section A                                                                                                                                                                   |
| Item No:       | 17                                                                                                                                                                                      |
| Question ID:   | <b>100017</b>                                                                                                                                                                           |
| Question Type: | MCQ                                                                                                                                                                                     |
| Question:      | If the numbers appeared on the two throws of a fair six faced die are $\alpha$ and $\beta$ , then the probability that $x^2 + \alpha x + \beta > 0$ , for all $x \in \mathbf{R}$ , is : |
| A:             | $\frac{17}{36}$                                                                                                                                                                         |
| B:             | $\frac{4}{9}$                                                                                                                                                                           |
| C:             | $\frac{1}{2}$                                                                                                                                                                           |
| D:             | $\frac{19}{36}$                                                                                                                                                                         |

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| Topic:         | Mathematics-Section A                                                                    |
| Item No:       | 18                                                                                       |
| Question ID:   | <b>100018</b>                                                                            |
| Question Type: | MCQ                                                                                      |
| Question:      | The number of solutions of $ \cos x  = \sin x$ , such that $-4\pi \leq x \leq 4\pi$ is : |
| A:             | 4                                                                                        |
| B:             | 6                                                                                        |
| C:             | 8                                                                                        |
| D:             | 12                                                                                       |

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| Topic:         | Mathematics-Section A                                                                                                                                                                                                                                                                                              |
| Item No:       | 19                                                                                                                                                                                                                                                                                                                 |
| Question ID:   | <b>100019</b>                                                                                                                                                                                                                                                                                                      |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                |
| Question:      | A tower PQ stands on a horizontal ground with base Q on the ground. The point R divides the tower in two parts such that QR = 15 m. If from a point A on the ground the angle of elevation of R is $60^\circ$ and the part PR of the tower subtends an angle of $15^\circ$ at A, then the height of the tower is : |
| A:             | $5(2\sqrt{3} + 3)$ m                                                                                                                                                                                                                                                                                               |
| B:             | $5(\sqrt{3} + 3)$ m                                                                                                                                                                                                                                                                                                |
| C:             | $10(\sqrt{3} + 1)$ m                                                                                                                                                                                                                                                                                               |
| D:             | $10(2\sqrt{3} + 1)$ m                                                                                                                                                                                                                                                                                              |

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| Topic:         | Mathematics-Section A                              |
| Item No:       | 20                                                 |
| Question ID:   | <b>100020</b>                                      |
| Question Type: | MCQ                                                |
| Question:      | Which of the following statements is a tautology ? |
| A:             | $((\sim p) \vee q) \Rightarrow p$                  |

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| B: | $p \Rightarrow ((\sim p) \vee q)$ |
| C: | $((\sim p) \vee q) \Rightarrow q$ |
| D: | $q \Rightarrow ((\sim p) \vee q)$ |

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| Topic:         | Mathematics-Section B                                                                                                                                                                                                                                                                                                                      |
| Item No:       | 21                                                                                                                                                                                                                                                                                                                                         |
| Question ID:   | <b>100021</b>                                                                                                                                                                                                                                                                                                                              |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                             |
| Question:      | <p>Let <math>A = \begin{pmatrix} 2 &amp; -1 &amp; -1 \\ 1 &amp; 0 &amp; -1 \\ 1 &amp; -1 &amp; 0 \end{pmatrix}</math> and <math>B = A - I</math>. If <math>\omega = \frac{\sqrt{3}i - 1}{2}</math>, then the number of elements in the set <math>\{n \in \{1, 2, \dots, 100\} : A^n + (\omega B)^n = A + B\}</math> is equal to _____.</p> |

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| Topic:         | Mathematics-Section B                                                                                                                                                                        |
| Item No:       | 22                                                                                                                                                                                           |
| Question ID:   | <b>100022</b>                                                                                                                                                                                |
| Question Type: | Numeric Answer                                                                                                                                                                               |
| Question:      | <p>The letters of the word 'MANKIND' are written in all possible orders and arranged in serial order as in an English dictionary. Then the serial number of the word 'MANKIND' is _____.</p> |

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| Topic:         | Mathematics-Section B                                                                                                                                                                                                                                            |
| Item No:       | 23                                                                                                                                                                                                                                                               |
| Question ID:   | <b>100023</b>                                                                                                                                                                                                                                                    |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                   |
| Question:      | <p>If the maximum value of the term independent of <math>t</math> in the expansion of <math>\left(t^2 x^{\frac{1}{5}} + \frac{(1-x)^{\frac{1}{10}}}{t}\right)^{15}</math>, <math>x \geq 0</math>, is <math>K</math>, then <math>8K</math> is equal to _____.</p> |

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| Topic: | Mathematics-Section B |
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| Item No:       | 24                                                                                                                                                                                                                                                                                                     |
| Question ID:   | <b>100024</b>                                                                                                                                                                                                                                                                                          |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                         |
| Question:      | Let $a, b$ be two non-zero real numbers. If $p$ and $r$ are the roots of the equation $x^2 - 8ax + 2a = 0$ and $q$ and $s$ are the roots of the equation $x^2 + 12bx + 6b = 0$ , such that $\frac{1}{p}, \frac{1}{q}, \frac{1}{r}, \frac{1}{s}$ are in A.P., then $a^{-1} - b^{-1}$ is equal to _____. |

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| Topic:         | Mathematics-Section B                                                                                                                                             |
| Item No:       | 25                                                                                                                                                                |
| Question ID:   | <b>100025</b>                                                                                                                                                     |
| Question Type: | Numeric Answer                                                                                                                                                    |
| Question:      | Let $a_1 = b_1 = 1$ , $a_n = a_{n-1} + 2$ and $b_n = a_n + b_{n-1}$ for every natural number $n \geq 2$ . Then $\sum_{n=1}^{15} a_n \cdot b_n$ is equal to _____. |

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| Topic:         | Mathematics-Section B                                                                                                                                                                                                                                                                                                                                |
| Item No:       | 26                                                                                                                                                                                                                                                                                                                                                   |
| Question ID:   | <b>100026</b>                                                                                                                                                                                                                                                                                                                                        |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                                       |
| Question:      | Let $f(x) = \begin{cases} \left\lceil 4x^2 - 8x + 5 \right\rceil, & \text{if } 8x^2 - 6x + 1 \geq 0 \\ \left[ 4x^2 - 8x + 5 \right], & \text{if } 8x^2 - 6x + 1 < 0, \end{cases}$ where $[\alpha]$ denotes the greatest integer less than or equal to $\alpha$ . Then the number of points in $\mathbf{R}$ where $f$ is not differentiable is _____. |

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| Topic:         | Mathematics-Section B |
| Item No:       | 27                    |
| Question ID:   | <b>100027</b>         |
| Question Type: | Numeric Answer        |

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| Question: | <p>If <math>\lim_{n \rightarrow \infty} \frac{(n+1)^{k-1}}{n^{k+1}} [(nk+1) + (nk+2) + \dots + (nk+n)]</math></p> <p><math>= 33 \cdot \lim_{n \rightarrow \infty} \frac{1}{n^{k+1}} \cdot [1^k + 2^k + 3^k + \dots + n^k],</math></p> <p>then the integral value of k is equal to _____.</p> |
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| Topic:         | Mathematics-Section B                                                                                                                                                                                                                                              |
| Item No:       | 28                                                                                                                                                                                                                                                                 |
| Question ID:   | <b>100028</b>                                                                                                                                                                                                                                                      |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                     |
| Question:      | Let the equation of two diameters of a circle $x^2 + y^2 - 2x + 2fy + 1 = 0$ be $2px - y = 1$ and $2x + py = 4p$ . Then the slope $m \in (0, \infty)$ of the tangent to the hyperbola $3x^2 - y^2 = 3$ passing through the centre of the circle is equal to _____. |

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| Topic:         | Mathematics-Section B                                                                                                                                                             |
| Item No:       | 29                                                                                                                                                                                |
| Question ID:   | <b>100029</b>                                                                                                                                                                     |
| Question Type: | Numeric Answer                                                                                                                                                                    |
| Question:      | The sum of diameters of the circles that touch (i) the parabola $75x^2 = 64(5y - 3)$ at the point $\left(\frac{8}{5}, \frac{6}{5}\right)$ and (ii) the y-axis, is equal to _____. |

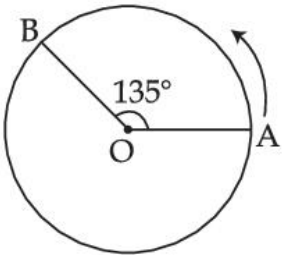
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| Topic:         | Mathematics-Section B |
| Item No:       | 30                    |
| Question ID:   | <b>100030</b>         |
| Question Type: | Numeric Answer        |

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| Question: | <p>The line of shortest distance between the lines <math>\frac{x-2}{0} = \frac{y-1}{1} = \frac{z}{1}</math> and <math>\frac{x-3}{2} = \frac{y-5}{2} = \frac{z-1}{1}</math> makes an angle of <math>\cos^{-1}\left(\sqrt{\frac{2}{27}}\right)</math> with the plane <math>P : ax - y - z = 0</math>, (<math>a &gt; 0</math>). If the image of the point <math>(1, 1, -5)</math> in the plane <math>P</math> is <math>(\alpha, \beta, \gamma)</math>, then <math>\alpha + \beta - \gamma</math> is equal to _____.</p> |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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| Topic:         | Physics-Section A                                                                                                                          |
| Item No:       | 31                                                                                                                                         |
| Question ID:   | 100031                                                                                                                                     |
| Question Type: | MCQ                                                                                                                                        |
| Question:      | If momentum [P], area [A] and time [T] are taken as fundamental quantities, then the dimensional formula for coefficient of viscosity is : |
| A:             | $[P A^{-1} T^0]$                                                                                                                           |
| B:             | $[P A T^{-1}]$                                                                                                                             |
| C:             | $[P A^{-1} T]$                                                                                                                             |
| D:             | $[P A^{-1} T^{-1}]$                                                                                                                        |

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| Topic:         | Physics-Section A                                                     |
| Item No:       | 32                                                                    |
| Question ID:   | 100032                                                                |
| Question Type: | MCQ                                                                   |
| Question:      | Which of the following physical quantities have the same dimensions ? |
| A:             | Electric displacement ( $\vec{D}$ ) and surface charge density        |
| B:             | Displacement current and electric field                               |
| C:             | Current density and surface charge density                            |
| D:             | Electric potential and energy                                         |

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| Topic: | Physics-Section A |
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|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Item No:       | 33                                                                                                                                                                                                                                                                                                   |
| Question ID:   | <b>100033</b>                                                                                                                                                                                                                                                                                        |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                  |
| Question:      | <p>A person moved from A to B on a circular path as shown in figure. If the distance travelled by him is 60 m, then the magnitude of displacement would be :</p> <p>(Given <math>\cos 135^\circ = -0.7</math>)</p>  |
| A:             | 42 m                                                                                                                                                                                                                                                                                                 |
| B:             | 47 m                                                                                                                                                                                                                                                                                                 |
| C:             | 19 m                                                                                                                                                                                                                                                                                                 |
| D:             | 40 m                                                                                                                                                                                                                                                                                                 |

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| Topic:         | Physics-Section A                                                                                                                                                                                                    |
| Item No:       | 34                                                                                                                                                                                                                   |
| Question ID:   | <b>100034</b>                                                                                                                                                                                                        |
| Question Type: | MCQ                                                                                                                                                                                                                  |
| Question:      | <p>A body of mass 0.5 kg travels on straight line path with velocity <math>v = (3x^2 + 4)</math> m/s. The net workdone by the force during its displacement from <math>x = 0</math> to <math>x = 2</math> m is :</p> |
| A:             | 64 J                                                                                                                                                                                                                 |
| B:             | 60 J                                                                                                                                                                                                                 |
| C:             | 120 J                                                                                                                                                                                                                |
| D:             | 128 J                                                                                                                                                                                                                |

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| Topic:       | Physics-Section A |
| Item No:     | 35                |
| Question ID: | <b>100035</b>     |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                           |
| Question:      | A solid cylinder and a solid sphere, having same mass M and radius R, roll down the same inclined plane from top without slipping. They start from rest. The ratio of velocity of the solid cylinder to that of the solid sphere, with which they reach the ground, will be : |
| A:             | $\sqrt{\frac{5}{3}}$                                                                                                                                                                                                                                                          |
| B:             | $\sqrt{\frac{4}{5}}$                                                                                                                                                                                                                                                          |
| C:             | $\sqrt{\frac{3}{5}}$                                                                                                                                                                                                                                                          |
| D:             | $\sqrt{\frac{14}{15}}$                                                                                                                                                                                                                                                        |

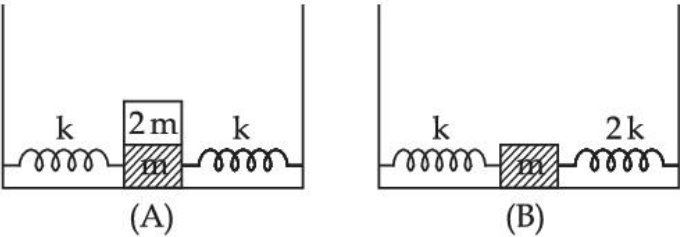
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| Topic:         | Physics-Section A                                                                                                                                                                                                                                                                                                         |
| Item No:       | 36                                                                                                                                                                                                                                                                                                                        |
| Question ID:   | <b>100036</b>                                                                                                                                                                                                                                                                                                             |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                       |
| Question:      | Three identical particles A, B and C of mass 100 kg each are placed in a straight line with AB = BC = 13 m. The gravitational force on a fourth particle P of the same mass is F, when placed at a distance 13 m from the particle B on the perpendicular bisector of the line AC. The value of F will be approximately : |
| A:             | 21 G                                                                                                                                                                                                                                                                                                                      |
| B:             | 100 G                                                                                                                                                                                                                                                                                                                     |
| C:             | 59 G                                                                                                                                                                                                                                                                                                                      |
| D:             | 42 G                                                                                                                                                                                                                                                                                                                      |

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| Topic:       | Physics-Section A |
| Item No:     | 37                |
| Question ID: | <b>100037</b>     |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                                                      |
| Question:      | A certain amount of gas of volume $V$ at $27^{\circ}\text{C}$ temperature and pressure $2 \times 10^7 \text{ Nm}^{-2}$ expands isothermally until its volume gets doubled. Later it expands adiabatically until its volume gets redoubled. The final pressure of the gas will be (Use $\gamma = 1.5$ ) : |
| A:             | $3.536 \times 10^5 \text{ Pa}$                                                                                                                                                                                                                                                                           |
| B:             | $3.536 \times 10^6 \text{ Pa}$                                                                                                                                                                                                                                                                           |
| C:             | $1.25 \times 10^6 \text{ Pa}$                                                                                                                                                                                                                                                                            |
| D:             | $1.25 \times 10^5 \text{ Pa}$                                                                                                                                                                                                                                                                            |

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| Topic:         | Physics-Section A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Item No:       | 38                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Question ID:   | <b>100038</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Question:      | <p>Following statements are given :</p> <p>(A) The average kinetic energy of a gas molecule decreases when the temperature is reduced.</p> <p>(B) The average kinetic energy of a gas molecule increases with increase in pressure at constant temperature.</p> <p>(C) The average kinetic energy of a gas molecule decreases with increase in volume.</p> <p>(D) Pressure of a gas increases with increase in temperature at constant pressure.</p> <p>(E) The volume of gas decreases with increase in temperature.</p> <p>Choose the correct answer from the options given below :</p> |
| A:             | (A) and (D) only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| B:             | (A), (B) and (D) only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| C:             | (B) and (D) only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| D:             | (A), (B) and (E) only                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

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| Topic:       | Physics-Section A |
| Item No:     | 39                |
| Question ID: | <b>100039</b>     |

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|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Question:      |  <p>In figure (A), mass '2 m' is fixed on mass 'm' which is attached to two springs of spring constant k. In figure (B), mass 'm' is attached to two springs of spring constant 'k' and '2k'. If mass 'm' in (A) and in (B) are displaced by distance 'x' horizontally and then released, then time period <math>T_1</math> and <math>T_2</math> corresponding to (A) and (B) respectively follow the relation.</p> |
| A:             | $\frac{T_1}{T_2} = \frac{3}{\sqrt{2}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| B:             | $\frac{T_1}{T_2} = \sqrt{\frac{3}{2}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| C:             | $\frac{T_1}{T_2} = \sqrt{\frac{2}{3}}$                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| D:             | $\frac{T_1}{T_2} = \frac{\sqrt{2}}{3}$                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic:         | Physics-Section A                                                                                                                                                                                                                              |
| Item No:       | 40                                                                                                                                                                                                                                             |
| Question ID:   | <b>100040</b>                                                                                                                                                                                                                                  |
| Question Type: | MCQ                                                                                                                                                                                                                                            |
| Question:      | A condenser of $2 \mu\text{F}$ capacitance is charged steadily from 0 to 5 C. Which of the following graph represents correctly the variation of potential difference (V) across it's plates with respect to the charge (Q) on the condenser ? |

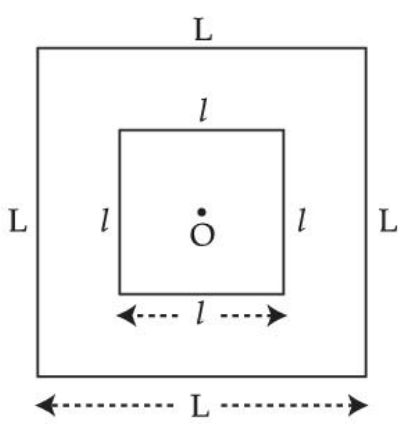
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| A: |  |
| B: |  |
| C: |  |
| D: |  |

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| Topic:       | Physics-Section A |
| Item No:     | 41                |
| Question ID: | <b>100041</b>     |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                                             |
| Question:      | Two charged particles, having same kinetic energy, are allowed to pass through a uniform magnetic field perpendicular to the direction of motion. If the ratio of radii of their circular paths is 6 : 5 and their respective masses ratio is 9 : 4. Then, the ratio of their charges will be : |
| A:             | 8 : 5                                                                                                                                                                                                                                                                                           |
| B:             | 5 : 4                                                                                                                                                                                                                                                                                           |
| C:             | 5 : 3                                                                                                                                                                                                                                                                                           |
| D:             | 8 : 7                                                                                                                                                                                                                                                                                           |

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| Topic:         | Physics-Section A                                                       |
| Item No:       | 42                                                                      |
| Question ID:   | <b>100042</b>                                                           |
| Question Type: | MCQ                                                                     |
| Question:      | To increase the resonant frequency in series LCR circuit,               |
| A:             | source frequency should be increased.                                   |
| B:             | another resistance should be added in series with the first resistance. |
| C:             | another capacitor should be added in series with the first capacitor.   |
| D:             | the source frequency should be decreased.                               |

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| Topic:         | Physics-Section A |
| Item No:       | 43                |
| Question ID:   | <b>100043</b>     |
| Question Type: | MCQ               |

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| Question: | <p>A small square loop of wire of side <math>l</math> is placed inside a large square loop of wire <math>L</math> (<math>L \gg l</math>). Both loops are coplanar and their centres coincide at point <math>O</math> as shown in figure. The mutual inductance of the system is :</p>  |
| A:        | $\frac{2\sqrt{2} \mu_0 L^2}{\pi l}$                                                                                                                                                                                                                                                                                                                                     |
| B:        | $\frac{\mu_0 l^2}{2\sqrt{2} \pi L}$                                                                                                                                                                                                                                                                                                                                     |
| C:        | $\frac{2\sqrt{2} \mu_0 l^2}{\pi L}$                                                                                                                                                                                                                                                                                                                                     |
| D:        | $\frac{\mu_0 L^2}{2\sqrt{2} \pi l}$                                                                                                                                                                                                                                                                                                                                     |

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| Topic:         | Physics-Section A                                                                                                                                                                                                                     |
| Item No:       | 44                                                                                                                                                                                                                                    |
| Question ID:   | <b>100044</b>                                                                                                                                                                                                                         |
| Question Type: | MCQ                                                                                                                                                                                                                                   |
| Question:      | The rms value of conduction current in a parallel plate capacitor is $6.9 \mu\text{A}$ . The capacity of this capacitor, if it is connected to $230 \text{ V}$ ac supply with an angular frequency of $600 \text{ rad/s}$ , will be : |
| A:             | $5 \text{ pF}$                                                                                                                                                                                                                        |
| B:             | $50 \text{ pF}$                                                                                                                                                                                                                       |
| C:             | $100 \text{ pF}$                                                                                                                                                                                                                      |

|    |        |
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| D: | 200 pF |
|----|--------|

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| Topic:         | Physics-Section A                                                                                        |
| Item No:       | 45                                                                                                       |
| Question ID:   | <b>100045</b>                                                                                            |
| Question Type: | MCQ                                                                                                      |
| Question:      | Which of the following statement is correct ?                                                            |
| A:             | In primary rainbow, observer sees red colour on the top and violet on the bottom                         |
| B:             | In primary rainbow, observer sees violet colour on the top and red on the bottom                         |
| C:             | In primary rainbow, light wave suffers total internal reflection twice before coming out of water drops. |
| D:             | Primary rainbow is less bright than secondary rainbow.                                                   |

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| Topic:         | Physics-Section A                                                                                                                                                                                                                                                                                                                                                                  |
| Item No:       | 46                                                                                                                                                                                                                                                                                                                                                                                 |
| Question ID:   | <b>100046</b>                                                                                                                                                                                                                                                                                                                                                                      |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                                |
| Question:      | Time taken by light to travel in two different materials A and B of refractive indices $\mu_A$ and $\mu_B$ of same thickness is $t_1$ and $t_2$ respectively. If $t_2 - t_1 = 5 \times 10^{-10}$ s and the ratio of $\mu_A$ to $\mu_B$ is 1 : 2. Then, the thickness of material, in meter is : (Given $v_A$ and $v_B$ are velocities of light in A and B materials respectively.) |
| A:             | $5 \times 10^{-10} v_A$ m                                                                                                                                                                                                                                                                                                                                                          |
| B:             | $5 \times 10^{-10}$ m                                                                                                                                                                                                                                                                                                                                                              |
| C:             | $1.5 \times 10^{-10}$ m                                                                                                                                                                                                                                                                                                                                                            |
| D:             | $5 \times 10^{-10} v_B$ m                                                                                                                                                                                                                                                                                                                                                          |

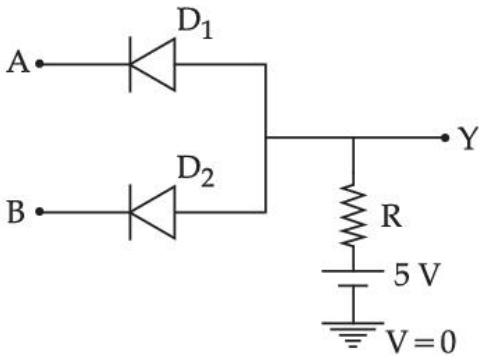
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| Topic:       | Physics-Section A |
| Item No:     | 47                |
| Question ID: | <b>100047</b>     |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                       |
| Question:      | A metal exposed to light of wavelength 800 nm and emits photoelectrons with a certain kinetic energy. The maximum kinetic energy of photo-electron doubles when light of wavelength 500 nm is used. The workfunction of the metal is : (Take $hc = 1230 \text{ eV-nm}$ ). |
| A:             | 1.537 eV                                                                                                                                                                                                                                                                  |
| B:             | 2.46 eV                                                                                                                                                                                                                                                                   |
| C:             | 0.615 eV                                                                                                                                                                                                                                                                  |
| D:             | 1.23 eV                                                                                                                                                                                                                                                                   |

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| Topic:         | Physics-Section A                                                                                                   |
| Item No:       | 48                                                                                                                  |
| Question ID:   | <b>100048</b>                                                                                                       |
| Question Type: | MCQ                                                                                                                 |
| Question:      | The momentum of an electron revolving in $n^{\text{th}}$ orbit is given by :<br>(Symbols have their usual meanings) |
| A:             | $\frac{nh}{2\pi r}$                                                                                                 |
| B:             | $\frac{nh}{2r}$                                                                                                     |
| C:             | $\frac{nh}{2\pi}$                                                                                                   |
| D:             | $\frac{2\pi r}{nh}$                                                                                                 |

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| Topic:         | Physics-Section A                                                                                                          |
| Item No:       | 49                                                                                                                         |
| Question ID:   | <b>100049</b>                                                                                                              |
| Question Type: | MCQ                                                                                                                        |
| Question:      | The magnetic moment of an electron (e) revolving in an orbit around nucleus with an orbital angular momentum is given by : |

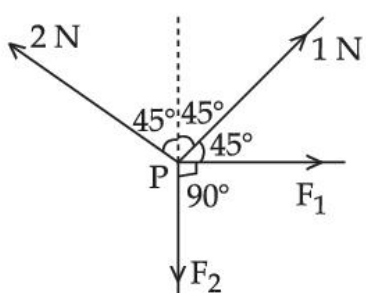
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| A: | $\vec{\mu}_L = \frac{e\vec{L}}{2m}$  |
| B: | $\vec{\mu}_L = -\frac{e\vec{L}}{2m}$ |
| C: | $\vec{\mu}_l = -\frac{e\vec{L}}{m}$  |
| D: | $\vec{\mu}_l = \frac{2e\vec{L}}{m}$  |

|                |                                                                                                                                                                                                                                                                                                                                                                              |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
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| Topic:         | Physics-Section A                                                                                                                                                                                                                                                                                                                                                            |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Item No:       | 50                                                                                                                                                                                                                                                                                                                                                                           |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Question ID:   | 100050                                                                                                                                                                                                                                                                                                                                                                       |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                          |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| Question:      | <p>In the circuit, the logical value of <math>A = 1</math> or <math>B = 1</math> when potential at A or B is 5 V and the logical value of <math>A = 0</math> or <math>B = 0</math> when potential at A or B is 0 V.</p> <div></div> <p>The truth table of the given circuit will be :</p> |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| A:             | <table><tr><td>A</td><td>B</td><td>Y</td></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table>                                                                                                                                                           | A | B | Y | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 |
| A              | B                                                                                                                                                                                                                                                                                                                                                                            | Y |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0              | 0                                                                                                                                                                                                                                                                                                                                                                            | 0 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1              | 0                                                                                                                                                                                                                                                                                                                                                                            | 0 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0              | 1                                                                                                                                                                                                                                                                                                                                                                            | 0 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1              | 1                                                                                                                                                                                                                                                                                                                                                                            | 1 |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

|    |   |   |   |
|----|---|---|---|
| B: | A | B | Y |
|    | 0 | 0 | 0 |
|    | 1 | 0 | 1 |
|    | 0 | 1 | 1 |
|    | 1 | 1 | 1 |
| C: | A | B | Y |
|    | 0 | 0 | 0 |
|    | 1 | 0 | 0 |
|    | 0 | 1 | 0 |
|    | 1 | 1 | 0 |
| D: | A | B | Y |
|    | 0 | 0 | 1 |
|    | 1 | 0 | 1 |
|    | 0 | 1 | 1 |
|    | 1 | 1 | 0 |

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| Topic:         | Physics-Section B                                                                                                                                                                                                                  |
| Item No:       | 51                                                                                                                                                                                                                                 |
| Question ID:   | <b>100051</b>                                                                                                                                                                                                                      |
| Question Type: | Numeric Answer                                                                                                                                                                                                                     |
| Question:      | A car is moving with speed of 150 km/h and after applying the break it will move 27 m before it stops. If the same car is moving with a speed of one third the reported speed then it will stop after travelling _____ m distance. |

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| Topic:         | Physics-Section B |
| Item No:       | 52                |
| Question ID:   | <b>100052</b>     |
| Question Type: | Numeric Answer    |

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| Question: | <p>Four forces are acting at a point P in equilibrium as shown in figure. The ratio of force <math>F_1</math> to <math>F_2</math> is <math>1 : x</math> where <math>x = \underline{\hspace{2cm}}</math>.</p>  |
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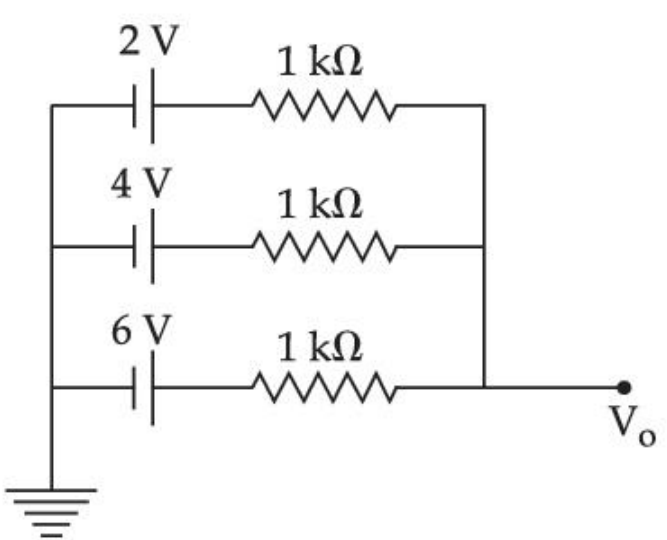
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| Topic:         | Physics-Section B                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Item No:       | 53                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Question ID:   | <b>100053</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Question:      | <p>A wire of length <math>L</math> and radius <math>r</math> is clamped rigidly at one end. When the other end of the wire is pulled by a force <math>F</math>, its length increases by 5 cm. Another wire of the same material of length <math>4L</math> and radius <math>4r</math> is pulled by a force <math>4F</math> under same conditions. The increase in length of this wire is <math>\underline{\hspace{2cm}}</math> cm.</p> |

|                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic:         | Physics-Section B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Item No:       | 54                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Question ID:   | <b>100054</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Question:      | <p>A unit scale is to be prepared whose length does not change with temperature and remains 20 cm, using a bimetallic strip made of brass and iron each of different length. The length of both components would change in such a way that difference between their lengths remains constant. If length of brass is 40 cm and length of iron will be <math>\underline{\hspace{2cm}}</math> cm.<br/> <math>(\alpha_{\text{iron}} = 1.2 \times 10^{-5} \text{ K}^{-1} \text{ and } \alpha_{\text{brass}} = 1.8 \times 10^{-5} \text{ K}^{-1})</math>.</p> |

|                |                   |
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| Topic:         | Physics-Section B |
| Item No:       | 55                |
| Question ID:   | <b>100055</b>     |
| Question Type: | Numeric Answer    |

|           |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|-----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question: | An observer is riding on a bicycle and moving towards a hill at $18 \text{ kmh}^{-1}$ . He hears a sound from a source at some distance behind him directly as well as after its reflection from the hill. If the original frequency of the sound as emitted by source is $640 \text{ Hz}$ and velocity of the sound in air is $320 \text{ m/s}$ , the beat frequency between the two sounds heard by observer will be _____ $\text{Hz}$ . |
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|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic:         | Physics-Section B                                                                                                                                                                                                                                                                                                                                                                                          |
| Item No:       | 56                                                                                                                                                                                                                                                                                                                                                                                                         |
| Question ID:   | <b>100056</b>                                                                                                                                                                                                                                                                                                                                                                                              |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                                                                                             |
| Question:      | <p>The volume charge density of a sphere of radius <math>6 \text{ m}</math> is <math>2 \mu\text{C cm}^{-3}</math>. The number of lines of force per unit surface area coming out from the surface of the sphere is _____ <math>\times 10^{10} \text{ NC}^{-1}</math>.</p> <p>[Given : Permittivity of vacuum <math>\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2 \text{ N}^{-1} \text{ m}^{-2}</math>]</p> |

|                |                                                                                                                                                                                    |
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| Topic:         | Physics-Section B                                                                                                                                                                  |
| Item No:       | 57                                                                                                                                                                                 |
| Question ID:   | <b>100057</b>                                                                                                                                                                      |
| Question Type: | Numeric Answer                                                                                                                                                                     |
| Question:      | <p>In the given figure, the value of <math>V_o</math> will be _____ <math>\text{V}</math>.</p>  |

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| Topic:       | Physics-Section B |
| Item No:     | 58                |
| Question ID: | <b>100058</b>     |

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|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Question Type: | Numeric Answer                                                                                                                                                                                                                                 |
| Question:      | Eight copper wire of length $l$ and diameter $d$ are joined in parallel to form a single composite conductor of resistance $R$ . If a single copper wire of length $2l$ have the same resistance ( $R$ ) then its diameter will be _____ $d$ . |

|                |                                                                                                                                                          |
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| Topic:         | Physics-Section B                                                                                                                                        |
| Item No:       | 59                                                                                                                                                       |
| Question ID:   | <b>100059</b>                                                                                                                                            |
| Question Type: | Numeric Answer                                                                                                                                           |
| Question:      | The energy band gap of semiconducting material to produce violet (wavelength = $4000 \text{ \AA}$ ) LED is _____ eV. (Round off to the nearest integer). |

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| Topic:         | Physics-Section B                                                                                                                                                                                                        |
| Item No:       | 60                                                                                                                                                                                                                       |
| Question ID:   | <b>100060</b>                                                                                                                                                                                                            |
| Question Type: | Numeric Answer                                                                                                                                                                                                           |
| Question:      | The required height of a TV tower which can cover the population of 6.03 lakh is $h$ . If the average population density is 100 per square km and the radius of earth is 6400 km, then the value of $h$ will be _____ m. |

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| Topic:         | Chemistry-Section A                                                                                                                                                                                                                                                                                                                                                              |
| Item No:       | 61                                                                                                                                                                                                                                                                                                                                                                               |
| Question ID:   | <b>100061</b>                                                                                                                                                                                                                                                                                                                                                                    |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                                                                              |
| Question:      | <p><math>\text{SO}_2\text{Cl}_2</math> on reaction with excess of water results into acidic mixture</p> $\text{SO}_2\text{Cl}_2 + 2\text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + 2\text{HCl}$ <p>16 moles of NaOH is required for the complete neutralisation of the resultant acidic mixture. The number of moles of <math>\text{SO}_2\text{Cl}_2</math> used is :</p> |
| A:             | 16                                                                                                                                                                                                                                                                                                                                                                               |
| B:             | 8                                                                                                                                                                                                                                                                                                                                                                                |
| C:             | 4                                                                                                                                                                                                                                                                                                                                                                                |

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| D: | 2 |
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| Topic:         | Chemistry-Section A                                             |
| Item No:       | 62                                                              |
| Question ID:   | <b>100062</b>                                                   |
| Question Type: | MCQ                                                             |
| Question:      | Which of the following sets of quantum numbers is not allowed ? |
| A:             | $n=3, l=2, m_l=0, s=+\frac{1}{2}$                               |
| B:             | $n=3, l=2, m_l=-2, s=+\frac{1}{2}$                              |
| C:             | $n=3, l=3, m_l=-3, s=-\frac{1}{2}$                              |
| D:             | $n=3, l=0, m_l=0, s=-\frac{1}{2}$                               |

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| Topic:         | Chemistry-Section A                                                                                                                                                                                                                                                                                              |
| Item No:       | 63                                                                                                                                                                                                                                                                                                               |
| Question ID:   | <b>100063</b>                                                                                                                                                                                                                                                                                                    |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                              |
| Question:      | The depression in freezing point observed for a formic acid solution of concentration $0.5 \text{ mL L}^{-1}$ is $0.0405^\circ\text{C}$ . Density of formic acid is $1.05 \text{ g mL}^{-1}$ . The Van't Hoff factor of the formic acid solution is nearly : (Given for water $k_f=1.86 \text{ k kg mol}^{-1}$ ) |
| A:             | 0.8                                                                                                                                                                                                                                                                                                              |
| B:             | 1.1                                                                                                                                                                                                                                                                                                              |
| C:             | 1.9                                                                                                                                                                                                                                                                                                              |
| D:             | 2.4                                                                                                                                                                                                                                                                                                              |

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| Topic:       | Chemistry-Section A |
| Item No:     | 64                  |
| Question ID: | <b>100064</b>       |

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| Question Type: | MCQ                                                                                                                                                                                                                                                                              |
| Question:      | 20 mL of 0.1 M $\text{NH}_4\text{OH}$ is mixed with 40 mL of 0.05 M $\text{HCl}$ . The pH of the mixture is nearest to :<br>(Given : $K_b(\text{NH}_4\text{OH}) = 1 \times 10^{-5}$ , $\log 2 = 0.30$ , $\log 3 = 0.48$ , $\log 5 = 0.69$ , $\log 7 = 0.84$ , $\log 11 = 1.04$ ) |
| A:             | 3.2                                                                                                                                                                                                                                                                              |
| B:             | 4.2                                                                                                                                                                                                                                                                              |
| C:             | 5.2                                                                                                                                                                                                                                                                              |
| D:             | 6.2                                                                                                                                                                                                                                                                              |

| Topic:                                                                                                             | Chemistry-Section A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|---------------------------------------------------------------------------------------|--------|--------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------|----------------------------------------------------------------------------|----------------------------------------------------------------------------------------------|---------|
| Item No:                                                                                                           | 65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| Question ID:                                                                                                       | 100065                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| Question Type:                                                                                                     | MCQ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| Question:                                                                                                          | <p>Match List - I with List - II</p> <table> <thead> <tr> <th>List - I</th><th>List - II</th></tr> </thead> <tbody> <tr> <td>(A) <math>\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})</math></td><td>(I) Cu</td></tr> <tr> <td>(B) <math>\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})</math></td><td>(II) <math>\text{Cu/ZnO} - \text{Cr}_2\text{O}_3</math></td></tr> <tr> <td>(C) <math>\text{CO}(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{HCHO}(\text{g})</math></td><td>(III) <math>\text{Fe}_x\text{O}_y + \text{K}_2\text{O} + \text{Al}_2\text{O}_3</math></td></tr> <tr> <td>(D) <math>\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})</math></td><td>(IV) Ni</td></tr> </tbody> </table> <p>Choose the <b>correct</b> answer from the options given below :</p> | List - I | List - II | (A) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$ | (I) Cu | (B) $\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})$ | (II) $\text{Cu/ZnO} - \text{Cr}_2\text{O}_3$ | (C) $\text{CO}(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{HCHO}(\text{g})$ | (III) $\text{Fe}_x\text{O}_y + \text{K}_2\text{O} + \text{Al}_2\text{O}_3$ | (D) $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$ | (IV) Ni |
| List - I                                                                                                           | List - II                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| (A) $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$                              | (I) Cu                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| (B) $\text{CO}(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow \text{CH}_4(\text{g}) + \text{H}_2\text{O}(\text{g})$ | (II) $\text{Cu/ZnO} - \text{Cr}_2\text{O}_3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| (C) $\text{CO}(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{HCHO}(\text{g})$                                 | (III) $\text{Fe}_x\text{O}_y + \text{K}_2\text{O} + \text{Al}_2\text{O}_3$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| (D) $\text{CO}(\text{g}) + 2\text{H}_2(\text{g}) \rightarrow \text{CH}_3\text{OH}(\text{g})$                       | (IV) Ni                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| A:                                                                                                                 | (A) - (II), (B) - (IV), (C) - (I), (D) - (III)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| B:                                                                                                                 | (A) - (II), (B) - (I), (C) - (IV), (D) - (III)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| C:                                                                                                                 | (A) - (III), (B) - (IV), (C) - (I), (D) - (II)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |
| D:                                                                                                                 | (A) - (III), (B) - (I), (C) - (IV), (D) - (II)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |          |           |                                                                                       |        |                                                                                                                    |                                              |                                                                                    |                                                                            |                                                                                              |         |

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| Topic:       | Chemistry-Section A |
| Item No:     | 66                  |
| Question ID: | 100066              |

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|----------------|------------------------------------------------------------------------------------------------|
| Question Type: | MCQ                                                                                            |
| Question:      | The IUPAC nomenclature of an element with electronic configuration $[Rn] 5f^{14}6d^17s^2$ is : |
| A:             | Unnilbium                                                                                      |
| B:             | Unnilunium                                                                                     |
| C:             | Unnilquadium                                                                                   |
| D:             | Unniltrium                                                                                     |

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| Topic:         | Chemistry-Section A                                                                                                                                                                                                                                                                                             |
| Item No:       | 67                                                                                                                                                                                                                                                                                                              |
| Question ID:   | <b>100067</b>                                                                                                                                                                                                                                                                                                   |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                             |
| Question:      | <p>The compound(s) that is(are) removed as slag during the extraction of copper is :</p> <p>(A) <math>CaO</math></p> <p>(B) <math>FeO</math></p> <p>(C) <math>Al_2O_3</math></p> <p>(D) <math>ZnO</math></p> <p>(E) <math>NiO</math></p> <p>Choose the <b>correct</b> answer from the options given below :</p> |
| A:             | (C), (D) only                                                                                                                                                                                                                                                                                                   |
| B:             | (A), (B), (E) only                                                                                                                                                                                                                                                                                              |
| C:             | (A), (B) only                                                                                                                                                                                                                                                                                                   |
| D:             | (B) only                                                                                                                                                                                                                                                                                                        |

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| Topic:         | Chemistry-Section A                                                                                      |
| Item No:       | 68                                                                                                       |
| Question ID:   | <b>100068</b>                                                                                            |
| Question Type: | MCQ                                                                                                      |
| Question:      | The reaction of $H_2O_2$ with potassium permanganate in acidic medium leads to the formation of mainly : |

|    |                  |
|----|------------------|
| A: | $\text{Mn}^{2+}$ |
| B: | $\text{Mn}^{4+}$ |
| C: | $\text{Mn}^{3+}$ |
| D: | $\text{Mn}^{6+}$ |

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| Topic:         | Chemistry-Section A                                               |
| Item No:       | 69                                                                |
| Question ID:   | <b>100069</b>                                                     |
| Question Type: | MCQ                                                               |
| Question:      | Choose the <b>correct</b> order of density of the alkali metals : |
| A:             | $\text{Li} < \text{K} < \text{Na} < \text{Rb} < \text{Cs}$        |
| B:             | $\text{Li} < \text{Na} < \text{K} < \text{Rb} < \text{Cs}$        |
| C:             | $\text{Cs} < \text{Rb} < \text{K} < \text{Na} < \text{Li}$        |
| D:             | $\text{Li} < \text{Na} < \text{K} < \text{Cs} < \text{Rb}$        |

|                |                                                                                                                                                                                                                       |
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| Topic:         | Chemistry-Section A                                                                                                                                                                                                   |
| Item No:       | 70                                                                                                                                                                                                                    |
| Question ID:   | <b>100070</b>                                                                                                                                                                                                         |
| Question Type: | MCQ                                                                                                                                                                                                                   |
| Question:      | <p>The geometry around boron in the product 'B' formed from the following reaction is</p> $\text{BF}_3 + \text{NaH} \xrightarrow{450 \text{ K}} \text{A} + \text{NaF}$ $\text{A} + \text{NMe}_3 \rightarrow \text{B}$ |
| A:             | trigonal planar                                                                                                                                                                                                       |
| B:             | tetrahedral                                                                                                                                                                                                           |
| C:             | pyramidal                                                                                                                                                                                                             |
| D:             | square planar                                                                                                                                                                                                         |

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| Topic:   | Chemistry-Section A |
| Item No: | 71                  |

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| Question ID:   | <b>100071</b>                                                                                |
| Question Type: | MCQ                                                                                          |
| Question:      | The interhalogen compound formed from the reaction of bromine with excess of fluorine is a : |
| A:             | hypohalite                                                                                   |
| B:             | halate                                                                                       |
| C:             | perhalate                                                                                    |
| D:             | halite                                                                                       |

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| Topic:         | Chemistry-Section A                                 |
| Item No:       | 72                                                  |
| Question ID:   | <b>100072</b>                                       |
| Question Type: | MCQ                                                 |
| Question:      | The photochemical smog does not generally contain : |
| A:             | NO                                                  |
| B:             | NO <sub>2</sub>                                     |
| C:             | SO <sub>2</sub>                                     |
| D:             | HCHO                                                |

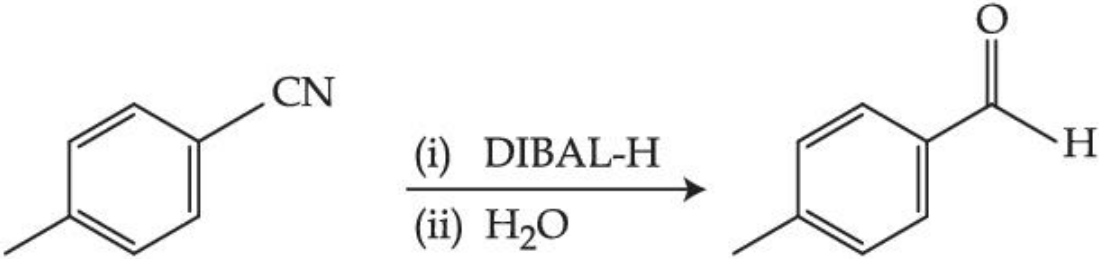
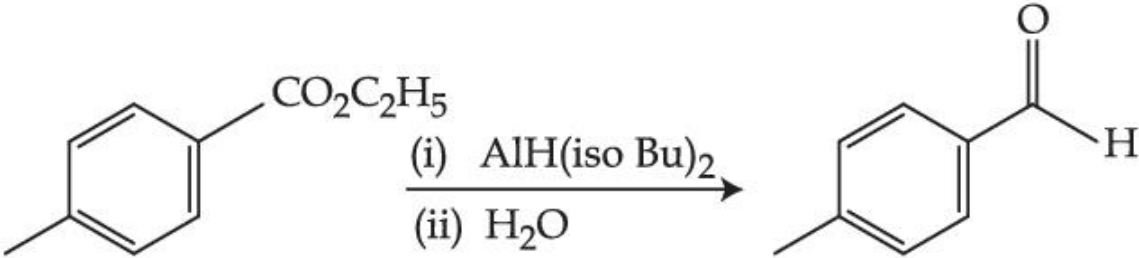
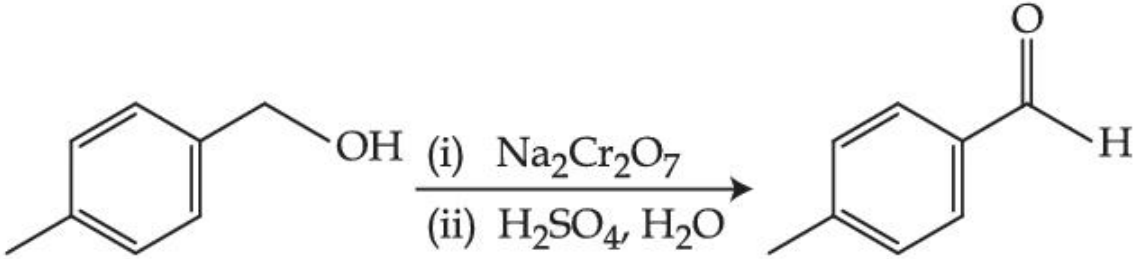
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| Topic:         | Chemistry-Section A |
| Item No:       | 73                  |
| Question ID:   | <b>100073</b>       |
| Question Type: | MCQ                 |

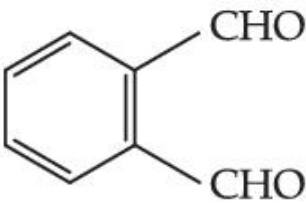
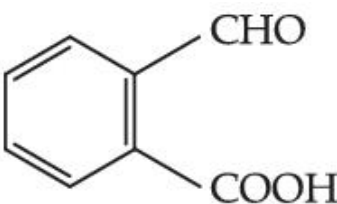
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| Question: | <p>A compound 'A' on reaction with 'X' and 'Y' produces the same major product but different by product 'a' and 'b'. Oxidation of 'a' gives a substance produced by ants.</p> <div style="text-align: center;"> <p>Compound 'A' <math>\xrightarrow{\text{X}}</math> a + <math>\text{O}=\text{C}(\text{CH}_3)-\text{CH}_2-\text{C}(\text{CH}_3)_2-\text{CH}_3</math></p> <p>Compound 'A' <math>\xrightarrow{\text{Y}}</math> b + <math>\text{O}=\text{C}(\text{CH}_3)-\text{CH}_2-\text{C}(\text{CH}_3)_2-\text{CH}_3</math></p> </div> <p>'X' and 'Y' respectively are</p> |
| A:        | $\text{KMnO}_4/\text{H}^+$ and dil. $\text{KMnO}_4$ , 273 K                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| B:        | $\text{KMnO}_4$ (dilute), 273 K and $\text{KMnO}_4/\text{H}^+$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| C:        | $\text{KMnO}_4/\text{H}^+$ and $\text{O}_3$ , $\text{H}_2\text{O}/\text{Zn}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| D:        | $\text{O}_3$ , $\text{H}_2\text{O}/\text{Zn}$ and $\text{KMnO}_4/\text{H}^+$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

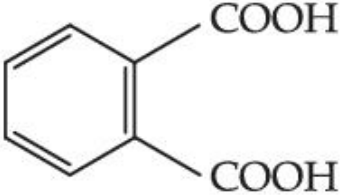
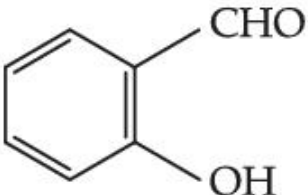
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| Topic:         | Chemistry-Section A                                                                                                                                                                                                                         |
| Item No:       | 74                                                                                                                                                                                                                                          |
| Question ID:   | 100074                                                                                                                                                                                                                                      |
| Question Type: | MCQ                                                                                                                                                                                                                                         |
| Question:      | <p>Most stable product of the following reaction is :</p> <div style="text-align: center;"> <p>(i) <math>\text{H}_3\text{C}-\text{C}_6\text{H}_4-\text{SO}_2\text{Cl}</math>, Pyridine</p> <p>(ii) <math>\text{NaCN}</math>, DMF</p> </div> |
| A:             |                                                                                                                                                                                                                                             |

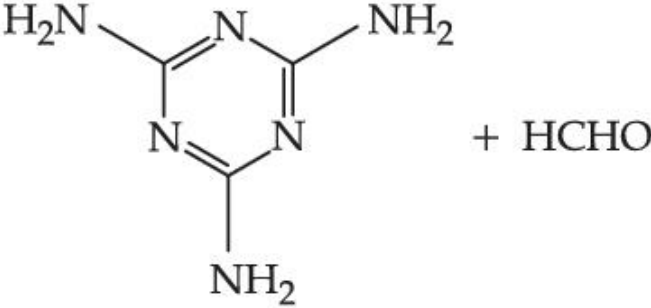
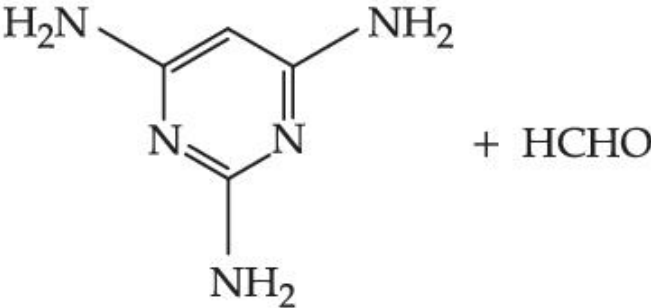
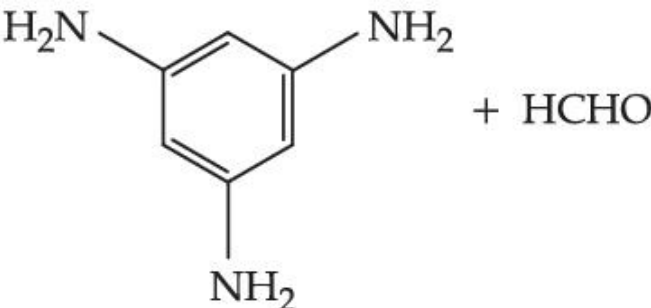
|    |  |
|----|--|
| B: |  |
| C: |  |
| D: |  |

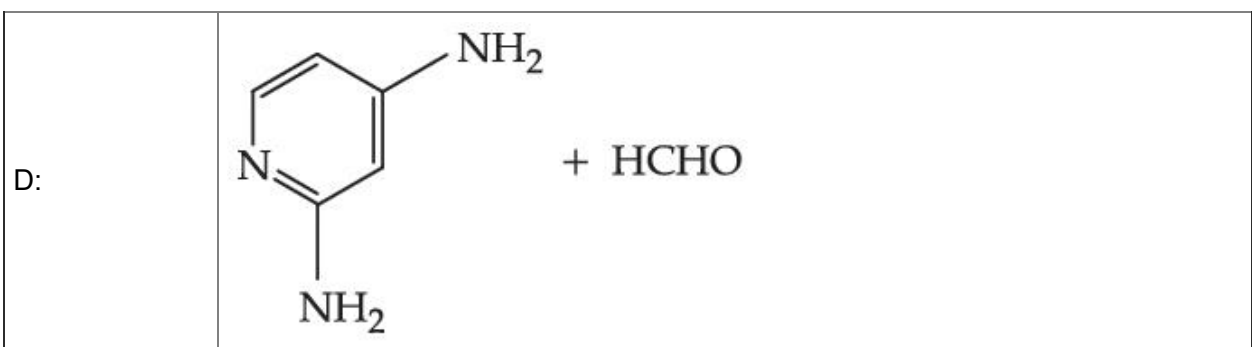
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| Topic:         | Chemistry-Section A                                                                                                                      |
| Item No:       | 75                                                                                                                                       |
| Question ID:   | <b>100075</b>                                                                                                                            |
| Question Type: | MCQ                                                                                                                                      |
| Question:      | Which one of the following reactions does <b>not</b> represent correct combination of substrate and product under the given conditions ? |
| A:             |                                                                                                                                          |

|    |                                                                                     |
|----|-------------------------------------------------------------------------------------|
| B: |   |
| C: |   |
| D: |  |

|                |                                                                                                                                                                                                                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Topic:         | Chemistry-Section A                                                                                                                                                                                                                                                                                                             |
| Item No:       | 76                                                                                                                                                                                                                                                                                                                              |
| Question ID:   | <b>100076</b>                                                                                                                                                                                                                                                                                                                   |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                                             |
| Question:      | An organic compound 'A' on reaction with $\text{NH}_3$ followed by heating gives compound B. Which on further strong heating gives compound C ( $\text{C}_8\text{H}_5\text{NO}_2$ ). Compound C on sequential reaction with ethanolic KOH, alkyl chloride and hydrolysis with alkali gives a primary amine. The compound A is : |
| A:             |                                                                                                                                                                                                                                              |
| B:             |                                                                                                                                                                                                                                              |

|    |                                                                                   |
|----|-----------------------------------------------------------------------------------|
| C: |  |
| D: |  |

|                |                                                                                     |
|----------------|-------------------------------------------------------------------------------------|
| Topic:         | Chemistry-Section A                                                                 |
| Item No:       | 77                                                                                  |
| Question ID:   | 100077                                                                              |
| Question Type: | MCQ                                                                                 |
| Question:      | Melamine polymer is formed by the condensation of :                                 |
| A:             |   |
| B:             |  |
| C:             |  |



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|----------------|-------------------------------------------------------------------------------------|
| Topic:         | Chemistry-Section A                                                                 |
| Item No:       | 78                                                                                  |
| Question ID:   | <b>100078</b>                                                                       |
| Question Type: | MCQ                                                                                 |
| Question:      | During the denaturation of proteins, which of these structures will remain intact ? |
| A:             | Primary                                                                             |
| B:             | Secondary                                                                           |
| C:             | Tertiary                                                                            |
| D:             | Quaternary                                                                          |

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| Topic:         | Chemistry-Section A                                                                                  |
| Item No:       | 79                                                                                                   |
| Question ID:   | <b>100079</b>                                                                                        |
| Question Type: | MCQ                                                                                                  |
| Question:      | Drugs used to bind to receptors, inhibiting its natural function and blocking a message are called : |
| A:             | Agonists                                                                                             |
| B:             | Antagonists                                                                                          |
| C:             | Allosterists                                                                                         |
| D:             | Anti histaminists                                                                                    |

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| Topic:   | Chemistry-Section A |
| Item No: | 80                  |

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| Question ID:   | <b>100080</b>                                                                                                                                                                                                                                                                                               |
| Question Type: | MCQ                                                                                                                                                                                                                                                                                                         |
| Question:      | <p>Given below are two statements :</p> <p><b>Statement I :</b> On heating with <math>\text{KHSO}_4</math>, glycerol is dehydrated and acrolein is formed.</p> <p><b>Statement II :</b> Acrolein has fruity odour and can be used to test glycerol's presence.</p> <p>Choose the <b>correct</b> option.</p> |
| A:             | Both <b>Statement I</b> and <b>Statement II</b> are correct.                                                                                                                                                                                                                                                |
| B:             | Both <b>Statement I</b> and <b>Statement II</b> are incorrect.                                                                                                                                                                                                                                              |
| C:             | <b>Statement I</b> is correct but <b>Statement II</b> is incorrect.                                                                                                                                                                                                                                         |
| D:             | <b>Statement I</b> is incorrect but <b>Statement II</b> is correct.                                                                                                                                                                                                                                         |

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| Topic:         | Chemistry-Section B                                                                                                                                                                                                                                                                                                             |
| Item No:       | 81                                                                                                                                                                                                                                                                                                                              |
| Question ID:   | <b>100081</b>                                                                                                                                                                                                                                                                                                                   |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                  |
| Question:      | <p>Among the following species</p> <p><math>\text{N}_2</math>, <math>\text{N}_2^+</math>, <math>\text{N}_2^-</math>, <math>\text{N}_2^{2-}</math>, <math>\text{O}_2</math>, <math>\text{O}_2^+</math>, <math>\text{O}_2^-</math>, <math>\text{O}_2^{2-}</math></p> <p>the number of species showing diamagnetism is _____ .</p> |

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| Topic:         | Chemistry-Section B                                                                                                                                                                                                                                                                                                                                                              |
| Item No:       | 82                                                                                                                                                                                                                                                                                                                                                                               |
| Question ID:   | <b>100082</b>                                                                                                                                                                                                                                                                                                                                                                    |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                                                                   |
| Question:      | <p>The enthalpy of combustion of propane, graphite and dihydrogen at 298 K are <math>-2220.0 \text{ kJ mol}^{-1}</math>, <math>-393.5 \text{ kJ mol}^{-1}</math> and <math>-285.8 \text{ kJ mol}^{-1}</math> respectively. The magnitude of enthalpy of formation of propane (<math>\text{C}_3\text{H}_8</math>) is _____ <math>\text{kJ mol}^{-1}</math>. (Nearest integer)</p> |

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| Topic:       | Chemistry-Section B |
| Item No:     | 83                  |
| Question ID: | <b>100083</b>       |

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| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                       |
| Question:      | <p>The pressure of a moist gas at 27°C is 4 atm. The volume of the container is doubled at the same temperature. The new pressure of the moist gas is _____ <math>\times 10^{-1}</math> atm. (Nearest integer)</p> <p>(Given : The vapour pressure of water at 27°C is 0.4 atm.)</p> |

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| Topic:         | Chemistry-Section B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Item No:       | 84                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Question ID:   | <b>100084</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Question:      | <p>The cell potential for <math>\text{Zn} \text{Zn}^{2+}(\text{aq})  \text{Sn}^{x+} \text{Sn}</math> is 0.801 V at 298 K. The reaction quotient for the above reaction is <math>10^{-2}</math>. The number of electrons involved in the given electrochemical cell reaction is _____.</p> <p>(Given : <math>E^\circ_{\text{Zn}^{2+} \text{Zn}} = -0.763 \text{ V}</math>, <math>E^\circ_{\text{Sn}^{x+} \text{Sn}} = +0.008 \text{ V}</math> and <math>\frac{2.303RT}{F} = 0.06 \text{ V}</math>)</p> |

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| Topic:         | Chemistry-Section B                                                                                                                                                                                                                                      |
| Item No:       | 85                                                                                                                                                                                                                                                       |
| Question ID:   | <b>100085</b>                                                                                                                                                                                                                                            |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                           |
| Question:      | <p>The half life for the decomposition of gaseous compound A is 240 s when the gaseous pressure was 500 Torr initially. When the pressure was 250 Torr, the half life was found to be 4.0 min. The order of the reaction is _____. (Nearest integer)</p> |

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| Topic:         | Chemistry-Section B |
| Item No:       | 86                  |
| Question ID:   | <b>100086</b>       |
| Question Type: | Numeric Answer      |

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| Question: | <p>Consider the following metal complexes :</p> <p><math>[\text{Co}(\text{NH}_3)_6]^{3+}</math></p> <p><math>[\text{CoCl}(\text{NH}_3)_5]^{2+}</math></p> <p><math>[\text{Co}(\text{CN})_6]^{3-}</math></p> <p><math>[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{3+}</math></p> <p>The spin-only magnetic moment value of the complex that absorbes light with shortest wavelength is _____ B.M. (Nearest integer)</p> |
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| Topic:         | Chemistry-Section B                                                                                                                                                                                                                                                                                                        |
| Item No:       | 87                                                                                                                                                                                                                                                                                                                         |
| Question ID:   | <b>100087</b>                                                                                                                                                                                                                                                                                                              |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                                                                             |
| Question:      | <p>Among <math>\text{Co}^{3+}</math>, <math>\text{Ti}^{2+}</math>, <math>\text{V}^{2+}</math> and <math>\text{Cr}^{2+}</math> ions, one if used as a reagent cannot liberate <math>\text{H}_2</math> from dilute mineral acid solution, its spin-only magnetic moment in gaseous state is _____ B.M. (Nearest integer)</p> |

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| Topic:         | Chemistry-Section B                                                                                                                                                                                                                                                      |
| Item No:       | 88                                                                                                                                                                                                                                                                       |
| Question ID:   | <b>100088</b>                                                                                                                                                                                                                                                            |
| Question Type: | Numeric Answer                                                                                                                                                                                                                                                           |
| Question:      | <p>While estimating the nitrogen present in an organic compound by Kjeldahl's method, the ammonia evolved from 0.25 g of the compound neutralized 2.5 mL of 2 M <math>\text{H}_2\text{SO}_4</math>. The percentage of nitrogen present in organic compound is _____.</p> |

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| Topic:         | Chemistry-Section B                                                                                                                                                        |
| Item No:       | 89                                                                                                                                                                         |
| Question ID:   | <b>100089</b>                                                                                                                                                              |
| Question Type: | Numeric Answer                                                                                                                                                             |
| Question:      | <p>The number of <math>\text{sp}^3</math> hybridised carbons in an acyclic neutral compound with molecular formula <math>\text{C}_4\text{H}_5\text{N}</math> is _____.</p> |

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| Topic:   | Chemistry-Section B |
| Item No: | 90                  |

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| Question ID:   | 100090                                                                                                                                                  |
| Question Type: | Numeric Answer                                                                                                                                          |
| Question:      | <p>In the given reaction</p> <p>(Where Et is <math>-\text{C}_2\text{H}_5</math>)</p> <p>The number of chiral carbon/s in product <b>A</b> is _____.</p> |