

Test Date	04/04/2024
Test Time	9:00 AM - 12:00 PM
Subject	B. Tech

## Section : Mathematics Section A

**Q.1** Let  $\alpha$  and  $\beta$  be the sum and the product of all the non-zero solutions of the equation  $(\bar{z})^2 + |z| = 0$ ,  $z \in \mathbb{C}$ . Then  $4(\alpha^2 + \beta^2)$  is equal to :

- Options**
- 6
  - 2
  - 4
  - 8

Question Type : MCQ

Question ID : 87827055429  
 Option 1 ID : 878270218247  
 Option 2 ID : 878270218245  
 Option 3 ID : 878270218246  
 Option 4 ID : 878270218248

**Q.2** Let a unit vector which makes an angle of  $60^\circ$  with  $2\hat{i} + 2\hat{j} - \hat{k}$  and an angle of  $45^\circ$  with  $\hat{i} - \hat{k}$  be  $\vec{C}$ . Then  $\vec{C} + \left(-\frac{1}{2}\hat{i} + \frac{1}{3\sqrt{2}}\hat{j} - \frac{\sqrt{2}}{3}\hat{k}\right)$  is :

- Options**
- $\left(\frac{1}{\sqrt{3}} + \frac{1}{2}\right)\hat{i} + \left(\frac{1}{\sqrt{3}} - \frac{1}{3\sqrt{2}}\right)\hat{j} + \left(\frac{1}{\sqrt{3}} + \frac{\sqrt{2}}{3}\right)\hat{k}$
  - $\frac{\sqrt{2}}{3}\hat{i} - \frac{1}{2}\hat{k}$
  - $\frac{\sqrt{2}}{3}\hat{i} + \frac{1}{3\sqrt{2}}\hat{j} - \frac{1}{2}\hat{k}$
  - $-\frac{\sqrt{2}}{3}\hat{i} + \frac{\sqrt{2}}{3}\hat{j} + \left(\frac{1}{2} + \frac{2\sqrt{2}}{3}\right)\hat{k}$

Question Type : MCQ

Question ID : 87827055445  
 Option 1 ID : 878270218309  
 Option 2 ID : 878270218311  
 Option 3 ID : 878270218312  
 Option 4 ID : 878270218310

**Q.3** The vertices of a triangle are  $A(-1, 3)$ ,  $B(-2, 2)$  and  $C(3, -1)$ . A new triangle is formed by shifting the sides of the triangle by one unit inwards. Then the equation of the side of the new triangle nearest to origin is :

**Options**

1.  $-x + y - (2 - \sqrt{2}) = 0$
2.  $x - y - (2 + \sqrt{2}) = 0$
3.  $x + y - (2 - \sqrt{2}) = 0$
4.  $x + y + (2 - \sqrt{2}) = 0$

Question Type : **MCQ**

Question ID : **87827055443**

Option 1 ID : **878270218304**

Option 2 ID : **878270218303**

Option 3 ID : **878270218301**

Option 4 ID : **878270218302**

**Q.4** Let  $\alpha, \beta \in \mathbf{R}$ . Let the mean and the variance of 6 observations  $-3, 4, 7, -6, \alpha, \beta$  be 2 and 23, respectively. The mean deviation about the mean of these 6 observations is :

**Options**

1.  $\frac{14}{3}$
2.  $\frac{16}{3}$
3.  $\frac{11}{3}$
4.  $\frac{13}{3}$

Question Type : **MCQ**

Question ID : **87827055447**

Option 1 ID : **878270218319**

Option 2 ID : **878270218318**

Option 3 ID : **878270218317**

Option 4 ID : **878270218320**

**Q.5** Let the point, on the line passing through the points P(1, -2, 3) and Q (5, -4, 7), farther from the origin and at a distance of 9 units from the point P, be  $(\alpha, \beta, \gamma)$ . Then  $\alpha^2 + \beta^2 + \gamma^2$  is equal to :

- Options**
1. 155
  2. 160
  3. 150
  4. 165

Question Type : **MCQ**

Question ID : **87827055444**

Option 1 ID : **878270218308**

Option 2 ID : **878270218307**

Option 3 ID : **878270218305**

Option 4 ID : **878270218306**

**Q.6** One of the points of intersection of the curves  $y = 1 + 3x - 2x^2$  and  $y = \frac{1}{x}$  is  $(\frac{1}{2}, 2)$ . Let the area of the region enclosed by these curves be  $\frac{1}{24}(l\sqrt{5} + m) - n \log_e(1 + \sqrt{5})$ , where  $l, m, n \in \mathbf{N}$ . Then  $l + m + n$  is equal to

- Options**
1. 31
  2. 29
  3. 30
  4. 32

Question Type : **MCQ**

Question ID : **87827055440**

Option 1 ID : **878270218291**

Option 2 ID : **878270218290**

Option 3 ID : **878270218289**

Option 4 ID : **878270218292**

**Q.7** Let  $f(x) = \begin{cases} -2, & -2 \leq x \leq 0 \\ x - 2, & 0 < x \leq 2 \end{cases}$  and  $h(x) = f(|x|) + |f(x)|$ . Then  $\int_{-2}^2 h(x) dx$  is equal to :

**Options**

1. 2
2. 4
3. 6
4. 1

Question Type : **MCQ**

Question ID : **87827055437**

Option 1 ID : **878270218278**

Option 2 ID : **878270218279**

Option 3 ID : **878270218280**

Option 4 ID : **878270218277**

**Q.8** Three urns A, B and C contain 7 red, 5 black; 5 red, 7 black and 6 red, 6 black balls, respectively. One of the urn is selected at random and a ball is drawn from it. If the ball drawn is black, then the probability that it is drawn from urn A is :

**Options**

1.  $\frac{5}{16}$
2.  $\frac{5}{18}$
3.  $\frac{4}{17}$
4.  $\frac{7}{18}$

Question Type : **MCQ**

Question ID : **87827055446**

Option 1 ID : **878270218313**

Option 2 ID : **878270218315**

Option 3 ID : **878270218314**

Option 4 ID : **878270218316**

**Q.9** If the solution  $y = y(x)$  of the differential equation  $(x^4 + 2x^3 + 3x^2 + 2x + 2)dy - (2x^2 + 2x + 3)dx = 0$  satisfies  $y(-1) = -\frac{\pi}{4}$ , then  $y(0)$  is equal to :

Options

1.  $\frac{\pi}{4}$
2.  $\frac{\pi}{2}$
3.  $-\frac{\pi}{12}$
4. 0

Question Type : MCQ

Question ID : 87827055441

Option 1 ID : 878270218293

Option 2 ID : 878270218294

Option 3 ID : 878270218296

Option 4 ID : 878270218295

**Q.10** A square is inscribed in the circle  $x^2 + y^2 - 10x - 6y + 30 = 0$ . One side of this square is parallel to  $y = x + 3$ . If  $(x_i, y_i)$  are the vertices of the square, then  $\sum(x_i^2 + y_i^2)$  is equal to :

Options

1. 148
2. 152
3. 160
4. 156

Question Type : MCQ

Question ID : 87827055442

Option 1 ID : 878270218297

Option 2 ID : 878270218298

Option 3 ID : 878270218300

Option 4 ID : 878270218299

**Q.11**

Let  $\alpha \in (0, \infty)$  and  $A = \begin{bmatrix} 1 & 2 & \alpha \\ 1 & 0 & 1 \\ 0 & 1 & 2 \end{bmatrix}$ . If  $\det(\text{adj}(2A - A^T) \cdot \text{adj}(A - 2A^T)) = 2^8$ , then  $(\det(A))^2$  is equal

to :

**Options**

1. 36
2. 16
3. 49
4. 1

Question Type : MCQ

Question ID : 87827055432

Option 1 ID : 878270218259

Option 2 ID : 878270218258

Option 3 ID : 878270218260

Option 4 ID : 878270218257

**Q.12**

Let  $f: \mathbf{R} \rightarrow \mathbf{R}$  be a function given by

$$f(x) = \begin{cases} \frac{1 - \cos 2x}{x^2}, & x < 0 \\ \alpha, & x = 0, \\ \frac{\beta \sqrt{1 - \cos x}}{x}, & x > 0 \end{cases}$$

where  $\alpha, \beta \in \mathbf{R}$ . If  $f$  is continuous at  $x=0$ , then  $\alpha^2 + \beta^2$  is equal to :

**Options**

1. 12
2. 6
3. 3
4. 48

Question Type : MCQ

Question ID : 87827055433

Option 1 ID : 878270218263

Option 2 ID : 878270218262

Option 3 ID : 878270218261

Option 4 ID : 878270218264

Q.13

If the system of equations

$$x + (\sqrt{2} \sin \alpha)y + (\sqrt{2} \cos \alpha)z = 0$$

$$x + (\cos \alpha)y + (\sin \alpha)z = 0$$

$$x + (\sin \alpha)y - (\cos \alpha)z = 0$$

has a non-trivial solution, then  $\alpha \in \left(0, \frac{\pi}{2}\right)$  is equal to :

Options

1.  $\frac{3\pi}{4}$

2.  $\frac{11\pi}{24}$

3.  $\frac{7\pi}{24}$

4.  $\frac{5\pi}{24}$

Question Type : MCQ

Question ID : 87827055431

Option 1 ID : 878270218253

Option 2 ID : 878270218256

Option 3 ID : 878270218254

Option 4 ID : 878270218255

Q.14

Let the sum of the maximum and the minimum values of the function  $f(x) = \frac{2x^2 - 3x + 8}{2x^2 + 3x + 8}$  be  $\frac{m}{n}$ ,

where  $\gcd(m, n) = 1$ . Then  $m + n$  is equal to :

Options

1. 182

2. 217

3. 201

4. 195

Question Type : MCQ

Question ID : 87827055439

Option 1 ID : 878270218285

Option 2 ID : 878270218288

Option 3 ID : 878270218287

Option 4 ID : 878270218286

**Q.15** Let the first three terms 2, p and q, with  $q \neq 2$ , of a G.P. be respectively the 7<sup>th</sup>, 8<sup>th</sup> and 13<sup>th</sup> terms of an A.P. If the 5<sup>th</sup> term of the G.P. is the n<sup>th</sup> term of the A.P., then n is equal to :

**Options**

1. 177
2. 169
3. 163
4. 151

Question Type : **MCQ**

Question ID : **87827055436**

Option 1 ID : **878270218276**

Option 2 ID : **878270218275**

Option 3 ID : **878270218274**

Option 4 ID : **878270218273**

**Q.16** There are 5 points  $P_1, P_2, P_3, P_4, P_5$  on the side AB, excluding A and B, of a triangle ABC. Similarly there are 6 points  $P_6, P_7, \dots, P_{11}$  on the side BC and 7 points  $P_{12}, P_{13}, \dots, P_{18}$  on the side CA of the triangle. The number of triangles, that can be formed using the points  $P_1, P_2, \dots, P_{18}$  as vertices, is :

**Options**

1. 776
2. 771
3. 796
4. 751

Question Type : **MCQ**

Question ID : **87827055434**

Option 1 ID : **878270218266**

Option 2 ID : **878270218265**

Option 3 ID : **878270218267**

Option 4 ID : **878270218268**



**Q.17**

If the domain of the function  $\sin^{-1}\left(\frac{3x-22}{2x-19}\right) + \log_e\left(\frac{3x^2-8x+5}{x^2-3x-10}\right)$  is  $(\alpha, \beta]$ , then  $3\alpha + 10\beta$  is equal

to :

**Options**

1. 100
2. 98
3. 97
4. 95

Question Type : **MCQ**

Question ID : **87827055428**

Option 1 ID : **878270218244**

Option 2 ID : **878270218243**

Option 3 ID : **878270218242**

Option 4 ID : **878270218241**

**Q.18**

The sum of all rational terms in the expansion of  $\left(2^{\frac{1}{5}} + 5^{\frac{1}{3}}\right)^{15}$  is equal to :

**Options**

1. 633
2. 3133
3. 931
4. 6131

Question Type : **MCQ**

Question ID : **87827055435**

Option 1 ID : **878270218271**

Option 2 ID : **878270218270**

Option 3 ID : **878270218269**

Option 4 ID : **878270218272**

**Q.19** Let  $f(x) = x^5 + 2e^{x/4}$  for all  $x \in \mathbf{R}$ . Consider a function  $g(x)$  such that  $(g \circ f)(x) = x$  for all  $x \in \mathbf{R}$ . Then the value of  $8g'(2)$  is :

- Options**
1. 8
  2. 4
  3. 16
  4. 2

Question Type : MCQ

Question ID : 87827055438  
Option 1 ID : 878270218283  
Option 2 ID : 878270218282  
Option 3 ID : 878270218284  
Option 4 ID : 878270218281

**Q.20** If 2 and 6 are the roots of the equation  $ax^2 + bx + 1 = 0$ , then the quadratic equation, whose roots are  $\frac{1}{2a+b}$  and  $\frac{1}{6a+b}$ , is :

- Options**
1.  $x^2 + 8x + 12 = 0$
  2.  $x^2 + 10x + 16 = 0$
  3.  $4x^2 + 14x + 12 = 0$
  4.  $2x^2 + 11x + 12 = 0$

Question Type : MCQ

Question ID : 87827055430  
Option 1 ID : 878270218249  
Option 2 ID : 878270218252  
Option 3 ID : 878270218250  
Option 4 ID : 878270218251

**Section : Mathematics Section B**

**Q.21** Let ABC be a triangle of area  $15\sqrt{2}$  and the vectors  $\vec{AB} = \hat{i} + 2\hat{j} - 7\hat{k}$ ,  $\vec{BC} = a\hat{i} + b\hat{j} + c\hat{k}$  and  $\vec{AC} = 6\hat{i} + d\hat{j} - 2\hat{k}$ ,  $d > 0$ . Then the square of the length of the largest side of the triangle ABC is \_\_\_\_\_.

Question Type : SA

Question ID : 87827055457

**Q.22** If  $\lim_{x \rightarrow 1} \frac{(5x+1)^{1/3} - (x+5)^{1/3}}{(2x+3)^{1/2} - (x+4)^{1/2}} = \frac{m\sqrt{5}}{n(2n)^{2/3}}$ , where  $\gcd(m, n) = 1$ , then  $8m + 12n$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055451

**Q.23** If the shortest distance between the lines  $\frac{x+2}{2} = \frac{y+3}{3} = \frac{z-5}{4}$  and  $\frac{x-3}{1} = \frac{y-2}{-3} = \frac{z+4}{2}$

is  $\frac{38}{3\sqrt{5}}$  k, and  $\int_0^k [x^2] dx = \alpha - \sqrt{\alpha}$ , where  $[x]$  denotes the greatest integer function, then  $6\alpha^3$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055456

**Q.24** Let A be a  $3 \times 3$  matrix of non-negative real elements such that  $A \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix} = 3 \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$ .

Then the maximum value of  $\det(A)$  is \_\_\_\_\_.

Question Type : SA

Question ID : 87827055449

**Q.25** In a survey of 220 students of a higher secondary school, it was found that at least 125 and at most 130 students studied Mathematics; at least 85 and at most 95 studied Physics; at least 75 and at most 90 studied Chemistry; 30 studied both Physics and Chemistry; 50 studied both Chemistry and Mathematics; 40 studied both Mathematics and Physics and 10 studied none of these subjects. Let m and n respectively be the least and the most number of students who studied all the three subjects. Then  $m+n$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055448

**Q.26** Let A be a square matrix of order 2 such that  $|A|=2$  and the sum of its diagonal elements is  $-3$ . If the points  $(x, y)$  satisfying  $A^2 + xA + yI = O$  lie on a hyperbola, whose transverse axis is parallel to the x-axis, eccentricity is e and the length of the latus rectum is l, then  $e^4 + l^4$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055454

**Q.27** Let the solution  $y=y(x)$  of the differential equation  $\frac{dy}{dx} - y = 1 + 4\sin x$  satisfy  $y(\pi)=1$ . Then

$y\left(\frac{\pi}{2}\right) + 10$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055453

**Q.28** If  $\int_0^{\frac{\pi}{4}} \frac{\sin^2 x}{1 + \sin x \cos x} dx = \frac{1}{a} \log_e \left(\frac{a}{3}\right) + \frac{\pi}{b\sqrt{3}}$ , where  $a, b \in \mathbb{N}$ , then  $a+b$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055452

Q.29

$$\text{Let } a = 1 + \frac{{}^2C_2}{3!} + \frac{{}^3C_2}{4!} + \frac{{}^4C_2}{5!} + \dots,$$

$$b = 1 + \frac{{}^1C_0 + {}^1C_1}{1!} + \frac{{}^2C_0 + {}^2C_1 + {}^2C_2}{2!} + \frac{{}^3C_0 + {}^3C_1 + {}^3C_2 + {}^3C_3}{3!} + \dots$$

Then  $\frac{2b}{a^2}$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055450

Q.30 Let the length of the focal chord PQ of the parabola  $y^2 = 12x$  be 15 units. If the distance of PQ from the origin is p, then  $10p^2$  is equal to \_\_\_\_\_.

Question Type : SA

Question ID : 87827055455

Section : Physics Section A

Q.31 The electric field in an electromagnetic wave is given by  $\vec{E} = \hat{i} 40 \cos\omega(t - z/c) \text{ NC}^{-1}$ . The magnetic field induction of this wave is (in SI unit) :

Options

1.  $\vec{B} = \hat{j} \frac{40}{c} \cos\omega(t - z/c)$

2.  $\vec{B} = \hat{i} \frac{40}{c} \cos\omega(t - z/c)$

3.  $\vec{B} = \hat{k} \frac{40}{c} \cos\omega(t - z/c)$

4.  $\vec{B} = \hat{j} 40 \cos\omega(t - z/c)$

Question Type : MCQ

Question ID : 87827055471

Option 1 ID : 878270218385

Option 2 ID : 878270218386

Option 3 ID : 878270218384

Option 4 ID : 878270218383

**Q.32** To measure the internal resistance of a battery, potentiometer is used. For  $R=10\ \Omega$ , the balance point is observed at  $l=500\text{ cm}$  and for  $R=1\ \Omega$  the balance point is observed at  $l=400\text{ cm}$ . The internal resistance of the battery is approximately :

Options

1.  $0.4\ \Omega$
2.  $0.3\ \Omega$
3.  $0.2\ \Omega$
4.  $0.1\ \Omega$

Question Type : **MCQ**

Question ID : **87827055477**

Option 1 ID : **878270218410**

Option 2 ID : **878270218409**

Option 3 ID : **878270218408**

Option 4 ID : **878270218407**

**Q.33** In an ac circuit, the instantaneous current is zero, when the instantaneous voltage is maximum. In this case, the source may be connected to :

- A. pure inductor.
- B. pure capacitor.
- C. pure resistor.
- D. combination of an inductor and capacitor.

Choose the **correct** answer from the options given below :

Options

1. B, C and D only
2. A and B only
3. A, B and D only
4. A, B and C only

Question Type : **MCQ**

Question ID : **87827055470**

Option 1 ID : **878270218380**

Option 2 ID : **878270218382**

Option 3 ID : **878270218381**

Option 4 ID : **878270218379**

**Q.34** An effective power of a combination of 5 identical convex lenses which are kept in contact along the principal axis is 25 D. Focal length of each of the convex lens is :

Options

1. 25 cm
2. 20 cm
3. 500 cm
4. 50 cm

Question Type : MCQ

Question ID : 87827055472

Option 1 ID : 878270218390

Option 2 ID : 878270218387

Option 3 ID : 878270218389

Option 4 ID : 878270218388

**Q.35** In an experiment to measure focal length ( $f$ ) of convex lens, the least counts of the measuring scales for the position of object ( $u$ ) and for the position of image ( $v$ ) are  $\Delta u$  and  $\Delta v$ , respectively. The error in the measurement of the focal length of the convex lens will be :

Options

1.  $f \left[ \frac{\Delta u}{u} + \frac{\Delta v}{v} \right]$
2.  $2f \left[ \frac{\Delta u}{u} + \frac{\Delta v}{v} \right]$
3.  $f^2 \left[ \frac{\Delta u}{u^2} + \frac{\Delta v}{v^2} \right]$
4.  $\frac{\Delta u}{u} + \frac{\Delta v}{v}$

Question Type : MCQ

Question ID : 87827055476

Option 1 ID : 878270218403

Option 2 ID : 878270218404

Option 3 ID : 878270218406

Option 4 ID : 878270218405

**Q.36** On celcius scale the temperature of body increases by 40°C. The increase in temperature on Fahrenheit scale is :

**Options**

1. 68°F
2. 72°F
3. 75°F
4. 70°F

Question Type : MCQ

Question ID : 87827055465

Option 1 ID : 878270218362

Option 2 ID : 878270218359

Option 3 ID : 878270218361

Option 4 ID : 878270218360

**Q.37** Which of the following nuclear fragments corresponding to nuclear fission between neutron ( ${}^1_0\text{n}$ ) and uranium isotope ( ${}^{235}_{92}\text{U}$ ) is correct :

**Options**

1.  ${}^{153}_{51}\text{Sb} + {}^{99}_{41}\text{Nb} + 3{}^1_0\text{n}$
2.  ${}^{144}_{56}\text{Ba} + {}^{89}_{36}\text{Kr} + 3{}^1_0\text{n}$
3.  ${}^{144}_{56}\text{Ba} + {}^{89}_{36}\text{Kr} + 4{}^1_0\text{n}$
4.  ${}^{140}_{56}\text{Xe} + {}^{94}_{38}\text{Sr} + 3{}^1_0\text{n}$

Question Type : MCQ

Question ID : 87827055474

Option 1 ID : 878270218395

Option 2 ID : 878270218396

Option 3 ID : 878270218398

Option 4 ID : 878270218397

Q.38

The equation of stationary wave is :

$$y = 2a \sin\left(\frac{2\pi nt}{\lambda}\right) \cos\left(\frac{2\pi x}{\lambda}\right).$$

Which of the following is NOT correct :

Options

1. The dimensions of  $nt$  is [L]
2. The dimensions of  $n/\lambda$  is [T]
3. The dimensions of  $x$  is [L]
4. The dimensions of  $n$  is  $[LT^{-1}]$

Question Type : MCQ

Question ID : 87827055458

Option 1 ID : 878270218331

Option 2 ID : 878270218334

Option 3 ID : 878270218332

Option 4 ID : 878270218333

Q.39

If a rubber ball falls from a height  $h$  and rebounds upto the height of  $h/2$ . The percentage loss of total energy of the initial system as well as velocity ball before it strikes the ground, respectively, are :

Options

1. 50%,  $\sqrt{\frac{gh}{2}}$
2. 50%,  $\sqrt{gh}$
3. 40%,  $\sqrt{2gh}$
4. 50%,  $\sqrt{2gh}$

Question Type : MCQ

Question ID : 87827055462

Option 1 ID : 878270218350

Option 2 ID : 878270218347

Option 3 ID : 878270218349

Option 4 ID : 878270218348



**Q.40** An electron is projected with uniform velocity along the axis inside a current carrying long solenoid.  
Then :

Options

1. the electron path will be circular about the axis.
2. the electron will continue to move with uniform velocity along the axis of the solenoid.
3. the electron will experience a force at  $45^\circ$  to the axis and execute a helical path.
4. the electron will be accelerated along the axis.

Question Type : **MCQ**

Question ID : **87827055469**

Option 1 ID : **878270218376**

Option 2 ID : **878270218378**

Option 3 ID : **878270218377**

Option 4 ID : **878270218375**

**Q.41** A body travels 102.5 m in  $n^{\text{th}}$  second and 115.0 m in  $(n+2)^{\text{th}}$  second. The acceleration is :

Options

1.  $12.5 \text{ m/s}^2$
2.  $9 \text{ m/s}^2$
3.  $5 \text{ m/s}^2$
4.  $6.25 \text{ m/s}^2$

Question Type : **MCQ**

Question ID : **87827055461**

Option 1 ID : **878270218345**

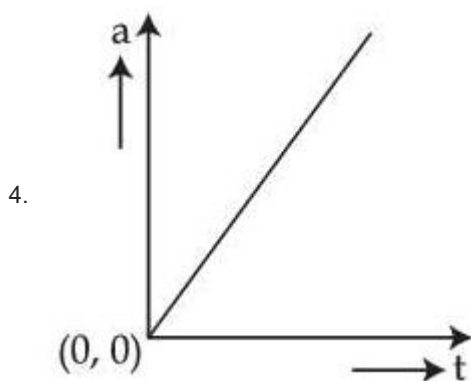
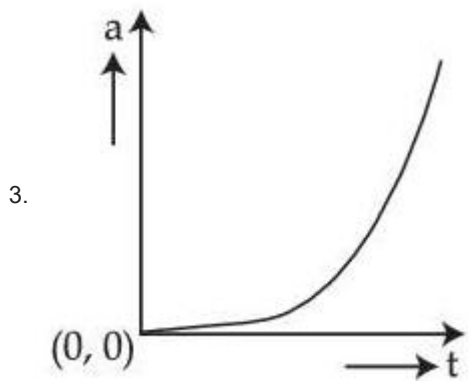
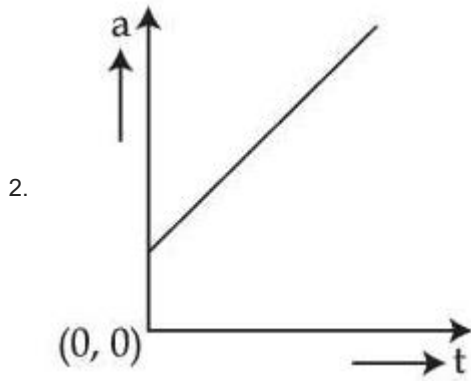
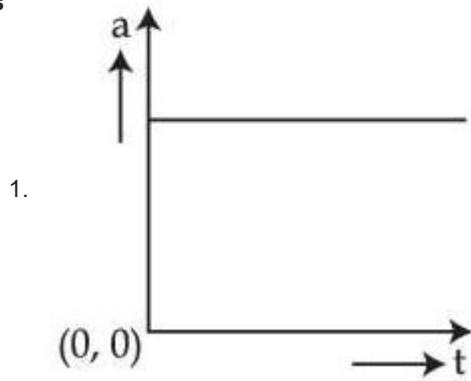
Option 2 ID : **878270218346**

Option 3 ID : **878270218343**

Option 4 ID : **878270218344**

**Q.42** A wooden block, initially at rest on the ground, is pushed by a force which increases linearly with time  $t$ . Which of the following curve best describes acceleration of the block with time :

**Options**



Question Type : **MCQ**

Question ID : **87827055460**

Option 1 ID : **878270218342**

Option 2 ID : **878270218341**

Option 3 ID : **878270218339**

Option 4 ID : **878270218340**

**Q.43** The co-ordinates of a particle moving in  $x$ - $y$  plane are given by :

$$x = 2 + 4t, \quad y = 3t + 8t^2.$$

The motion of the particle is :

**Options**

1. non-uniformly accelerated.
2. uniformly accelerated having motion along a parabolic path.
3. uniformly accelerated having motion along a straight line.
4. uniform motion along a straight line.

Question Type : **MCQ**

Question ID : **87827055459**

Option 1 ID : **878270218335**

Option 2 ID : **878270218337**

Option 3 ID : **878270218336**

Option 4 ID : **878270218338**

**Q.44** The resistances of the platinum wire of a platinum resistance thermometer at the ice point and steam point are  $8 \Omega$  and  $10 \Omega$  respectively. After inserting in a hot bath of temperature  $400^\circ\text{C}$ , the resistance of platinum wire is :

**Options**

1.  **$16 \Omega$**
2.  **$2 \Omega$**
3.  **$10 \Omega$**
4.  **$8 \Omega$**

Question Type : **MCQ**

Question ID : **87827055468**

Option 1 ID : **878270218373**

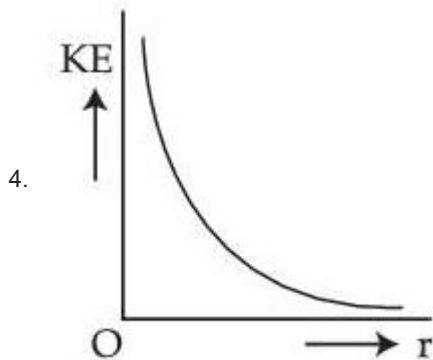
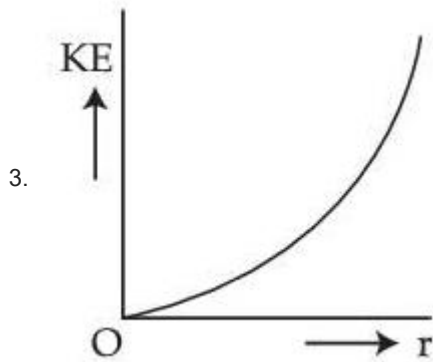
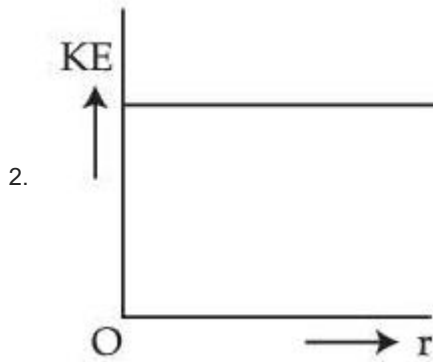
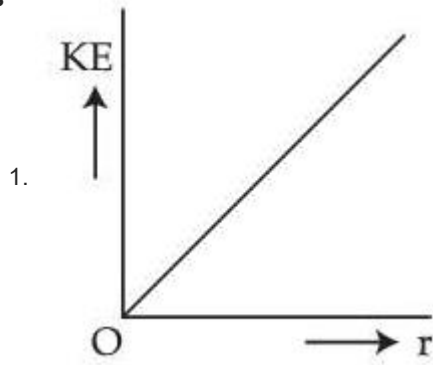
Option 2 ID : **878270218374**

Option 3 ID : **878270218372**

Option 4 ID : **878270218371**

**Q.45** An infinitely long positively charged straight thread has a linear charge density  $\lambda \text{ Cm}^{-1}$ . An electron revolves along a circular path having axis along the length of the wire. The graph that correctly represents the variation of the kinetic energy of electron as a function of radius of circular path from the wire is :

Options



Question Type : MCQ

Question ID : 87827055467

Option 1 ID : 878270218369

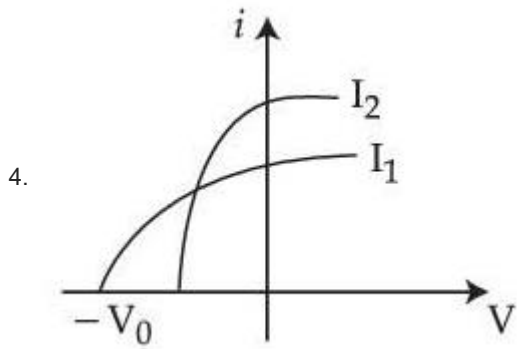
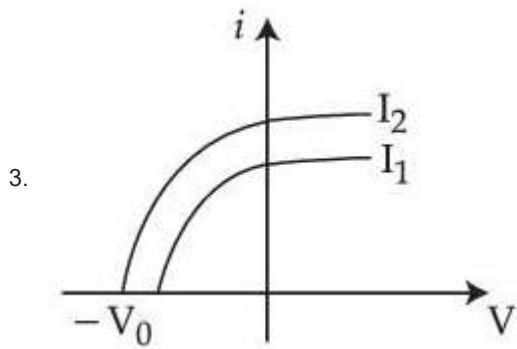
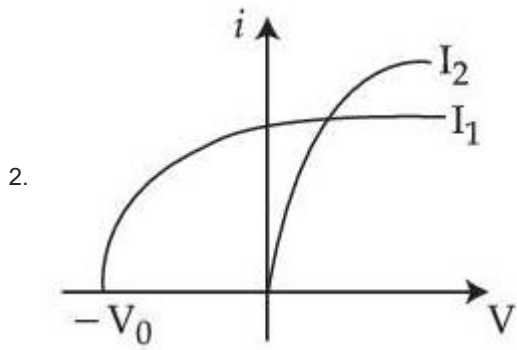
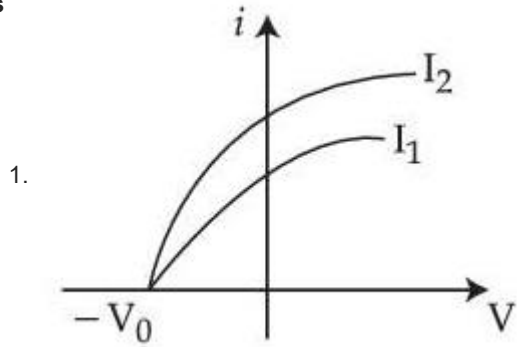
Option 2 ID : 878270218370

Option 3 ID : 878270218368

Option 4 ID : 878270218367

**Q.46** Which figure shows the correct variation of applied potential difference ( $V$ ) with photoelectric current ( $I$ ) at two different intensities of light ( $I_1 < I_2$ ) of same wavelengths :

Options



Question Type : **MCQ**

Question ID : **87827055473**

Option 1 ID : **878270218392**

Option 2 ID : **878270218393**

Option 3 ID : **878270218394**

Option 4 ID : **878270218391**

**Q.47** A metal wire of uniform mass density having length  $L$  and mass  $M$  is bent to form a semicircular arc and a particle of mass  $m$  is placed at the centre of the arc. The gravitational force on the particle by the wire is :

Options

1.  $\frac{2GmM\pi}{L^2}$
2. 0
3.  $\frac{GMm\pi}{2L^2}$
4.  $\frac{GmM\pi^2}{L^2}$

Question Type : MCQ

Question ID : 87827055463

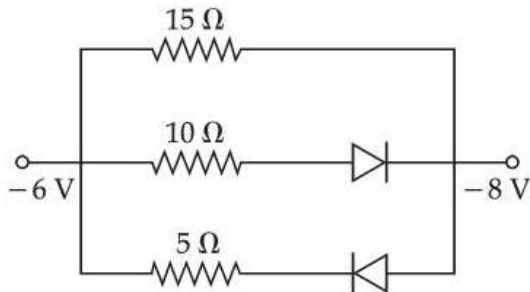
Option 1 ID : 878270218353

Option 2 ID : 878270218351

Option 3 ID : 878270218354

Option 4 ID : 878270218352

**Q.48** The value of net resistance of the network as shown in the given figure is :



Options

1.  $(5/2) \Omega$
2.  $(30/11) \Omega$
3.  $(15/4) \Omega$
4.  $6 \Omega$

Question Type : MCQ

Question ID : 87827055475

Option 1 ID : 878270218401

Option 2 ID : 878270218399

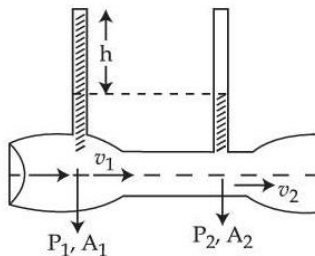
Option 3 ID : 878270218400

Option 4 ID : 878270218402

**Q.49** Given below are two statements :

**Statement I :** When speed of liquid is zero everywhere, pressure difference at any two points depends on equation  $P_1 - P_2 = \rho g(h_2 - h_1)$ .

**Statement II :** In ventury tube shown  $2gh = v_1^2 - v_2^2$



In the light of the above statements, choose the **most appropriate** answer from the options given below.

**Options**

1. Both **Statement I** and **Statement II** are correct.
2. **Statement I** is correct but **Statement II** is incorrect.
3. Both **Statement I** and **Statement II** are incorrect.
4. **Statement I** is incorrect but **Statement II** is correct.

Question Type : **MCQ**

Question ID : **87827055464**

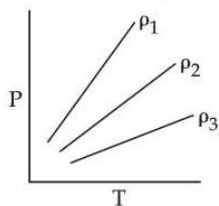
Option 1 ID : **878270218355**

Option 2 ID : **878270218357**

Option 3 ID : **878270218356**

Option 4 ID : **878270218358**

**Q.50** P-T diagram of an ideal gas having three different densities  $\rho_1, \rho_2, \rho_3$  (in three different cases) is shown in the figure. Which of the following is correct :



**Options**

1.  $\rho_2 < \rho_3$
2.  $\rho_1 = \rho_2 = \rho_3$
3.  $\rho_1 > \rho_2$
4.  $\rho_1 < \rho_2$

Question Type : **MCQ**

Question ID : **87827055466**

Option 1 ID : **878270218364**

Option 2 ID : **878270218365**

Option 3 ID : **878270218366**

Option 4 ID : **878270218363**

- Q.51** A hydrogen atom changes its state from  $n=3$  to  $n=2$ . Due to recoil, the percentage change in the wave length of emitted light is approximately  $1 \times 10^{-n}$ . The value of  $n$  is \_\_\_\_\_.  
 [Given  $Rhc=13.6$  eV,  $hc=1242$  eV nm,  $h=6.6 \times 10^{-34}$  J s mass of the hydrogenatom =  $1.6 \times 10^{-27}$  kg]

Question Type : SA  
 Question ID : 87827055487

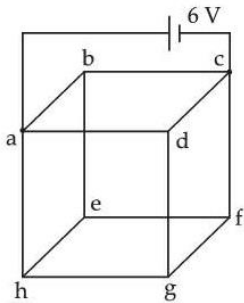
- Q.52** A solid sphere and a hollow cylinder roll up without slipping on same inclined plane with same initial speed  $v$ . The sphere and the cylinder reaches upto maximum heights  $h_1$  and  $h_2$ , respectively, above the initial level. The ratio  $h_1 : h_2$  is  $\frac{n}{10}$ . The value of  $n$  is \_\_\_\_\_.

Question Type : SA  
 Question ID : 87827055479

- Q.53** Two wavelengths  $\lambda_1$  and  $\lambda_2$  are used in Young's double slit experiment.  $\lambda_1=450$  nm and  $\lambda_2=650$  nm. The minimum order of fringe produced by  $\lambda_2$  which overlaps with the fringe produced by  $\lambda_1$  is  $n$ . The value of  $n$  is \_\_\_\_\_.

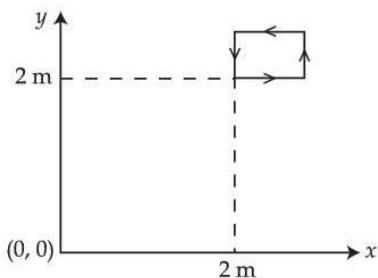
Question Type : SA  
 Question ID : 87827055486

- Q.54** Twelve wires each having resistance  $2 \Omega$  are joined to form a cube. A battery of 6 V emf is joined across point a and c. The voltage difference between e and f is \_\_\_\_\_ V.



Question Type : SA  
 Question ID : 87827055483

- Q.55** The magnetic field existing in a region is given by  $\vec{B} = 0.2(1 + 2x)\hat{k}$  T. A square loop of edge 50 cm carrying 0.5 A current is placed in  $x$ - $y$  plane with its edges parallel to the  $x$ - $y$  axes, as shown in figure. The magnitude of the net magnetic force experienced by the loop is \_\_\_\_\_ mN.



Question Type : SA  
 Question ID : 87827055484



**Q.56** An elastic spring under tension of 3 N has a length  $a$ . Its length is  $b$  under tension 2 N. For its length  $(3a - 2b)$ , the value of tension will be \_\_\_\_\_ N.

Question Type : SA  
Question ID : 87827055481

**Q.57** A alternating current at any instant is given by  $i = [6 + \sqrt{56} \sin(100\pi t + \pi/3)]$  A. The *rms* value of the current is \_\_\_\_\_ A.

Question Type : SA  
Question ID : 87827055485

**Q.58** A soap bubble is blown to a diameter of 7 cm. 36960 erg of work is done in blowing it further. If surface tension of soap solution is 40 dyne/cm then the new radius is \_\_\_\_\_ cm Take  $\left(\pi = \frac{22}{7}\right)$ .

Question Type : SA  
Question ID : 87827055480

**Q.59** Two forces  $\vec{F}_1$  and  $\vec{F}_2$  are acting on a body. One force has magnitude thrice that of the other force and the resultant of the two forces is equal to the force of larger magnitude. The angle between  $\vec{F}_1$  and  $\vec{F}_2$  is  $\cos^{-1}\left(\frac{1}{n}\right)$ . The value of  $|n|$  is \_\_\_\_\_.

Question Type : SA  
Question ID : 87827055478

**Q.60** An infinite plane sheet of charge having uniform surface charge density  $+\sigma_s$  C/m<sup>2</sup> is placed on  $x$ - $y$  plane. Another infinitely long line charge having uniform linear charge density  $+\lambda_e$  C/m is placed at  $z=4$  m plane and parallel to  $y$ -axis. If the magnitude values  $|\sigma_s| = 2 |\lambda_e|$  then at point  $(0, 0, 2)$ , the ratio of magnitudes of electric field values due to sheet charge to that of line charge is  $\pi\sqrt{n} : 1$ . The value of  $n$  is \_\_\_\_\_.

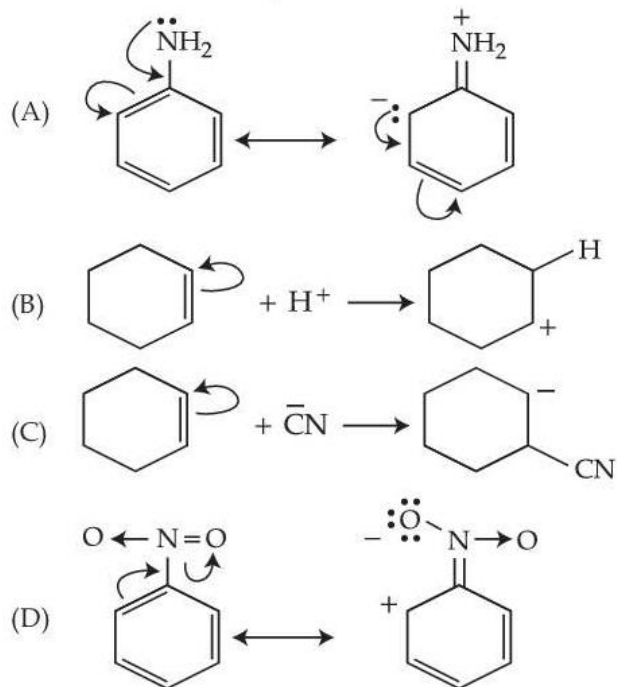
Question Type : SA  
Question ID : 87827055482

Q.61

Match List I with List II :

List - I

Mechanism steps



List - II

Effect

(I) - E effect

(II) - R effect

(III) + E effect

(IV) + R effect

Choose the **correct** answer from the options given below :

Options

- (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
- (A) - (II), (B) - (IV), (C) - (III), (D) - (I)
- (A) - (III), (B) - (I), (C) - (II), (D) - (IV)
- (A) - (IV), (B) - (III), (C) - (I), (D) - (II)

Question Type : MCQ

Question ID : 87827055501

Option 1 ID : 878270218475

Option 2 ID : 878270218476

Option 3 ID : 878270218474

Option 4 ID : 878270218473

**Q.62** The Molarity (M) of an aqueous solution containing 5.85 g of NaCl in 500 mL water is :  
(Given : Molar Mass Na : 23 and Cl : 35.5  $\text{gmol}^{-1}$ )

**Options**

1. 4
2. 0.2
3. 20
4. 2

Question Type : **MCQ**

Question ID : **87827055488**

Option 1 ID : **878270218421**

Option 2 ID : **878270218423**

Option 3 ID : **878270218422**

Option 4 ID : **878270218424**

**Q.63** Number of molecules/ions from the following in which the central atom is involved in  $\text{sp}^3$  hybridization is \_\_\_\_\_.

$\text{NO}_3^-$ ,  $\text{BCl}_3$ ,  $\text{ClO}_2^-$ ,  $\text{ClO}_3$

**Options**

1. 2
2. 4
3. 1
4. 3

Question Type : **MCQ**

Question ID : **87827055495**

Option 1 ID : **878270218450**

Option 2 ID : **878270218452**

Option 3 ID : **878270218449**

Option 4 ID : **878270218451**

**Q.64** What pressure (bar) of  $H_2$  would be required to make emf of hydrogen electrode zero in pure water at  $25^\circ C$  ?

**Options**

1. 0.5
2.  $10^{-7}$
3.  $10^{-14}$
4. 1

Question Type : **MCQ**

Question ID : **87827055492**

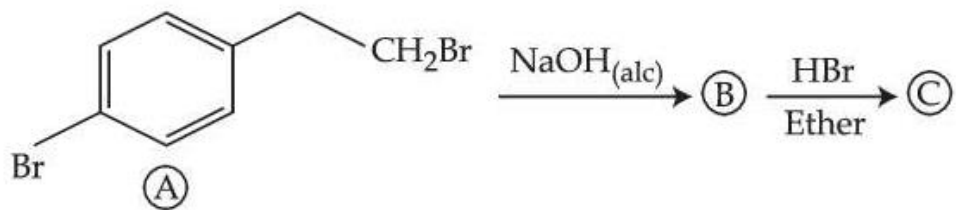
Option 1 ID : **878270218440**

Option 2 ID : **878270218437**

Option 3 ID : **878270218438**

Option 4 ID : **878270218439**

Q.65

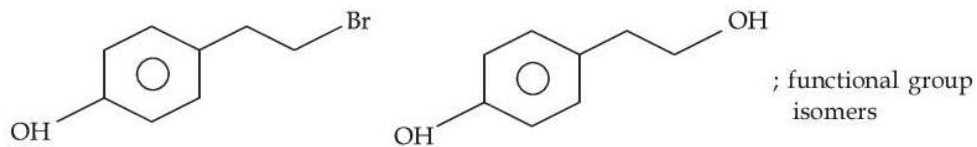


Identify (B) and (C) and how are (A) and (C) related ?

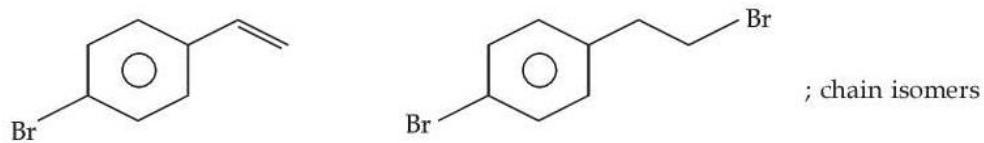
(B)

(C)

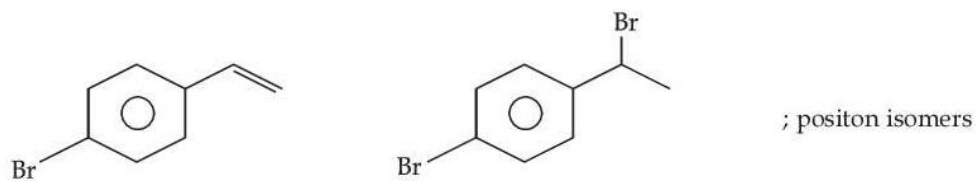
Options 1.



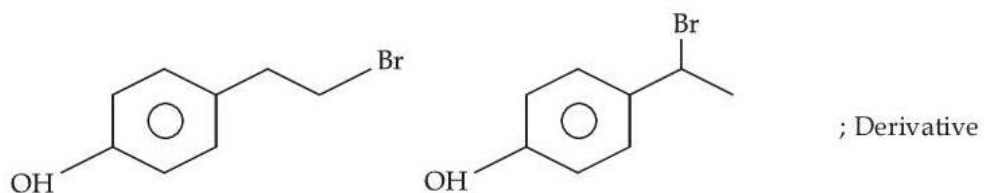
2.



3.



4.



Question Type : MCQ

Question ID : 87827055503

Option 1 ID : 878270218481

Option 2 ID : 878270218483

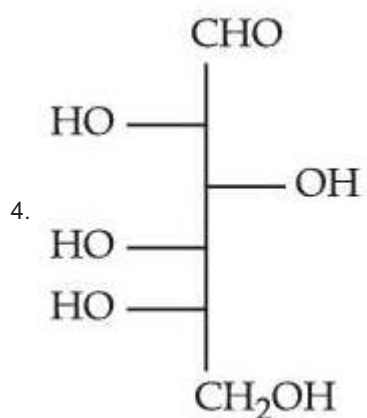
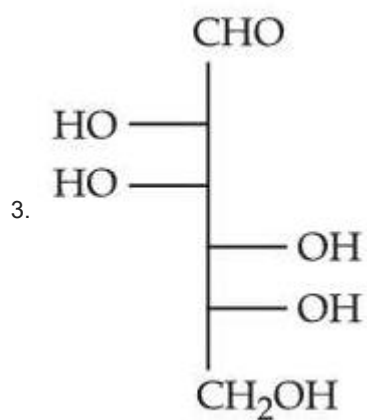
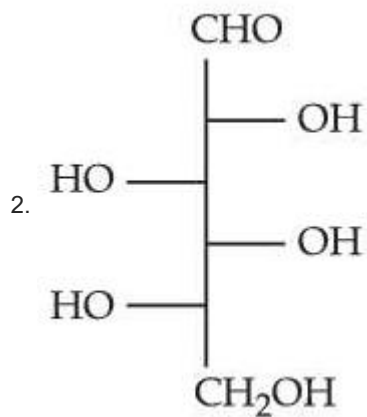
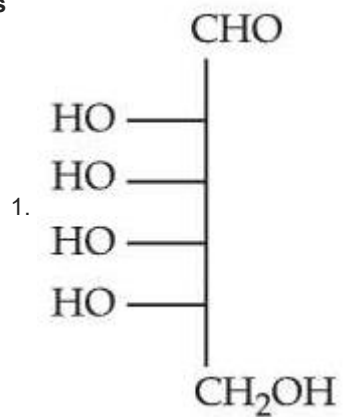
Option 3 ID : 878270218482

Option 4 ID : 878270218484

Q.66

Which of the following is the correct structure of L-Glucose ?

Options



Question Type : MCQ

Question ID : 87827055507

Option 1 ID : 878270218500

Option 2 ID : 878270218497

Option 3 ID : 878270218498

**Q.67** Which among the following is **incorrect** statement ?

- Options**
1. Electromeric effect dominates over inductive effect
  2. The electromeric effect is, temporary effect
  3. Hydrogen ion ( $H^+$ ) shows negative electromeric effect
  4. The organic compound shows electromeric effect in the presence of the reagent only.

Question Type : **MCQ**

Question ID : **87827055502**

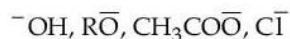
Option 1 ID : **878270218479**

Option 2 ID : **878270218478**

Option 3 ID : **878270218480**

Option 4 ID : **878270218477**

**Q.68** What will be the decreasing order of basic strength of the following conjugate bases ?



- Options**
1.  ${}^{-}\text{OH} > \text{R}\bar{\text{O}} > \text{CH}_3\text{CO}\bar{\text{O}} > \text{Cl}^{-}$
  2.  $\text{Cl}^{-} > {}^{-}\text{OH} > \text{R}\bar{\text{O}} > \text{CH}_3\text{CO}\bar{\text{O}}$
  3.  $\text{Cl}^{-} > \text{R}\bar{\text{O}} > {}^{-}\text{OH} > \text{CH}_3\text{CO}\bar{\text{O}}$
  4.  $\text{R}\bar{\text{O}} > {}^{-}\text{OH} > \text{CH}_3\text{CO}\bar{\text{O}} > \text{Cl}^{-}$

Question Type : **MCQ**

Question ID : **87827055490**

Option 1 ID : **878270218429**

Option 2 ID : **878270218431**

Option 3 ID : **878270218432**

Option 4 ID : **878270218430**

**Q.69** Number of elements from the following that CANNOT form compounds with valencies which match with their respective group valencies is \_\_\_\_\_.  
B, C, N, S, O, F, P, Al, Si

**Options**

1. 7
2. 6
3. 5
4. 3

Question Type : **MCQ**

Question ID : **87827055494**

Option 1 ID : **878270218448**

Option 2 ID : **878270218447**

Option 3 ID : **878270218445**

Option 4 ID : **878270218446**

**Q.70** Which of the following nitrogen containing compound does not give Lassaigne's test ?

**Options**

1. Phenyl hydrazine
2. Glycene
3. Hydrazine
4. Urea

Question Type : **MCQ**

Question ID : **87827055500**

Option 1 ID : **878270218472**

Option 2 ID : **878270218470**

Option 3 ID : **878270218471**

Option 4 ID : **878270218469**



**Q.71** Given below are two statements :

**Statement I :** Acidity of  $\alpha$ -hydrogens of aldehydes and ketones is responsible for Aldol reaction.

**Statement II :** Reaction between benzaldehyde and ethanal will NOT give Cross - Aldol product.

In the light of the above statements, choose the **most appropriate** answer from the options given below :

**Options**

1. Both **Statement I** and **Statement II** are incorrect
2. Both **Statement I** and **Statement II** are correct
3. **Statement I** is correct but **Statement II** is incorrect
4. **Statement I** is incorrect but **Statement II** is correct

Question Type : **MCQ**

Question ID : **87827055505**

Option 1 ID : **878270218490**

Option 2 ID : **878270218489**

Option 3 ID : **878270218491**

Option 4 ID : **878270218492**

**Q.72** Number of complexes from the following with even number of unpaired "d" electrons is \_\_\_\_\_.

$[\text{V}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Ni}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$

[Given atomic numbers : V = 23, Cr = 24, Fe = 26, Ni = 28, Cu = 29]

**Options**

1. **4**
2. **1**
3. **2**
4. **5**

Question Type : **MCQ**

Question ID : **87827055498**

Option 1 ID : **878270218463**

Option 2 ID : **878270218461**

Option 3 ID : **878270218462**

Option 4 ID : **878270218464**

**Q.73** In the precipitation of the iron group (III) in qualitative analysis, ammonium chloride is added before adding ammonium hydroxide to :

Options

1. decrease concentration of  $\text{OH}^-$  ions
2. prevent interference by phosphate ions
3. increase concentration of  $\text{Cl}^-$  ions
4. increase concentration of  $\text{NH}_4^+$  ions

Question Type : MCQ

Question ID : 87827055499

Option 1 ID : 878270218465

Option 2 ID : 878270218466

Option 3 ID : 878270218467

Option 4 ID : 878270218468

**Q.74** The correct sequence of ligands in the order of decreasing field strength is :

Options

1.  $\text{OH}^- > \text{F}^- > \text{NH}_3 > \text{CN}^-$
2.  $\text{CO} > \text{H}_2\text{O} > \text{F}^- > \text{S}^{2-}$
3.  $\text{NCS}^- > \text{EDTA}^{4-} > \text{CN}^- > \text{CO}$
4.  $\text{S}^{2-} > \text{OH}^- > \text{EDTA}^{4-} > \text{CO}$

Question Type : MCQ

Question ID : 87827055497

Option 1 ID : 878270218459

Option 2 ID : 878270218457

Option 3 ID : 878270218458

Option 4 ID : 878270218460

**Q.75** Which one of the following molecules has maximum dipole moment ?

- Options**
1.  $\text{NH}_3$
  2.  $\text{PF}_5$
  3.  $\text{NF}_3$
  4.  $\text{CH}_4$

Question Type : **MCQ**

Question ID : **87827055489**

Option 1 ID : **878270218426**

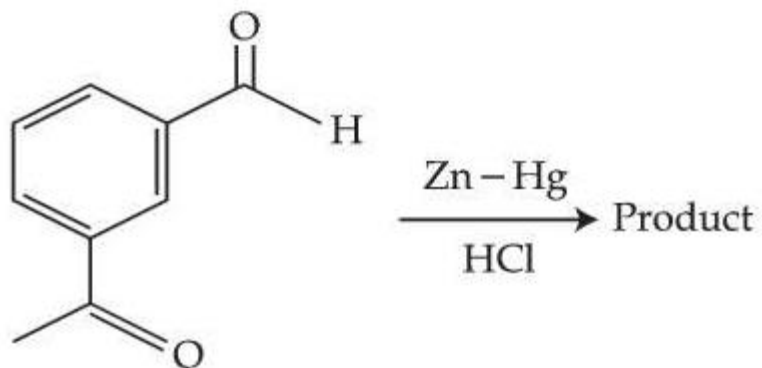
Option 2 ID : **878270218428**

Option 3 ID : **878270218425**

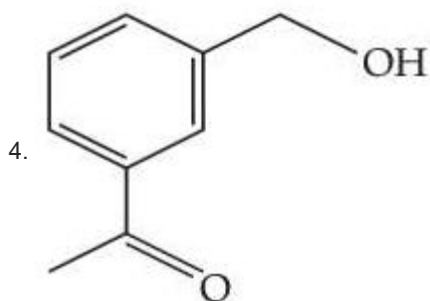
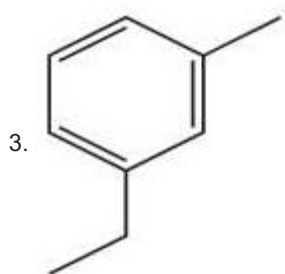
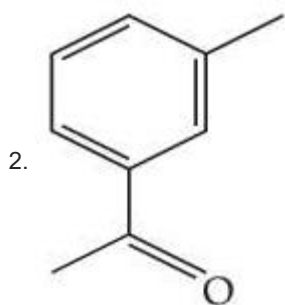
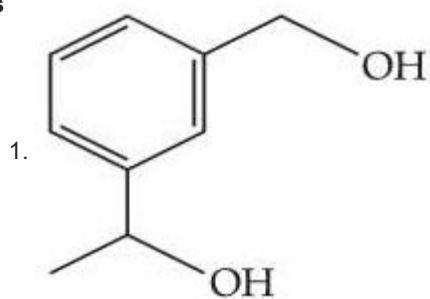
Option 4 ID : **878270218427**

Q.76

Identify the product in the following reaction :



Options



Question Type : MCQ

Question ID : 87827055506

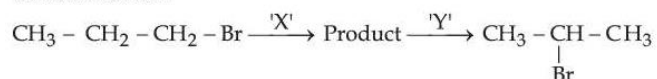
Option 1 ID : 878270218496

Option 2 ID : 878270218494

Option 3 ID : 878270218493

Option 4 ID : 878270218495

**Q.77** Identify the correct set of reagents or reaction conditions 'X' and 'Y' in the following set of transformation.



**Options**

1. X = conc.alc. NaOH, 80°C, Y = Br<sub>2</sub>/CHCl<sub>3</sub>
2. X = conc.alc. NaOH, 80°C, Y = HBr/acetic acid
3. X = dil.aq. NaOH, 20°C, Y = Br<sub>2</sub>/CHCl<sub>3</sub>
4. X = dil.aq. NaOH, 20°C, Y = HBr/acetic acid

Question Type : MCQ

Question ID : 87827055504

Option 1 ID : 878270218488

Option 2 ID : 878270218486

Option 3 ID : 878270218487

Option 4 ID : 878270218485

**Q.78** One of the commonly used electrode is calomel electrode. Under which of the following categories, calomel electrode comes ?

**Options**

1. Metal - Insoluble Salt - Anion electrodes
2. Metal ion - Metal electrodes
3. Oxidation - Reduction electrodes
4. Gas - Ion electrodes

Question Type : MCQ

Question ID : 87827055491

Option 1 ID : 878270218435

Option 2 ID : 878270218434

Option 3 ID : 878270218436

Option 4 ID : 878270218433

**Q.79** The correct order of first ionization enthalpy values of the following elements is :

- (A) O
- (B) N
- (C) Be
- (D) F
- (E) B

Choose the correct answer from the options given below :

- Options**
1.  $E < C < A < B < D$
  2.  $A < B < D < C < E$
  3.  $B < D < C < E < A$
  4.  $C < E < A < B < D$

Question Type : MCQ

Question ID : 87827055493

Option 1 ID : 878270218443

Option 2 ID : 878270218441

Option 3 ID : 878270218442

Option 4 ID : 878270218444

**Q.80** The element which shows only one oxidation state other than its elemental form is :

- Options**
1. Titanium
  2. Scandium
  3. Nickel
  4. Cobalt

Question Type : MCQ

Question ID : 87827055496

Option 1 ID : 878270218455

Option 2 ID : 878270218454

Option 3 ID : 878270218456

Option 4 ID : 878270218453

Section : **Chemistry Section B**

**Q.81** The enthalpy of formation of ethane ( $C_2H_6$ ) from ethylene by addition of hydrogen where the bond-energies of C-H, C-C, C=C, H-H are 414 kJ, 347 kJ, 615 kJ and 435 kJ respectively is \_\_\_\_\_ kJ

Question Type : SA

Question ID : 87827055510

Q.82 The number of different chain isomers for  $C_7H_{16}$  is \_\_\_\_\_.

Question Type : SA  
Question ID : 87827055515

Q.83 X g of ethylamine is subjected to reaction with  $NaNO_2/HCl$  followed by water; evolved dinitrogen gas which occupied 2.24 L volume at STP. X is \_\_\_\_\_  $\times 10^{-1}$  g.

Question Type : SA  
Question ID : 87827055517

Q.84 Only 2 mL of  $KMnO_4$  solution of unknown molarity is required to reach the end point of a titration of 20 mL of oxalic acid (2 M) in acidic medium. The molarity of  $KMnO_4$  solution should be \_\_\_\_\_ M.

Question Type : SA  
Question ID : 87827055514

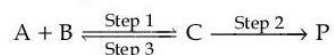
Q.85 The de-Broglie's wavelength of an electron in the 4<sup>th</sup> orbit is \_\_\_\_\_  $\pi a_0$ . ( $a_0$  = Bohr's radius)

Question Type : SA  
Question ID : 87827055508

Q.86 Number of molecules/species from the following having one unpaired electron is \_\_\_\_\_.  
 $O_2, O_2^{-1}, NO, CN^{-1}, O_2^{2-}$

Question Type : SA  
Question ID : 87827055509

Q.87 Consider the following transformation involving first order elementary reaction in each step at constant temperature as shown below.



Some details of the above reactions are listed below.

Step	Rate constant ( $\text{sec}^{-1}$ )	Activation energy ( $\text{kJ mol}^{-1}$ )
1	$k_1$	300
2	$k_2$	200
3	$k_3$	$E_{a3}$

If the overall rate constant of the above transformation (k) is given as  $k = \frac{k_1 k_2}{k_3}$  and the overall activation energy ( $E_a$ ) is  $400 \text{ kJ mol}^{-1}$ , then the value of  $E_{a3}$  is \_\_\_\_\_  $\text{kJ mol}^{-1}$  (nearest integer)

Question Type : SA  
Question ID : 87827055512

Q.88 Consider the following reaction  
 $MnO_2 + KOH + O_2 \rightarrow A + H_2O$ .  
Product 'A' in neutral or acidic medium disproportionate to give products 'B' and 'C' along with water. The sum of spin-only magnetic moment values of B and C is \_\_\_\_\_ BM. (nearest integer) (Given atomic number of Mn is 25)

Question Type : SA  
Question ID : 87827055513

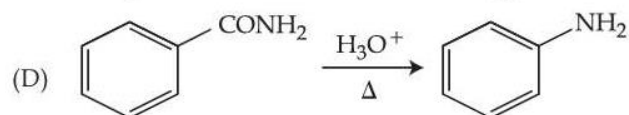
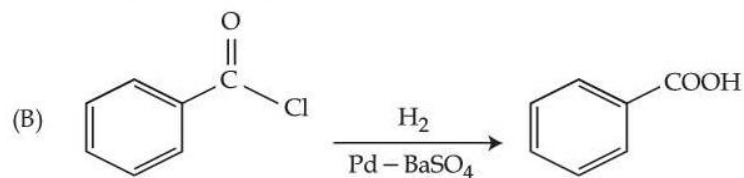
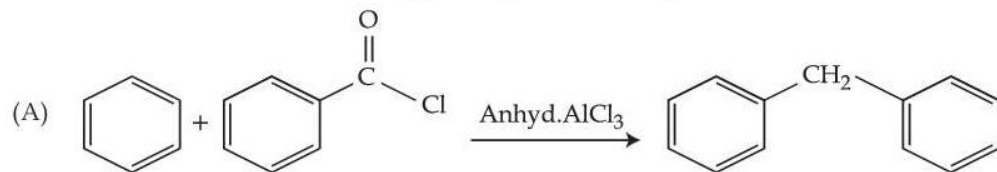
**Q.89** 2.5 g of a non-volatile, non-electrolyte is dissolved in 100 g of water at 25°C. The solution showed a boiling point elevation by 2°C. Assuming the solute concentration is negligible with respect to the solvent concentration, the vapor pressure of the resulting aqueous solution is \_\_\_\_\_ mm of Hg (nearest integer)

[Given : Molal boiling point elevation constant of water ( $K_b$ ) = 0.52 K. kg mol<sup>-1</sup>,  
1 atm pressure = 760 mm of Hg, molar mass of water = 18 g mol<sup>-1</sup>]

Question Type : SA

Question ID : 87827055511

**Q.90** The number of the correct reaction(s) among the following is \_\_\_\_\_.



Question Type : SA

Question ID : 87827055516