JEE April 2024

Test Date	09/04/2024
Test Time	9:00 AM - 12:00 PM
Subject	B. Tech

Section : **Mathematics Section A**

Q.1 The solution of the differential equation $(x^2+y^2)dx-5xy\ dy=0,\ y(1)=0$, is :

Options

1. $\left|x^2-2y^2\right|^6=x$
2. $\left|x^2-2y^2\right|^5=x^2$
3. $\left|x^2-4y^2\right|^5=x^2$
4. $\left|x^2-4y^2\right|^6=x$

Question Type : **MCQ**
Question ID : **87827056157**
Option 1 ID : **878270220437**
Option 2 ID : **878270220438**
Option 3 ID : **878270220440**
Option 4 ID : **878270220439**

Q.2 Let $f(x)=ax^3+bx^2+cx+41$ be such that $f(1)=40,\ f'(1)=2$ and $f''(1)=4$. Then $a^2+b^2+c^2$ is equal to :

Options

1. 51
2. 62
3. 54
4. 73

Question Type : **MCQ**
Question ID : **87827056153**
Option 1 ID : **878270220421**
Option 2 ID : **878270220423**
Option 3 ID : **878270220422**
Option 4 ID : **878270220424**

Q.3 Let $f(x)=x^2+9$, $g(x)=\frac{x}{x-9}$ and $a=fog(10)$, $b=gof(3)$. If e and l denote the eccentricity and the length of the latus rectum of the ellipse $\frac{x^2}{a}+\frac{y^2}{b}=1$, then $8e^2+l^2$ is equal to.

Options

1. 16
2. 6
3. 8
4. 12

Question Type : **MCQ**
Question ID : **87827056159**
Option 1 ID : **878270220445**
Option 2 ID : **878270220448**
Option 3 ID : **878270220447**
Option 4 ID : **878270220446**

Q.4 Let α, β be the roots of the equation $x^2+2\sqrt{2}x-1=0$. The quadratic equation, whose roots are $\alpha^4+\beta^4$ and $\frac{1}{10}(\alpha^6+\beta^6)$, is :

Options

1. $x^2-195x+9506=0$
2. $x^2-190x+9466=0$
3. $x^2-195x+9466=0$
4. $x^2-180x+9506=0$

Question Type : **MCQ**
Question ID : **87827056149**
Option 1 ID : **878270220407**
Option 2 ID : **878270220406**
Option 3 ID : **878270220408**
Option 4 ID : **878270220405**

Q.5 The parabola $y^2=4x$ divides the area of the circle $x^2+y^2=5$ in two parts. The area of the smaller part is equal to :

Options

1. $\frac{1}{3}+\sqrt{5}\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)$

2. $\frac{1}{3}+5\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)$

3. $\frac{2}{3}+\sqrt{5}\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)$

4. $\frac{2}{3}+5\sin^{-1}\left(\frac{2}{\sqrt{5}}\right)$

Question Type : **MCQ**
Question ID : **87827056156**
Option 1 ID : **878270220433**
Option 2 ID : **878270220435**
Option 3 ID : **878270220434**
Option 4 ID : **878270220436**

Q.6 Let the line L intersect the lines $x-2=-y=z-1$, $2(x+1)=2(y-1)=z+1$ and be parallel to the line $\frac{x-2}{3}=\frac{y-1}{1}=\frac{z-2}{2}$. Then which of the following points lies on L?

Options

1. $\left(-\frac{1}{3},1,1\right)$

2. $\left(-\frac{1}{3},1,-1\right)$

3. $\left(-\frac{1}{3},-1,-1\right)$

4. $\left(-\frac{1}{3},-1,1\right)$

Question Type : **MCQ**
Question ID : **87827056162**
Option 1 ID : **878270220459**
Option 2 ID : **878270220457**
Option 3 ID : **878270220460**
Option 4 ID : **878270220458**

Q.7 Let $\vec{OA} = 2\vec{a}$, $\vec{OB} = 6\vec{a} + 5\vec{b}$ and $\vec{OC} = 3\vec{b}$, where O is the origin. If the area of the parallelogram with adjacent sides $\vec{OA}$ and $\vec{OC}$ is 15 sq. units, then the area (in sq. units) of the quadrilateral OABC is equal to :

Options

1. 35
2. 40
3. 32
4. 38

Question Type : **MCQ**
Question ID : **87827056164**
Option 1 ID : **878270220466**
Option 2 ID : **878270220468**
Option 3 ID : **878270220465**
Option 4 ID : **878270220467**

Q.8 The solution curve, of the differential equation $2y\frac{dy}{dx} + 3 = 5\frac{dy}{dx}$, passing through the point (0, 1) is a conic, whose vertex lies on the line :

Options

1. $2x+3y=-6$
2. $2x+3y=9$
3. $2x+3y=-9$
4. $2x+3y=6$

Question Type : **MCQ**
Question ID : **87827056158**
Option 1 ID : **878270220443**
Option 2 ID : **878270220441**
Option 3 ID : **878270220444**
Option 4 ID : **878270220442**

Q.9 A variable line L passes through the point (3, 5) and intersects the positive coordinate axes at the points A and B. The minimum area of the triangle OAB, where O is the origin, is :

Options

1. 30
2. 25
3. 40
4. 35

Question Type : **MCQ**
Question ID : **87827056154**
Option 1 ID : **878270220428**
Option 2 ID : **878270220427**
Option 3 ID : **878270220425**
Option 4 ID : **878270220426**

Q.10 The shortest distance between the lines $\frac{x-3}{4}=\frac{y+7}{-11}=\frac{z-1}{5}$ and $\frac{x-5}{3}=\frac{y-9}{-6}=\frac{z+2}{1}$ is :

Options

1. $\frac{187}{\sqrt{563}}$
2. $\frac{185}{\sqrt{563}}$
3. $\frac{179}{\sqrt{563}}$
4. $\frac{178}{\sqrt{563}}$

Question Type : **MCQ**
Question ID : **87827056163**
Option 1 ID : **878270220464**
Option 2 ID : **878270220463**
Option 3 ID : **878270220462**
Option 4 ID : **878270220461**

Q.11 The coefficient of x^{70} in $x^2(1+x)^{98}+x^3(1+x)^{97}+x^4(1+x)^{96}+\ldots+x^{54}(1+x)^{46}$ is ${}^{99}C_p-{}^{46}C_q$. Then a possible value of $p+q$ is :

Options

1. 68
2. 61
3. 55
4. 83

Question Type : **MCQ**
Question ID : **87827056151**
Option 1 ID : **878270220415**
Option 2 ID : **878270220416**
Option 3 ID : **878270220413**
Option 4 ID : **878270220414**

Q.12 Let $\lambda, \mu \in \mathbf{R}$. If the system of equations

$$3x+5y+\lambda z=3$$
$$7x+11y-9z=2$$
$$97x+155y-189z=\mu$$

has infinitely many solutions, then $\mu+2\lambda$ is equal to :

Options

1. 22
2. 25
3. 24
4. 27

Question Type : **MCQ**
Question ID : **87827056150**
Option 1 ID : **878270220409**
Option 2 ID : **878270220411**
Option 3 ID : **878270220410**
Option 4 ID : **878270220412**

Q.13 If the sum of the series $\frac{1}{1\cdot(1+d)}+\frac{1}{(1+d)(1+2d)}+\ldots+\frac{1}{(1+9d)(1+10d)}$ is equal to 5, then 50d is equal to :

Options

1. 20
2. 5
3. 10
4. 15

Question Type : **MCQ**
Question ID : **87827056152**
Option 1 ID : **878270220420**
Option 2 ID : **878270220417**
Option 3 ID : **878270220418**
Option 4 ID : **878270220419**

Q.14 Let $\left|\cos\theta\cos(60-\theta)\cos(60+\theta)\right| \le \frac{1}{8}$, $\theta\in[0, 2\pi]$. Then, the sum of all $\theta\in[0, 2\pi]$, where $\cos 3\theta$ attains its maximum value, is :

Options

1. 9π
2. 6π
3. 15π
4. 18π

Question Type : **MCQ**
Question ID : **87827056167**
Option 1 ID : **878270220479**
Option 2 ID : **878270220477**
Option 3 ID : **878270220480**
Option 4 ID : **878270220478**

Q.15 Let $\int \frac{2-\tan x}{3+\tan x}\,dx = \frac{1}{2}\left(\alpha x + \log_e|\beta \sin x + \gamma \cos x|\right) + C$, where C is the constant of integration.

Then $\alpha + \frac{\gamma}{\beta}$ is equal to :

Options

1. 3
2. 7
3. 4
4. 1

Question Type : **MCQ**
Question ID : **87827056155**
Option 1 ID : **878270220430**
Option 2 ID : **878270220432**
Option 3 ID : **878270220431**
Option 4 ID : **878270220429**

Q.16 The frequency distribution of the age of students in a class of 40 students is given below.

Age	15	16	17	18	19	20
No of Students	5	8	5	12	x	y

If the mean deviation about the median is 1.25, then $4x+5y$ is equal to :

Options

1. 43
2. 47
3. 44
4. 46

Question Type : **MCQ**
Question ID : **87827056166**
Option 1 ID : **878270220473**
Option 2 ID : **878270220476**
Option 3 ID : **878270220474**
Option 4 ID : **878270220475**

Q.17 A ray of light coming from the point P(1, 2) gets reflected from the point Q on the x-axis and then passes through the point R(4, 3). If the point S(h, k) is such that PQRS is a parallelogram, then hk^2 is equal to :

Options

1. 90
2. 80
3. 70
4. 60

Question Type : **MCQ**
Question ID : **87827056161**
Option 1 ID : **878270220456**
Option 2 ID : **878270220455**
Option 3 ID : **878270220454**
Option 4 ID : **878270220453**

Q.18 If the domain of the function $f(x) = \sin^{-1}\left(\frac{x-1}{2x+3}\right)$ is $\mathbf{R} - (\alpha, \beta)$, then $12\alpha\beta$ is equal to :

Options

1. 32
2. 24
3. 40
4. 36

Question Type : **MCQ**
Question ID : **87827056148**
Option 1 ID : **878270220402**
Option 2 ID : **878270220401**
Option 3 ID : **878270220404**
Option 4 ID : **878270220403**

Q.19 Let three vectors $\vec{a} = \alpha\hat{i} + 4\hat{j} + 2\hat{k}$, $\vec{b} = 5\hat{i} + 3\hat{j} + 4\hat{k}$, $\vec{c} = x\hat{i} + y\hat{j} + z\hat{k}$ form a triangle such that $\vec{c} = \vec{a} - \vec{b}$ and the area of the triangle is $5\sqrt{6}$. If α is a positive real number, then $|\vec{c}|^2$ is equal to :

Options

1. 14
2. 10
3. 12
4. 16

Question Type : **MCQ**
Question ID : **87827056165**
Option 1 ID : **878270220471**
Option 2 ID : **878270220469**
Option 3 ID : **878270220470**
Option 4 ID : **878270220472**

Q.20 Let a circle passing through (2, 0) have its centre at the point (h, k). Let (x_c, y_c) be the point of intersection of the lines $3x+5y=1$ and $(2+c)x+5c^2y=1$. If $h = \lim\limits_{c\to 1} x_c$ and $k = \lim\limits_{c\to 1} y_c$, then the equation of the circle is :

Options

1. $25x^2+25y^2-20x+2y-60=0$
2. $25x^2+25y^2-2x+2y-60=0$
3. $5x^2+5y^2-4x-2y-12=0$
4. $5x^2+5y^2-4x+2y-12=0$

Question Type : **MCQ**
Question ID : **87827056160**
Option 1 ID : **878270220449**
Option 2 ID : **878270220450**
Option 3 ID : **878270220452**
Option 4 ID : **878270220451**

Section : **Mathematics Section B**

Q.21 The sum of the square of the modulus of the elements in the set $\{z=a+ib : a, b \in \mathbf{Z}, z \in \mathbf{C}, |z-1| \le 1, |z-5| \le |z-5i|\}$ is _____.

Question Type : **SA**
Question ID : **87827056169**

Q.22 Let A be a non-singular matrix of order 3. If $\det(3\text{adj}(2\text{adj}((\det A)A))) = 3^{-13} \cdot 2^{-10}$ and $\det(3\text{adj}(2A)) = 2^m \cdot 3^n$, then $|3m+2n|$ is equal to _____.

Question Type : **SA**
Question ID : **87827056170**

Q.23 Let $A = \{2, 3, 6, 7\}$ and $B = \{4, 5, 6, 8\}$. Let R be a relation defined on $A \times B$ by (a_1, b_1) R (a_2, b_2) if and only if $a_1 + a_2 = b_1 + b_2$. Then the number of elements in R is _____.

Question Type : **SA**
Question ID : **87827056168**

Q.24 If a function f satisfies $f(m+n) = f(m) + f(n)$ for all $m, n \in \mathbf{N}$ and $f(1) = 1$, then the largest natural number λ such that $\sum_{k=1}^{2022} f(\lambda + k) \leq (2022)^2$ is equal to _____.

Question Type : **SA**
Question ID : **87827056173**

Q.25 Let $\lim\limits_{n\to\infty}\left(\frac{n}{\sqrt{n^4+1}} - \frac{2n}{(n^2+1)\sqrt{n^4+1}} + \frac{n}{\sqrt{n^4+16}} - \frac{8n}{(n^2+4)\sqrt{n^4+16}} + \ldots + \frac{n}{\sqrt{n^4+n^4}} - \frac{2n\cdot n^2}{(n^2+n^2)\sqrt{n^4+n^4}}\right)$ be $\frac{\pi}{k}$, using only the principal values of the inverse trigonometric functions. Then k^2 is equal to _____.

Question Type : **SA**
Question ID : **87827056175**

Q.26 Let the centre of a circle, passing through the points (0, 0), (1, 0) and touching the circle $x^2 + y^2 = 9$, be (h, k). Then for all possible values of the coordinates of the centre (h, k), $4(h^2 + k^2)$ is equal to _____.

Question Type : **SA**
Question ID : **87827056176**

Q.27 Let the set of all positive values of λ, for which the point of local minimum of the function $(1 + x(\lambda^2 - x^2))$ satisfies $\frac{x^2 + x + 2}{x^2 + 5x + 6} < 0$, be (α, β). Then $\alpha^2 + \beta^2$ is equal to _____.

Question Type : **SA**
Question ID : **87827056174**

Q.28 Let a, b and c denote the outcome of three independent rolls of a fair tetrahedral die, whose four faces are marked 1, 2, 3, 4. If the probability that $ax^2 + bx + c = 0$ has all real roots is $\frac{m}{n}$, gcd(m, n) = 1, then m + n is equal to _____.

Question Type : **SA**
Question ID : **87827056177**

Q.29

Let $f:(0,\pi)\to\mathbf{R}$ be a function given by $f(x)=\begin{cases}\left(\frac{8}{7}\right)^{\frac{\tan 8x}{\tan 7x}}, & 0<x<\frac{\pi}{2}\\ a-8, & x=\frac{\pi}{2}\\ (1+|\cot x|)^{\frac{b}{a}|\tan x|}, & \frac{\pi}{2}<x<\pi\end{cases}$

where $a, b\in\mathbf{Z}$. If f is continuous at $x=\frac{\pi}{2}$, then a^2+b^2 is equal to _____.

Question Type : **SA**
Question ID : **87827056171**

Q.30

The remainder when 428^{2024} is divided by 21 is _____.

Question Type : **SA**
Question ID : **87827056172**

Section : **Physics Section A**

Q.31

A light unstretchable string passing over a smooth light pulley connects two blocks of masses m_1 and m_2. If the acceleration of the system is $\frac{g}{8}$, then the ratio of the masses $\frac{m_2}{m_1}$ is :

Options

1. $8:1$
2. $9:7$
3. $5:3$
4. $4:3$

Question Type : **MCQ**
Question ID : **87827056181**
Option 1 ID : **878270220503**
Option 2 ID : **878270220504**
Option 3 ID : **878270220506**
Option 4 ID : **878270220505**

Q.32 A particle of mass m moves on a straight line with its velocity increasing with distance according to the equation $v = \alpha\sqrt{x}$, where α is a constant. The total work done by all the forces applied on the particle during its displacement from $x = 0$ to $x = d$, will be :

Options

1. $\frac{m\alpha^2 d}{2}$
2. $\frac{m}{2\alpha^2 d}$
3. $\frac{md}{2\alpha^2}$
4. $2m\alpha^2 d$

Question Type : **MCQ**
Question ID : **87827056182**
Option 1 ID : **878270220508**
Option 2 ID : **878270220509**
Option 3 ID : **878270220507**
Option 4 ID : **878270220510**

Q.33 A bulb and a capacitor are connected in series across an ac supply. A dielectric is then placed between the plates of the capacitor. The glow of the bulb :

Options

1. decreases
2. increases
3. becomes zero
4. remains same

Question Type : **MCQ**
Question ID : **87827056190**
Option 1 ID : **878270220541**
Option 2 ID : **878270220540**
Option 3 ID : **878270220542**
Option 4 ID : **878270220539**

Q.34 A galvanmeter has a coil of resistance 200 Ω with a full scale deflection at 20 μA. The value of resistance to be added to use it as an ammeter of range (0-20) mA is :

Options

1. $0.10\ \Omega$
2. $0.50\ \Omega$
3. $0.20\ \Omega$
4. $0.40\ \Omega$

Question Type : **MCQ**
Question ID : **87827056197**
Option 1 ID : **878270220568**
Option 2 ID : **878270220567**
Option 3 ID : **878270220569**
Option 4 ID : **878270220570**

Q.35 A sphere of relative density σ and diameter D has concentric cavity of diameter d. The ratio of $\frac{D}{d}$, if it just floats on water in a tank is :

Options

1. $\left(\frac{\sigma - 1}{\sigma}\right)^{1/3}$
2. $\left(\frac{\sigma + 1}{\sigma - 1}\right)^{1/3}$
3. $\left(\frac{\sigma}{\sigma - 1}\right)^{1/3}$
4. $\left(\frac{\sigma - 2}{\sigma + 2}\right)^{1/3}$

Question Type : **MCQ**
Question ID : **87827056184**
Option 1 ID : **878270220515**
Option 2 ID : **878270220518**
Option 3 ID : **878270220516**
Option 4 ID : **878270220517**

Q.36 A particle moving in a straight line covers half the distance with speed 6 m/s. The other half is covered in two equal time intervals with speeds 9 m/s and 15 m/s respectively. The average speed of the particle during the motion is :

Options

1. $10\ m/s$
2. $8\ m/s$
3. $8.8\ m/s$
4. $9.2\ m/s$

Question Type : **MCQ**
Question ID : **87827056179**
Option 1 ID : **878270220495**
Option 2 ID : **878270220496**
Option 3 ID : **878270220497**
Option 4 ID : **878270220498**

Q.37 The energy equivalent of 1 g of substance is :

Options

1. 5.6×10^{26} MeV
2. 5.6 eV
3. 11.2×10^{24} MeV
4. 5.6×10^{12} MeV

Question Type : **MCQ**
Question ID : **87827056194**
Option 1 ID : **878270220558**
Option 2 ID : **878270220555**
Option 3 ID : **878270220557**
Option 4 ID : **878270220556**

Q.38 A sample of 1 mole gas at temperature T is adiabatically expanded to double its volume. If adiabatic constant for the gas is $\gamma = \frac{3}{2}$, then the work done by the gas in the process is :

Options

1. $RT\left[2-\sqrt{2}\right]$
2. $RT\left[2+\sqrt{2}\right]$
3. $\frac{R}{T}\left[2-\sqrt{2}\right]$
4. $\frac{T}{R}\left[2+\sqrt{2}\right]$

Question Type : **MCQ**
Question ID : **87827056185**
Option 1 ID : **878270220519**
Option 2 ID : **878270220520**
Option 3 ID : **878270220521**
Option 4 ID : **878270220522**

Q.39 A plane EM wave is propagating along x direction. It has a wavelength of 4 mm. If electric field is in y direction with the maximum magnitude of 60 Vm^{-1}, the equation for magnetic field is :

Options

1. $B_z = 2\times10^{-7}\sin\left[\frac{\pi}{2}\left(x-3\times10^8 t\right)\right]\hat{k}\,T$
2. $B_x = 60\sin\left[\frac{\pi}{2}\left(x-3\times10^8 t\right)\right]\hat{i}\,T$
3. $B_z = 60\sin\left[\frac{\pi}{2}\left(x-3\times10^8 t\right)\right]\hat{k}\,T$
4. $B_z = 2\times10^{-7}\sin\left[\frac{\pi}{2}\times10^3\left(x-3\times10^8 t\right)\right]\hat{k}\,T$

Question Type : **MCQ**
Question ID : **87827056191**
Option 1 ID : **878270220545**
Option 2 ID : **878270220544**
Option 3 ID : **878270220543**
Option 4 ID : **878270220546**

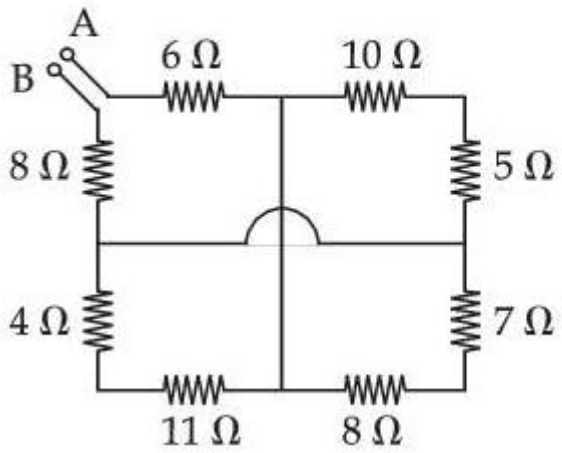
Q.40 A proton, an electron and an alpha particle have the same energies. Their de-Broglie wavelengths will be compared as :

Options

1. $\lambda_p < \lambda_e < \lambda_\alpha$
2. $\lambda_e > \lambda_\alpha > \lambda_p$
3. $\lambda_p > \lambda_e > \lambda_\alpha$
4. $\lambda_\alpha < \lambda_p < \lambda_e$

Question Type : **MCQ**
Question ID : **87827056193**
Option 1 ID : **878270220552**
Option 2 ID : **878270220554**
Option 3 ID : **878270220551**
Option 4 ID : **878270220553**

Q.41 The equivalent resistance between A and B is :



Options

1. 25 Ω
2. 18 Ω
3. 27 Ω
4. 19 Ω

Question Type : **MCQ**
Question ID : **87827056188**
Option 1 ID : **878270220532**
Option 2 ID : **878270220531**
Option 3 ID : **878270220534**
Option 4 ID : **878270220533**

Q.42 One main scale division of a vernier caliper is equal to m units. If n^{th} division of main scale coincides with $(n+1)^{th}$ division of vernier scale, the least count of the vernier caliper is :

Options

1. $\frac{m}{n(n+1)}$
2. $\frac{m}{(n+1)}$
3. $\frac{n}{(n+1)}$
4. $\frac{1}{(n+1)}$

Question Type : **MCQ**
Question ID : **87827056196**
Option 1 ID : **878270220566**
Option 2 ID : **878270220564**
Option 3 ID : **878270220565**
Option 4 ID : **878270220563**

Q.43 A heavy iron bar, of weight W is having its one end on the ground and the other on the shoulder of a person. The bar makes an angle θ with the horizontal. The weight experienced by the person is :

Options

1. W
2. $\frac{W}{2}$
3. $W\cos\theta$
4. $W\sin\theta$

Question Type : **MCQ**
Question ID : **87827056180**
Option 1 ID : **878270220501**
Option 2 ID : **878270220502**
Option 3 ID : **878270220499**
Option 4 ID : **878270220500**

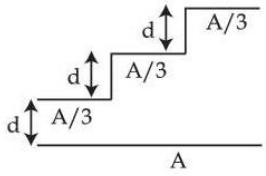
Q.44 The dimensional formula of latent heat is :

Options

1. $[M^0LT^{-2}]$
2. $[ML^2T^{-2}]$
3. $[M^0L^2T^{-2}]$
4. $[MLT^{-2}]$

Question Type : **MCQ**
Question ID : **87827056178**
Option 1 ID : **878270220494**
Option 2 ID : **878270220491**
Option 3 ID : **878270220492**
Option 4 ID : **878270220493**

Q.45 A capacitor is made of a flat plate of area A and a second plate having a stair-like structure as shown in figure. If the area of each stair is $\frac{A}{3}$ and the height is d, the capacitance of the arrangement is :



Options

1. $\frac{13\,\epsilon_0\,A}{17\,d}$
2. $\frac{11\,\epsilon_0\,A}{20\,d}$
3. $\frac{18\,\epsilon_0\,A}{11\,d}$
4. $\frac{11\,\epsilon_0\,A}{18\,d}$

Question Type : **MCQ**
Question ID : **87827056187**
Option 1 ID : **878270220528**
Option 2 ID : **878270220529**
Option 3 ID : **878270220530**
Option 4 ID : **878270220527**

Q.46 A light emitting diode (LED) is fabricated using GaAs semiconducting material whose band gap is 1.42 eV. The wavelength of light emitted from the LED is :

Options

1. 650 nm
2. 875 nm
3. 1243 nm
4. 1400 nm

Question Type : **MCQ**
Question ID : **87827056195**
Option 1 ID : **878270220561**
Option 2 ID : **878270220562**
Option 3 ID : **878270220560**
Option 4 ID : **878270220559**

Q.47 Given below are two statements :

Statement (I) : When an object is placed at the centre of curvature of a concave lens, image is formed at the centre of curvature of the lens on the other side.

Statement (II) : Concave lens always forms a virtual and erect image.

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

Options

1. **Statement I** is false but **Statement II** is true
2. **Statement I** is true but **Statement II** is false
3. Both **Statement I** and **Statement II** are false
4. Both **Statement I** and **Statement II** are true

Question Type : **MCQ**
Question ID : **87827056192**
Option 1 ID : **878270220550**
Option 2 ID : **878270220549**
Option 3 ID : **878270220548**
Option 4 ID : **878270220547**

Q.48 The volume of an ideal gas ($\gamma = 1.5$) is changed adiabatically from 5 litres to 4 litres. The ratio of initial pressure to final pressure is :

Options

1. $\frac{16}{25}$
2. $\frac{2}{\sqrt{5}}$
3. $\frac{4}{5}$
4. $\frac{8}{5\sqrt{5}}$

Question Type : **MCQ**
Question ID : **87827056186**
Option 1 ID : **878270220526**
Option 2 ID : **878270220523**
Option 3 ID : **878270220525**
Option 4 ID : **878270220524**

Q.49 An astronaut takes a ball of mass m from earth to space. He throws the ball into a circular orbit about earth at an altitude of 318.5 km. From earth's surface to the orbit, the change in total mechanical energy of the ball is $x\frac{GM_em}{21R_e}$. The value of x is (take $R_e = 6370$ km) :

Options

1. 12
2. 11
3. 9
4. 10

Question Type : **MCQ**
Question ID : **87827056183**
Option 1 ID : **878270220514**
Option 2 ID : **878270220513**
Option 3 ID : **878270220511**
Option 4 ID : **878270220512**

Q.50 Given below are two statements :

Statement (I) : When currents vary with time, Newton's third law is valid only if momentum carried by the electromagnetic field is taken into account.

Statement (II) : Ampere's circuital law does not depend on Biot-Savart's law.

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

Options

1. **Statement I** is true but **Statement II** is false
2. **Statement I** is false but **Statement II** is true
3. Both **Statement I** and **Statement II** are true
4. Both **Statement I** and **Statement II** are false

Question Type : **MCQ**
Question ID : **87827056189**
Option 1 ID : **878270220537**
Option 2 ID : **878270220538**
Option 3 ID : **878270220535**
Option 4 ID : **878270220536**

Section : **Physics Section B**

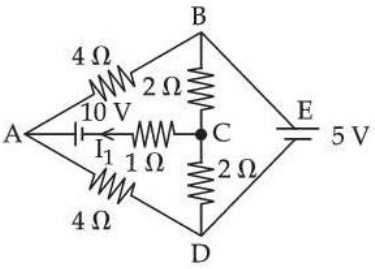
Q.51 In a Young's double slit experiment, the intensity at a point is $\left(\frac{1}{4}\right)^{th}$ of the maximum intensity, the minimum distance of the point from the central maximum is _____ μm.
(Given : $\lambda = 600$ nm, $d = 1.0$ mm, $D = 1.0$ m)

Question Type : **SA**
Question ID : **87827056206**

Q.52 If $\vec{a}$ and $\vec{b}$ makes an angle $\cos^{-1}\left(\frac{5}{9}\right)$ with each other, then $|\vec{a} + \vec{b}| = \sqrt{2}|\vec{a} - \vec{b}|$ for $|\vec{a}| = n|\vec{b}|$
The integer value of n is _____.

Question Type : **SA**
Question ID : **87827056198**

Q.53 The current flowing through the 1 Ω resistor is $\frac{n}{10}$ A. The value of n is _____.



Question Type : **SA**
Question ID : **87827056203**

Q.54 When a coil is connected across a 20 V dc supply, it draws a current of 5 A. When it is connected across 20 V, 50 Hz ac supply, it draws a current of 4 A. The self inductance of the coil is _____ mH. (Take $\pi = 3$)

Question Type : **SA**
Question ID : **87827056205**

Q.55 The position, velocity and acceleration of a particle executing simple harmonic motion are found to have magnitudes of 4 m, 2 ms^{-1} and 16 ms^{-2} at a certain instant. The amplitude of the motion is $\sqrt{x}$, m where x is _____.

Question Type : **SA**
Question ID : **87827056201**

Q.56 A square loop of edge length 2 m carrying current of 2 A is placed with its edges parallel to the x-y axis. A magnetic field is passing through the x-y plane and expressed as $\vec{B} = B_0 (1 + 4x) \hat{k}$, where $B_0 = 5$ T. The net magnetic force experienced by the loop is _____ N.

Question Type : **SA**
Question ID : **87827056204**

Q.57 A star has 100% helium composition. It starts to convert three ^4He into one ^{12}C via triple alpha process as $^4He + {}^4He + {}^4He \rightarrow {}^{12}C + Q$. The mass of the star is 2.0×10^{32} kg and it generates energy at the rate of 5.808×10^{30} W. The rate of converting these ^4He to ^{12}C is $n \times 10^{42}\ s^{-1}$, where n is _____.
[Take, mass of $^4He = 4.0026$ u, mass of $^{12}C = 12$ u]

Question Type : **SA**
Question ID : **87827056207**

Q.58 A string is wrapped around the rim of a wheel of moment of inertia 0.40 kgm^2 and radius 10 cm. The wheel is free to rotate about its axis. Initially the wheel is at rest. The string is now pulled by a force of 40 N. The angular velocity of the wheel after 10 s is x rad/s, where x is _____.

Question Type : **SA**
Question ID : **87827056199**

Q.59 Two persons pull a wire towards themselves. Each person exerts a force of 200 N on the wire. Young's modulus of the material of wire is 1×10^{11} N m^{-2}. Original length of the wire is 2 m and the area of cross section is 2 cm^2. The wire will extend in length by _____ μm.

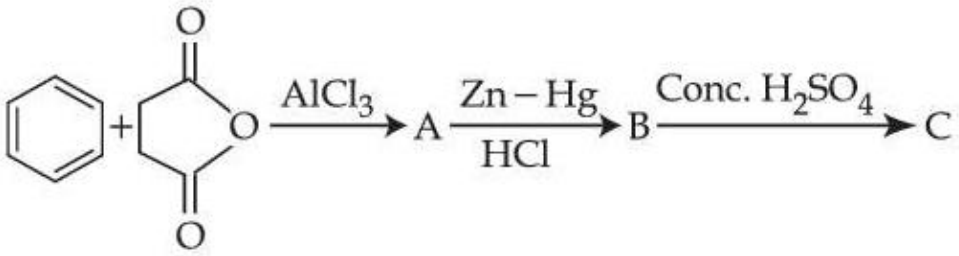
Question Type : **SA**
Question ID : **87827056200**

Q.60 At the centre of a half ring of radius R = 10 cm and linear charge density 4n C m^{-1}, the potential is $x\ \pi$ V. The value of x is _____.

Question Type : **SA**
Question ID : **87827056202**

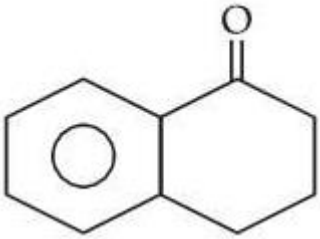
Section : **Chemistry Section A**

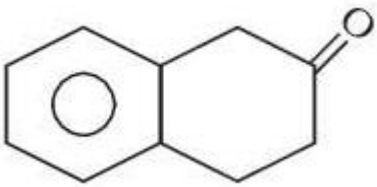
Q.61

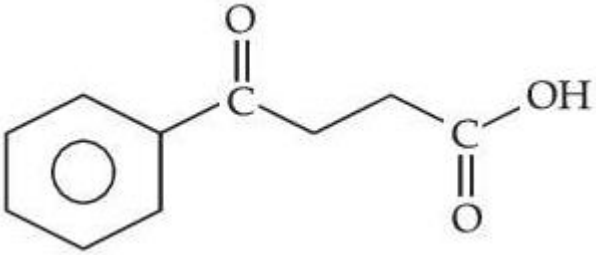


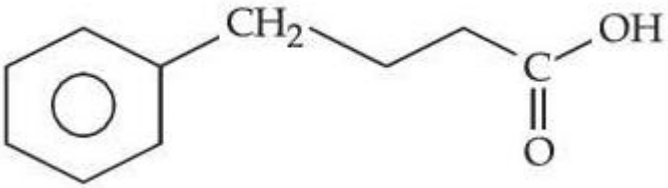
What is the structure of C ?

Options

1. 

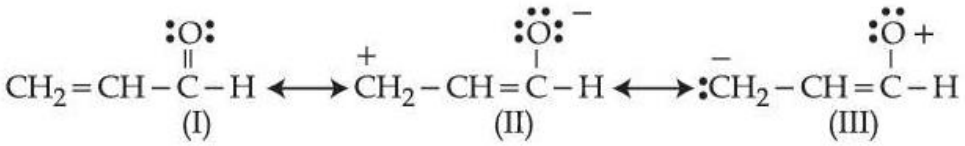
2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **87827056219**
Option 1 ID : **878270220625**
Option 2 ID : **878270220626**
Option 3 ID : **878270220627**
Option 4 ID : **878270220628**

Q.62 Relative stability of the contributing structures is :

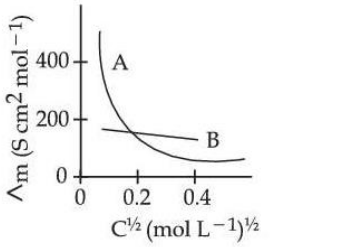


Options

1. (I) > (II) > (III)
2. (III) > (II) > (I)
3. (II) > (I) > (III)
4. (I) > (III) > (II)

Question Type : **MCQ**
Question ID : **87827056218**
Option 1 ID : **878270220624**
Option 2 ID : **878270220621**
Option 3 ID : **878270220622**
Option 4 ID : **878270220623**

Q.63 The molar conductivity for electrolytes A and B are plotted against $C^{1/2}$ as shown below. Electrolytes A and B respectively are :



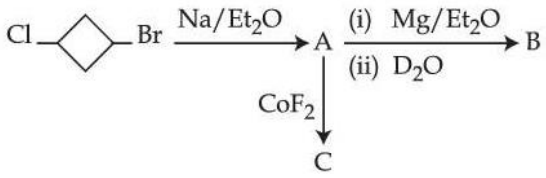
A B

Options

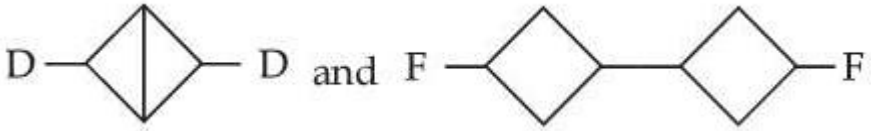
1. weak electrolyte strong electrolyte
2. weak electrolyte weak electrolyte
3. strong electrolyte strong electrolyte
4. strong electrolyte weak electrolyte

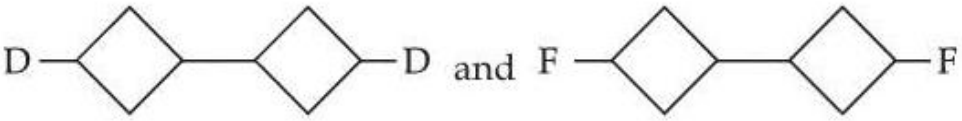
Question Type : **MCQ**
Question ID : **87827056211**
Option 1 ID : **878270220593**
Option 2 ID : **878270220595**
Option 3 ID : **878270220596**
Option 4 ID : **878270220594**

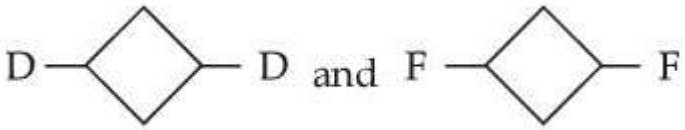
Q.64 In the following sequence of reaction, the major products B and C respectively are :

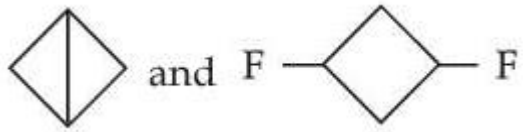


Options

1. 

2. 

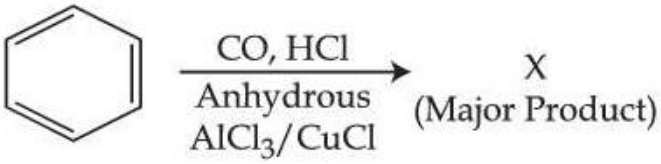
3. 

4. 

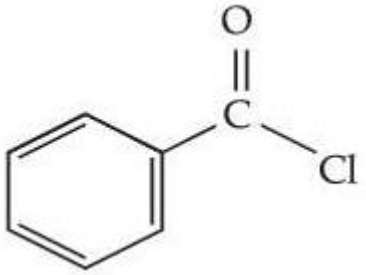
Question Type : **MCQ**
Question ID : **87827056221**
Option 1 ID : **878270220636**
Option 2 ID : **878270220633**
Option 3 ID : **878270220635**
Option 4 ID : **878270220634**

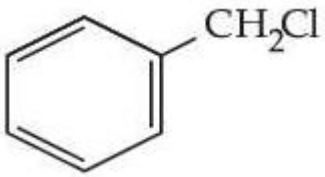
Q.65

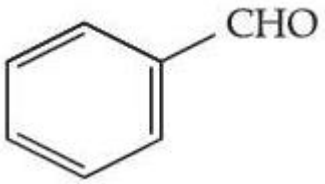
Identify major product "X" formed in the following reaction :

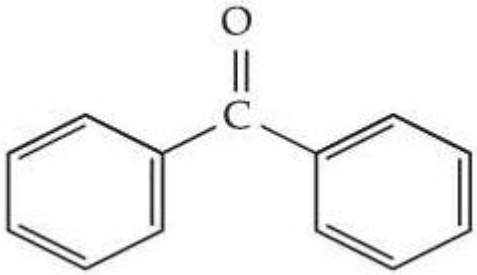


Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **87827056222**
Option 1 ID : **878270220637**
Option 2 ID : **878270220638**
Option 3 ID : **878270220639**
Option 4 ID : **878270220640**

Q.66 Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : S_N2 reaction of $C_6H_5CH_2Br$ occurs more readily than the S_N2 reaction of CH_3CH_2Br.

Reason (R) : The partially bonded unhybridized p-orbital that develops in the trigonal bipyramidal transition state is stabilized by conjugation with the phenyl ring.

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

Options 1.

Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

2.

Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

3. **(A)** is correct but **(R)** is not correct

4. **(A)** is not correct but **(R)** is correct

Question Type : **MCQ**
Question ID : **87827056220**
Option 1 ID : **878270220629**
Option 2 ID : **878270220630**
Option 3 ID : **878270220631**
Option 4 ID : **878270220632**

Q.67 Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : Both rhombic and monoclinic sulphur exist as S_8 while oxygen exists as O_2.

Reason (R) : Oxygen forms $p\pi - p\pi$ multiple bonds with itself and other elements having small size and high electronegativity like C, N, which is not possible for sulphur.

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

Options 1.

Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

2. **(A)** is not correct but **(R)** is correct

3. **(A)** is correct but **(R)** is not correct

4.

Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

Question Type : **MCQ**
Question ID : **87827056213**
Option 1 ID : **878270220601**
Option 2 ID : **878270220604**
Option 3 ID : **878270220603**
Option 4 ID : **878270220602**

Q.68 The F^- ions make the enamel on teeth much harder by converting hydroxyapatite (the enamel on the surface of teeth) into much harder fluoroapatite having the formula.

Options

1. $[3(Ca_3(PO_4)_3)\cdot CaF_2]$
2. $[3(Ca_2(PO_4)_2)\cdot Ca(OH)_2]$
3. $[3(Ca_3(PO_4)_2)\cdot Ca(OH)_2]$
4. $[3(Ca_3(PO_4)_2)\cdot CaF_2]$

Question Type : **MCQ**
Question ID : **87827056214**
Option 1 ID : **878270220608**
Option 2 ID : **878270220606**
Option 3 ID : **878270220605**
Option 4 ID : **878270220607**

Q.69 Given below are two statements :

Statement (I) : The oxidation state of an element in a particular compound is the charge acquired by its atom on the basis of electron gain enthalpy consideration from other atoms in the molecule.

Statement (II) : $p\pi - p\pi$ bond formation is more prevalent in second period elements over other periods.

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

Question Type : **MCQ**
Question ID : **87827056212**
Option 1 ID : **878270220597**
Option 2 ID : **878270220600**
Option 3 ID : **878270220599**
Option 4 ID : **878270220598**

Q.70 The electronic configuration of Cu(II) is $3d^9$ whereas that of Cu(I) is $3d^{10}$. Which of the following is correct ?

Options

1. Cu(I) and Cu(II) are equally stable
2. Stability of Cu(I) and Cu(II) depends on nature of copper salts
3. Cu(II) is more stable
4. Cu(II) is less stable

Question Type : **MCQ**
Question ID : **87827056215**
Option 1 ID : **878270220611**
Option 2 ID : **878270220612**
Option 3 ID : **878270220609**
Option 4 ID : **878270220610**

Q.71 In which one of the following pairs the central atoms exhibit sp^2 hybridization ?

Options

1. NH_2^- and H_2O
2. NH_2^- and BF_3
3. BF_3 and NO_2^-
4. H_2O and NO_2

Question Type : **MCQ**
Question ID : **87827056209**
Option 1 ID : **878270220585**
Option 2 ID : **878270220588**
Option 3 ID : **878270220586**
Option 4 ID : **878270220587**

Q.72 0.05M $CuSO_4$ when treated with 0.01M $K_2Cr_2O_7$ gives green colour solution of $Cu_2Cr_2O_7$. The two solutions are separated as shown below :

[SPM : Semi Permeable Membrane]

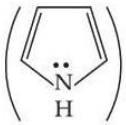
$K_2Cr_2O_7$	$CuSO_4$
Side X	SPM Side Y

Due to osmosis :

Options

1. Molarity of $CuSO_4$ solution is lowered.
2. Green colour formation observed on side Y.
3. Green colour formation observed on side X.
4. Molarity of $K_2Cr_2O_7$ solution is lowered.

Question Type : **MCQ**
Question ID : **87827056210**
Option 1 ID : **878270220592**
Option 2 ID : **878270220589**
Option 3 ID : **878270220590**
Option 4 ID : **878270220591**

Q.73 Correct order of basic strength of Pyrrole  , Pyridine  and Piperidine  is :

Options

1. Pyrrole > Piperidine > Pyridine
2. Pyrrole > Pyridine > Piperidine
3. Piperidine > Pyridine > Pyrrole
4. Pyridine > Piperidine > Pyrrole

Question Type : **MCQ**
Question ID : **87827056225**
Option 1 ID : **878270220651**
Option 2 ID : **878270220650**
Option 3 ID : **878270220649**
Option 4 ID : **878270220652**

Q.74 On reaction of Lead Sulphide with dilute nitric acid which of the following is **not** formed ?

Options

1. Lead nitrate
2. Nitric oxide
3. Nitrous oxide
4. Sulphur

Question Type : **MCQ**
Question ID : **87827056226**
Option 1 ID : **878270220653**
Option 2 ID : **878270220654**
Option 3 ID : **878270220655**
Option 4 ID : **878270220656**

Q.75 Identify the **incorrect** statements regarding primary standard of titrimetric analysis.

(A) It should be purely available in dry form.
(B) It should not undergo chemical change in air.
(C) It should be hygroscopic and should react with another chemical instantaneously and stoichiometrically.
(D) It should be readily soluble in water.
(E) $KMnO_4$ & NaOH can be used as primary standard.

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

Options

1. (C) and (D) only
2. (B) and (E) only
3. (C) and (E) only
4. (A) and (B) only

Question Type : **MCQ**
Question ID : **87827056227**
Option 1 ID : **878270220658**
Option 2 ID : **878270220659**
Option 3 ID : **878270220660**
Option 4 ID : **878270220657**

Q.76 Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : The total number of geometrical isomers shown by $[Co(en)_2Cl_2]^+$ complex ion is three.

Reason (R) : $[Co(en)_2Cl_2]^+$ complex ion has an octahedral geometry.

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

Options

1. **(A)** is not correct but **(R)** is correct

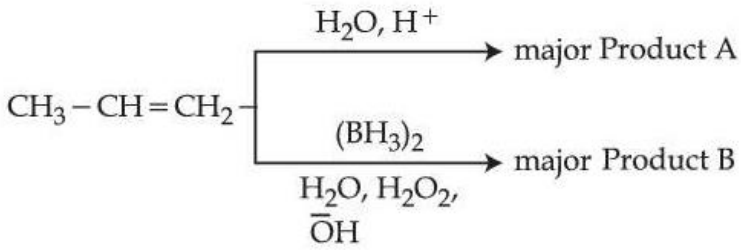
2. Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**

3. Both **(A)** and **(R)** are correct but **(R)** is **not** the correct explanation of **(A)**

4. **(A)** is correct but **(R)** is not correct

Question Type : **MCQ**
Question ID : **87827056216**
Option 1 ID : **878270220616**
Option 2 ID : **878270220613**
Option 3 ID : **878270220614**
Option 4 ID : **878270220615**

Q.77 Identify the product A and product B in the following set of reactions.



Options

1. A - $CH_3CH_2CH_3$ B - $CH_3CH_2CH_3$

2. A - $CH_3CH_2CH_2-OH$ B - $CH_3CH_2CH_2-OH$

3. A - $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$ B - $CH_3CH_2CH_2-OH$

4. A - $CH_3CH_2CH_2-OH$ B - $CH_3\underset{\underset{OH}{|}}{CH}-CH_3$

Question Type : **MCQ**
Question ID : **87827056223**
Option 1 ID : **878270220644**
Option 2 ID : **878270220641**
Option 3 ID : **878270220642**
Option 4 ID : **878270220643**

Q.78 Compare the energies of following sets of quantum numbers for multielectron system.

(A) $n=4, l=1$

(B) $n=4, l=2$

(C) $n=3, l=1$

(D) $n=3, l=2$

(E) $n=4, l=0$

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

Options

1. $(E) < (C) < (D) < (A) < (B)$

2. $(C) < (E) < (D) < (A) < (B)$

3. $(E) > (C) > (A) > (D) > (B)$

4. $(B) > (A) > (C) > (E) > (D)$

Question Type : **MCQ**
Question ID : **87827056208**
Option 1 ID : **878270220583**
Option 2 ID : **878270220582**
Option 3 ID : **878270220581**
Option 4 ID : **878270220584**

Q.79 Methods used for purification of organic compounds are based on :

Options

1. neither on nature of compound nor on the impurity present.

2. nature of compound and presence of impurity.

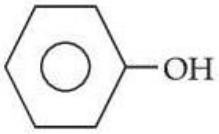
3. presence of impurity only.

4. nature of compound only.

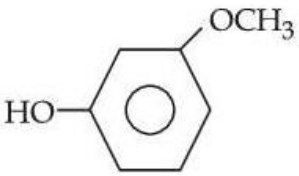
Question Type : **MCQ**
Question ID : **87827056217**
Option 1 ID : **878270220620**
Option 2 ID : **878270220619**
Option 3 ID : **878270220618**
Option 4 ID : **878270220617**

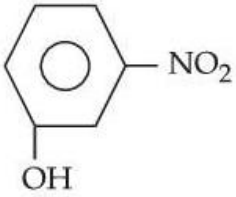
Q.80

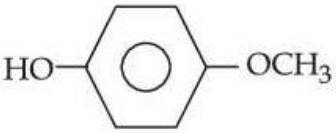
For the given compounds, the correct order of increasing pK_a value :

(A) 

(B) 

(C) 

(D) 

(E) 

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

Options

1. (D) < (E) < (C) < (B) < (A)

2. (B) < (D) < (A) < (C) < (E)

3. (E) < (D) < (B) < (A) < (C)

4. (E) < (D) < (C) < (B) < (A)

Question Type : **MCQ**
Question ID : **87827056224**
Option 1 ID : **878270220648**
Option 2 ID : **878270220647**
Option 3 ID : **878270220646**
Option 4 ID : **878270220645**

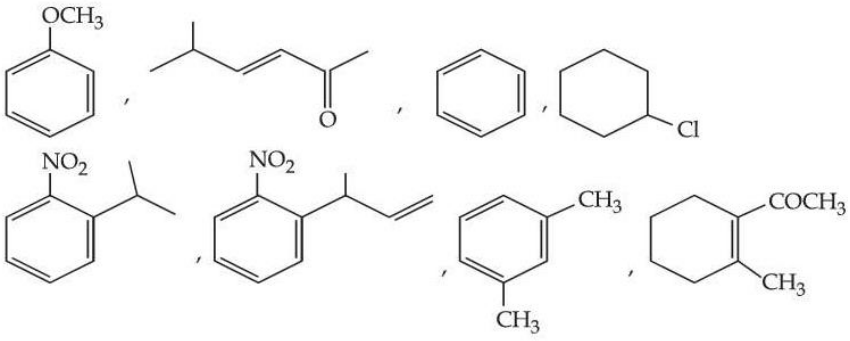
Section : **Chemistry Section B**

Q.81 The total number of species from the following in which one unpaired electron is present, is _____.

$N_2, O_2, C_2^-, O_2^-, O_2^{2-}, H_2^+, CN^-, He_2^+$

Question Type : **SA**
Question ID : **87827056229**

Q.82 How many compounds among the following compounds show inductive, mesomeric as well as hyperconjugation effects ?



Question Type : **SA**
Question ID : **87827056236**

Q.83 Molarity (M) of an aqueous solution containing x g of anhyd. $CuSO_4$ in 500 mL solution at 32 °C is 2×10^{-1} M. Its molality will be _____ $\times 10^{-3}$ m. (nearest integer).
[Given density of the solution = 1.25 g/mL]

Question Type : **SA**
Question ID : **87827056228**

Q.84 When equal volume of 1M HCl and 1M H_2SO_4 are separately neutralised by excess volume of 1M NaOH solution. x and y kJ of heat is liberated respectively. The value of y/x is _____.

Question Type : **SA**
Question ID : **87827056231**

Q.85 Number of ambidentate ligands among the following is _____.

$NO_2^-, SCN^-, C_2O_4^{2-}, NH_3, CN^-, SO_4^{2-}, H_2O.$

Question Type : **SA**
Question ID : **87827056235**

Q.86 The standard reduction potentials at 298 K for the following half cells are given below :

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O, \quad E^\circ = 1.33V$

$Fe^{3+}(aq) + 3e^- \rightarrow Fe \qquad E^\circ = -0.04V$

$Ni^{2+}(aq) + 2e^- \rightarrow Ni \qquad E^\circ = -0.25V$

$Ag^+(aq) + e^- \rightarrow Ag \qquad E^\circ = 0.80V$

$Au^{3+}(aq) + 3e^- \rightarrow Au \qquad E^\circ = 1.40V$

Consider the given electrochemical reactions,

The number of metal(s) which will be oxidized be $Cr_2O_7^{2-}$, in aqueous solution is _____.

Question Type : **SA**
Question ID : **87827056232**

Q.87 Total number of essential amino acid among the given list of amino acids is _____.

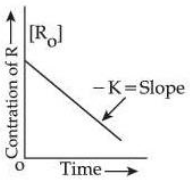
Arginine, Phenylalanine, Aspartic acid, Cysteine, Histidine, Valine, Proline

Question Type : **SA**
Question ID : **87827056237**

Q.88 Given below are two statements :

Statement I : The rate law for the reaction $A + B \rightarrow C$ is rate $(r) = k[A]^2[B]$. When the concentration of both A and B is doubled, the reaction rate is increased "x" times.

Statement II :



The figure is showing "the variation in concentration against time plot" for a "y" order reaction.

The Value of $x + y$ is _____.

Question Type : **SA**
Question ID : **87827056233**

Q.89 Number of colourless lanthanoid ions among the following is _____.

$Eu^{3+}, Lu^{3+}, Nd^{3+}, La^{3+}, Sm^{3+}$

Question Type : **SA**
Question ID : **87827056234**

Q.90 The heat of solution of anhydrous $CuSO_4$ and $CuSO_4 \cdot 5H_2O$ are -70 kJ mol^{-1} and $+12$ kJ mol^{-1} respectively.

The heat of hydration of $CuSO_4$ to $CuSO_4 \cdot 5H_2O$ is $-x$ kJ. The value of x is _____. (nearest integer).

Question Type : **SA**
Question ID : **87827056230**