JEE April 2024

Test Date	06/04/2024
Test Time	3:00 PM - 6:00 PM
Subject	B. Tech

Section : **Mathematics Section A**

Q.1 $\lim\limits_{n\to\infty} \dfrac{\left(1^2-1\right)(n-1)+\left(2^2-2\right)(n-2)+\cdots\cdots+\left((n-1)^2-(n-1)\right)\cdot 1}{\left(1^3+2^3+\cdots\cdots+n^3\right)-\left(1^2+2^2+\cdots\cdots+n^2\right)}$ is equal to :

Options

1. $\dfrac{1}{3}$
2. $\dfrac{3}{4}$
3. $\dfrac{1}{2}$
4. $\dfrac{2}{3}$

Question Type : **MCQ**
Question ID : **87827055886**
Option 1 ID : **878270219624**
Option 2 ID : **878270219626**
Option 3 ID : **878270219623**
Option 4 ID : **878270219625**

Q.2 Suppose for a differentiable function h, $h(0)=0$, $h(1)=1$ and $h'(0)=h'(1)=2$. If $g(x)=h(e^x)e^{h(x)}$, then $g'(0)$ is equal to :

Options

1. 8
2. 4
3. 5
4. 3

Question Type : **MCQ**
Question ID : **87827055887**
Option 1 ID : **878270219630**
Option 2 ID : **878270219628**
Option 3 ID : **878270219629**
Option 4 ID : **878270219627**

Q.3

If the function $f(x)=\left(\frac{1}{x}\right)^{2x}$; $x > 0$ attains the maximum value at $x=\frac{1}{e}$ then :

Options

1. $e^{\pi} < \pi^{e}$
2. $(2e)^{\pi} > \pi^{(2e)}$
3. $e^{2\pi} < (2\pi)^{e}$
4. $e^{\pi} > \pi^{e}$

Question Type : **MCQ**
Question ID : **87827055885**
Option 1 ID : **878270219620**
Option 2 ID : **878270219622**
Option 3 ID : **878270219621**
Option 4 ID : **878270219619**

Q.4

Let P (α, β, γ) be the image of the point Q $(3, -3, 1)$ in the line $\frac{x-0}{1}=\frac{y-3}{1}=\frac{z-1}{-1}$ and R be the point $(2, 5, -1)$. If the area of the triangle PQR is λ and $\lambda^2=14K$, then K is equal to :

Options

1. 36
2. 81
3. 18
4. 72

Question Type : **MCQ**
Question ID : **87827055894**
Option 1 ID : **878270219656**
Option 2 ID : **878270219658**
Option 3 ID : **878270219655**
Option 4 ID : **878270219657**

Q.5 A software company sets up m number of computer systems to finish an assignment in 17 days. If 4 computer systems crashed on the start of the second day, 4 more computer systems crashed on the start of the third day and so on, then it took 8 more days to finish the assignment. The value of m is equal to :

Options

1. 160
2. 125
3. 180
4. 150

Question Type : **MCQ**
Question ID : **87827055884**
Option 1 ID : **878270219617**
Option 2 ID : **878270219616**
Option 3 ID : **878270219618**
Option 4 ID : **878270219615**

Q.6 If z_1, z_2 are two distinct complex number such that $\left|\frac{z_1-2z_2}{\frac{1}{2}-z_1\bar{z}_2}\right|=2$, then

Options

1. both z_1 and z_2 lie on the same circle.
2. z_1 lies on a circle of radius $\frac{1}{2}$ and z_2 lies on a circle of radius 1.
3. either z_1 lies on a circle of radius 1 or z_2 lies on a circle of radius $\frac{1}{2}$.
4. either z_1 lies on a circle of radius $\frac{1}{2}$ or z_2 lies on a circle of radius 1.

Question Type : **MCQ**
Question ID : **87827055880**
Option 1 ID : **878270219599**
Option 2 ID : **878270219600**
Option 3 ID : **878270219602**
Option 4 ID : **878270219601**

Q.7 Let $0 \le r \le n$. If ${}^{n+1}C_{r+1} : {}^{n}C_{r} : {}^{n-1}C_{r-1} = 55 : 35 : 21$, then $2n+5r$ is equal to :

Options

1. 62
2. 50
3. 60
4. 55

Question Type : **MCQ**
Question ID : **87827055883**
Option 1 ID : **878270219614**
Option 2 ID : **878270219611**
Option 3 ID : **878270219613**
Option 4 ID : **878270219612**

Q.8 If $\int \frac{1}{a^2\sin^2 x + b^2\cos^2 x}\,dx = \frac{1}{12}\tan^{-1}(3\tan x) + \text{constant}$, then the maximum value of $a\sin x + b\cos x$, is :

Options

1. $\sqrt{42}$
2. $\sqrt{41}$
3. $\sqrt{39}$
4. $\sqrt{40}$

Question Type : **MCQ**
Question ID : **87827055889**
Option 1 ID : **878270219635**
Option 2 ID : **878270219638**
Option 3 ID : **878270219636**
Option 4 ID : **878270219637**

Q.9

Let $\vec{a}=2\hat{i}+\hat{j}-\hat{k}, \vec{b}=\left(\left(\vec{a}\times\left(\hat{i}+\hat{j}\right)\right)\times\hat{i}\right)\times\hat{i}$. Then the square of the projection of $\vec{a}$ on $\vec{b}$ is :

Options

1. $\frac{2}{3}$
2. $\frac{1}{3}$
3. $\frac{1}{5}$
4. 2

Question Type : **MCQ**
Question ID : **87827055895**
Option 1 ID : **878270219661**
Option 2 ID : **878270219659**
Option 3 ID : **878270219662**
Option 4 ID : **878270219660**

Q.10

Let $\vec{a}=6\hat{i}+\hat{j}-\hat{k}$ and $\vec{b}=\hat{i}+\hat{j}$. If $\vec{c}$ is a is vector such that $|\vec{c}|\geq 6$, $\vec{a}\cdot\vec{c}=6|\vec{c}|$, $|\vec{c}-\vec{a}|=2\sqrt{2}$ and the angle between $\vec{a}\times\vec{b}$ and $\vec{c}$ is 60°, then $\left|\left(\vec{a}\times\vec{b}\right)\times\vec{c}\right|$ is equal to :

Options

1. $\frac{3}{2}\sqrt{3}$
2. $\frac{9}{2}\left(6+\sqrt{6}\right)$
3. $\frac{9}{2}\left(6-\sqrt{6}\right)$
4. $\frac{3}{2}\sqrt{6}$

Question Type : **MCQ**
Question ID : **87827055896**
Option 1 ID : **878270219663**
Option 2 ID : **878270219666**
Option 3 ID : **878270219665**
Option 4 ID : **878270219664**

Q.11 Let $A = \{1, 2, 3, 4, 5\}$. Let R be a relation on A defined by xRy if and only if $4x \leq 5y$. Let m be the number of elements in R and n be the minimum number of elements from $A \times A$ that are required to be added to R to make it a symmetric relation. Then $m + n$ is equal to :

Options

1. 23
2. 24
3. 26
4. 25

Question Type : **MCQ**
Question ID : **87827055879**
Option 1 ID : **878270219595**
Option 2 ID : **878270219596**
Option 3 ID : **878270219598**
Option 4 ID : **878270219597**

Q.12 If the locus of the point, whose distances from the point (2, 1) and (1, 3) are in the ratio 5 : 4, is $ax^2 + by^2 + cxy + dx + ey + 170 = 0$, then the value of $a^2 + 2b + 3c + 4d + e$ is equal to :

Options

1. -27
2. 437
3. 5
4. 37

Question Type : **MCQ**
Question ID : **87827055891**
Option 1 ID : **878270219645**
Option 2 ID : **878270219644**
Option 3 ID : **878270219643**
Option 4 ID : **878270219646**

Q.13 If A is a square matrix of order 3 such that $\det(A)=3$ and $\det(\text{adj}(-4\ \text{adj}(-3\ \text{adj}(3\ \text{adj}((2A)^{-1})))))=2^m\ 3^n$, then $m+2n$ is equal to :

Options

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

Question Type : **MCQ**
Question ID : **87827055881**
Option 1 ID : **878270219606**
Option 2 ID : **878270219603**
Option 3 ID : **878270219605**
Option 4 ID : **878270219604**

Q.14 Suppose the solution of the differential equation $\frac{dy}{dx}=\frac{(2+\alpha)x-\beta y+2}{\beta x-2\alpha y-(\beta\gamma-4\alpha)}$ represents a circle passing through origin. Then the radius of this circle is :

Options

1. $\frac{\sqrt{17}}{2}$
2. 2
3. $\sqrt{17}$
4. $\frac{1}{2}$

Question Type : **MCQ**
Question ID : **87827055890**
Option 1 ID : **878270219639**
Option 2 ID : **878270219640**
Option 3 ID : **878270219641**
Option 4 ID : **878270219642**

Q.15

If the area of the region $\left\{(x,y):\ \frac{a}{x^2}\le y\le\frac{1}{x},\ 1\le x\le 2,\ 0<a<1\right\}$ is $(\log_e 2)-\frac{1}{7}$ then the value of $7a-3$ is equal to :

Options

1. 1
2. -1
3. 0
4. 2

Question Type : **MCQ**
Question ID : **87827055888**
Option 1 ID : **878270219633**
Option 2 ID : **878270219631**
Option 3 ID : **878270219632**
Option 4 ID : **878270219634**

Q.16

Let $f(x)=\frac{1}{7-\sin 5x}$ be a function defined on **R**. Then the range of the function $f(x)$ is equal to :

Options

1. $\left[\frac{1}{7},\frac{1}{5}\right]$
2. $\left[\frac{1}{8},\frac{1}{5}\right]$
3. $\left[\frac{1}{8},\frac{1}{6}\right]$
4. $\left[\frac{1}{7},\frac{1}{6}\right]$

Question Type : **MCQ**
Question ID : **87827055878**
Option 1 ID : **878270219592**
Option 2 ID : **878270219591**
Option 3 ID : **878270219594**
Option 4 ID : **878270219593**

Q.17 If P(6, 1) be the orthocentre of the triangle whose vertices are A (5, −2), B(8, 3) and C (h, k), then the point C lies on the circle :

Options

1. $x^2+y^2-61=0$
2. $x^2+y^2-74=0$
3. $x^2+y^2-52=0$
4. $x^2+y^2-65=0$

Question Type : **MCQ**
Question ID : **87827055892**
Option 1 ID : **878270219648**
Option 2 ID : **878270219650**
Option 3 ID : **878270219647**
Option 4 ID : **878270219649**

Q.18 If three letters can be posted to any one of the 5 different addresses, then the probability that the three letters are posted to exactly two addresses is :

Options

1. $\frac{6}{25}$
2. $\frac{12}{25}$
3. $\frac{4}{25}$
4. $\frac{18}{25}$

Question Type : **MCQ**
Question ID : **87827055897**
Option 1 ID : **878270219668**
Option 2 ID : **878270219669**
Option 3 ID : **878270219667**
Option 4 ID : **878270219670**

Q.19 If all the words with or without meaning made using all the letters of the word "NAGPUR" are arranged as in a dictionary, then the word at 315^{th} position in this arrangement is :

Options

1. NRAGPU
2. NRAGUP
3. NRAPGU
4. NRAPUG

Question Type : **MCQ**
Question ID : **87827055882**
Option 1 ID : **878270219607**
Option 2 ID : **878270219609**
Option 3 ID : **878270219608**
Option 4 ID : **878270219610**

Q.20 Let ABC be an equilateral triangle. A new triangle is formed by joining the middle points of all sides of the triangle ABC and the same process is repeated infinitely many times. If P is the sum of perimeters and Q is be the sum of areas of all the triangles formed in this process, then :

Options

1. $P^2=6\sqrt{3}Q$
2. $P^2=36\sqrt{3}Q$
3. $P=36\sqrt{3}Q^2$
4. $P^2=72\sqrt{3}Q$

Question Type : **MCQ**
Question ID : **87827055893**
Option 1 ID : **878270219652**
Option 2 ID : **878270219653**
Option 3 ID : **878270219651**
Option 4 ID : **878270219654**

Section : **Mathematics Section B**

Q.21 If $S(x)=(1+x)+2(1+x)^2+3(1+x)^3+\cdots+60(1+x)^{60}$, $x\neq 0$, and $(60)^2 S(60)=a(b)^b+b$, where $a, b\in N$, then $(a+b)$ equal to _____.

Question Type : **SA**
Question ID : **87827055900**

Q.22 Let α, β be roots of $x^2+\sqrt{2}x-8=0$. If $U_n=\alpha^n+\beta^n$, then $\frac{U_{10}+\sqrt{2}U_9}{2U_8}$ is equal to _____.

Question Type : **SA**
Question ID : **87827055898**

Q.23 If the system of equations

$$2x+7y+\lambda z=3$$
$$3x+2y+5z=4$$
$$x+\mu y+32z=-1$$

has infinitely many solutions, then $(\lambda-\mu)$ is equal to _____ :

Question Type : **SA**
Question ID : **87827055899**

Q.24 If the shortest distance between the lines $\frac{x-\lambda}{3}=\frac{y-2}{-1}=\frac{z-1}{1}$ and $\frac{x+2}{-3}=\frac{y+5}{2}=\frac{z-4}{4}$ is $\frac{44}{\sqrt{30}}$, then the largest possible value of $|\lambda|$ is equal to _____.

Question Type : **SA**
Question ID : **87827055905**

Q.25 The length of the latus rectum and directrices of a hyperbola with eccentricity e are 9 and $x=\pm\frac{4}{\sqrt{3}}$, respectively. Let the line $y-\sqrt{3}x+\sqrt{3}=0$ touch this hyperbola at (x_0, y_0). If m is the product of the focal distances of the point (x_0, y_0), then $4e^2+m$ is equal to _____.

Question Type : **SA**
Question ID : **87827055904**

Q.26 Let [t] denote the greatest integer less than or equal to t. Let $f:[0,\infty)\to\mathbf{R}$ be a function defined by $f(x)=\left[\frac{x}{2}+3\right]-[\sqrt{x}]$. Let S be the set of all points in the interval [0, 8] at which f is not continuous. Then $\sum_{a\in S} a$ is equal to _____.

Question Type : **SA**
Question ID : **87827055901**

Q.27 If the solution $y(x)$ of the given differential equation $(e^y+1)\cos x\,dx+e^y\sin x\,dy=0$ passes through the point $\left(\frac{\pi}{2},0\right)$, then the value of $e^{y\left(\frac{\pi}{6}\right)}$ is equal to _____.

Question Type : **SA**
Question ID : **87827055903**

Q.28 In a triangle ABC, BC=7, AC=8, AB=$\alpha\in\mathbf{N}$ and $\cos A=\frac{2}{3}$. If $49\cos(3C)+42=\frac{m}{n}$, where gcd(m,n)=1, then m+n is equal to _____.

Question Type : **SA**
Question ID : **87827055907**

Q.29 Let [t] denote the largest integer less than or equal to t. If

$$\int_0^3 \left([x^2] + \left[\frac{x^2}{2} \right] \right) dx = a + b\sqrt{2} - \sqrt{3} - \sqrt{5} + c\sqrt{6} - \sqrt{7}$$, where a, b, c $\in$ **Z**, then a + b + c is equal to _____.

Question Type : **SA**
Question ID : **87827055902**

Q.30 From a lot of 12 items containing 3 defectives, a sample of 5 items is drawn at random. Let the random variable X denote the number of defective items in the sample. Let items in the sample be drawn one by one without replacement. If variance of X is $\frac{m}{n}$, where gcd(m, n) = 1, then n − m is equal to _____.

Question Type : **SA**
Question ID : **87827055906**

Section : **Physics Section A**

Q.31 In the given electromagnetic wave $E_y = 600 \sin(\omega t - kx)\ Vm^{-1}$, intensity of the associated light beam is (in W/m^2 : (Given $\epsilon_0 = 9 \times 10^{-12} C^2 N^{-1} m^{-2}$)

Options

1. 729
2. 972
3. 486
4. 243

Question Type : **MCQ**
Question ID : **87827055922**
Option 1 ID : **878270219737**
Option 2 ID : **878270219738**
Option 3 ID : **878270219740**
Option 4 ID : **878270219739**

Q.32 When UV light of wavelength 300 nm is incident on the metal surface having work function 2.13 eV, electron emission takes place. The stopping potential is :
(Given hc = 1240 eV nm)

Options

1. 4 V
2. 2 V
3. 1.5 V
4. 4.1 V

Question Type : **MCQ**
Question ID : **87827055924**
Option 1 ID : **878270219748**
Option 2 ID : **878270219747**
Option 3 ID : **878270219746**
Option 4 ID : **878270219745**

Q.33 Energy of 10 non rigid diatomic molecules at temperature T is :

Options

1. 35 RT
2. $\frac{7}{2}$ RT
3. 70 K_BT
4. 35 K_BT

Question Type : **MCQ**
Question ID : **87827055918**
Option 1 ID : **878270219721**
Option 2 ID : **878270219723**
Option 3 ID : **878270219722**
Option 4 ID : **878270219724**

Q.34 Given below are two statements :

Statement (I) : Dimensions of specific heat is $[L^2T^{-2}K^{-1}]$.

Statement (II) : Dimensions of gas constant is $[M\,L^2\,T^{-1}K^{-1}]$.

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

Options 1. **Statement (I)** is correct but **statement (II)** is incorrect

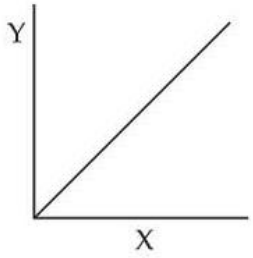
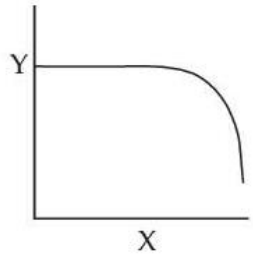
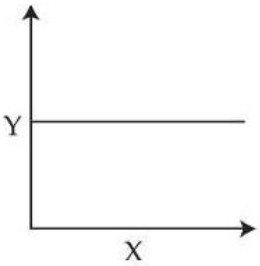
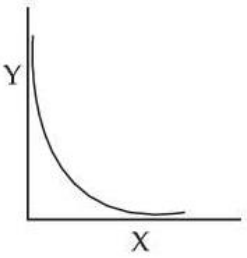
2. Both **statement (I)** and **statement (II)** are correct

3. **Statement (I)** is incorrect but **statement (II)** is correct

4. Both **statement (I)** and **statement (II)** are incorrect

Question Type : **MCQ**
Question ID : **87827055909**
Option 1 ID : **878270219687**
Option 2 ID : **878270219685**
Option 3 ID : **878270219688**
Option 4 ID : **878270219686**

Q.35 Match **List-I** with **List-II** :

List-I Y vs X	**List-II** Shape of Graph
(A) Y = magnetic susceptibility X = magnetising field	(I) 
(B) Y = magnetic field X = distance from centre of a current carrying wire for $x < a$ (where a = radius of wire)	(II) 
(C) Y = magnetic field X = distance from centre of a current carrying wire for $x > a$ (where a = radius of wire)	(III) 
(D) Y = magnetic field inside solenoid X = distance from centre	(IV) 

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

Options

1. (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
2. (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
3. (A)-(IV), (B)-(I), (C)-(III), (D)-(II)
4. (A)-(III), (B)-(IV), (C)- (I), (D)-(II)

Question Type : **MCQ**
Question ID : **87827055912**
Option 1 ID : **878270219698**
Option 2 ID : **878270219699**
Option 3 ID : **878270219697**
Option 4 ID : **878270219700**

Q.36 The longest wavelength associated with Paschen series is : (Given $R_H = 1.097 \times 10^7$ SI unit)

Options

1. 1.876×10^{-6} m
2. 2.973×10^{-6} m
3. 3.646×10^{-6} m
4. 1.094×10^{-6} m

Question Type : **MCQ**
Question ID : **87827055925**
Option 1 ID : **878270219750**
Option 2 ID : **878270219749**
Option 3 ID : **878270219752**
Option 4 ID : **878270219751**

Q.37 A car of 800 kg is taking turn on a banked road of radius 300 m and angle of banking 30°. If coefficient of static friction is 0.2 then the maximum speed with which car can negotiate the turn safely : ($g = 10$ m/s^2, $\sqrt{3} = 1.73$)

Options

1. 264 m/s
2. 102.8 m/s
3. 51.4 m/s
4. 70.4 m/s

Question Type : **MCQ**
Question ID : **87827055908**
Option 1 ID : **878270219682**
Option 2 ID : **878270219683**
Option 3 ID : **878270219681**
Option 4 ID : **878270219684**

Q.38 For the thin convex lens, the radii of curvature are at 15 cm and 30 cm respectively. The focal length the lens is 20 cm. The refractive index of the material is :

Options

1. 1.8
2. 1.5
3. 1.2
4. 1.4

Question Type : **MCQ**
Question ID : **87827055923**
Option 1 ID : **878270219744**
Option 2 ID : **878270219742**
Option 3 ID : **878270219743**
Option 4 ID : **878270219741**

Q.39 The number of electrons flowing per second in the filament of a 110 W bulb operating at 220 V is : (Given $e = 1.6 \times 10^{-19}$ C)

Options

1. 1.25×10^{19}
2. 31.25×10^{17}
3. 6.25×10^{18}
4. 6.25×10^{17}

Question Type : **MCQ**
Question ID : **87827055920**
Option 1 ID : **878270219730**
Option 2 ID : **878270219731**
Option 3 ID : **878270219732**
Option 4 ID : **878270219729**

Q.40 A body of weight 200 N is suspended from a tree branch through a chain of mass 10 kg. The branch pulls the chain by a force equal to (if $g = 10\ m/s^2$) :

Options

1. 150 N
2. 300 N
3. 100 N
4. 200 N

Question Type : **MCQ**
Question ID : **87827055911**
Option 1 ID : **878270219696**
Option 2 ID : **878270219695**
Option 3 ID : **878270219694**
Option 4 ID : **878270219693**

Q.41 In a vernier calliper, when both jaws touch each other, zero of the vernier scale shifts towards left and its 4^{th} division coincides exactly with a certain division on main scale. If 50 vernier scale divisions equal to 49 main scale divisions and zero error in the instrument is 0.04 mm then how many main scale divisions are there in 1 cm ?

Options

1. 5
2. 20
3. 10
4. 40

Question Type : **MCQ**
Question ID : **87827055917**
Option 1 ID : **878270219720**
Option 2 ID : **878270219718**
Option 3 ID : **878270219717**
Option 4 ID : **878270219719**

Q.42 In a coil, the current changes from -2 A to $+2$A in 0.2 s and induces an emf of 0.1 V. The self inductance of the coil is :

Options

1. 4 mH
2. 5 mH
3. 1 mH
4. 2.5 mH

Question Type : **MCQ**
Question ID : **87827055921**
Option 1 ID : **878270219735**
Option 2 ID : **878270219736**
Option 3 ID : **878270219733**
Option 4 ID : **878270219734**

Q.43 When kinetic energy of a body becomes 36 times of its original value, the percentage increase in the momentum of the body will be :

Options

1. 500%
2. 60%
3. 600%
4. 6%

Question Type : **MCQ**
Question ID : **87827055913**
Option 1 ID : **878270219702**
Option 2 ID : **878270219703**
Option 3 ID : **878270219704**
Option 4 ID : **878270219701**

Q.44 Two identical conducting spheres P and S with charge Q on each, repel each other with a force 16 N. A third identical uncharged conducting sphere R is successively brought in contact with the two spheres. The new force of repulsion between P and S is :

Options

1. 1 N
2. 6 N
3. 4 N
4. 12 N

Question Type : **MCQ**
Question ID : **87827055919**
Option 1 ID : **878270219728**
Option 2 ID : **878270219725**
Option 3 ID : **878270219727**
Option 4 ID : **878270219726**

Q.45 A body projected vertically upwards with a certain speed from the top of a tower reaches the ground in t_1. If it is projected vertically downwards from the same point with the same speed, it reaches the ground in t_2. Time required to reach the ground, if it is dropped from the top of the tower, is :

Options

1. $\sqrt{t_1+t_2}$
2. $\sqrt{t_1-t_2}$
3. $\sqrt{\frac{t_1}{t_2}}$
4. $\sqrt{t_1 t_2}$

Question Type : **MCQ**
Question ID : **87827055910**
Option 1 ID : **878270219690**
Option 2 ID : **878270219691**
Option 3 ID : **878270219692**
Option 4 ID : **878270219689**

Q.46 Assuming the earth to be a sphere of uniform mass density, a body weighed 300 N on the surface of earth. How much it would weigh at R/4 depth under surface of earth ?

Options

1. 75 N
2. 300 N
3. 375 N
4. 225 N

Question Type : **MCQ**
Question ID : **87827055914**
Option 1 ID : **878270219705**
Option 2 ID : **878270219707**
Option 3 ID : **878270219708**
Option 4 ID : **878270219706**

Q.47 In finding out refractive index of glass slab the following observations were made through travelling microscope 50 vernier scale division = 49 MSD; 20 divisions on main scale in each cm

For mark on paper

MSR = 8.45 cm, VC = 26

For mark on paper seen through slab

MSR = 7.12 cm, VC = 41

For powder particle on the top surface of the glass slab

MSR = 4.05 cm, VC = 1

(MSR = Main Scale Reading, VC = Vernier Coincidence)

Refractive index of the glass slab is :

Options

1. 1.52
2. 1.24
3. 1.42
4. 1.35

Question Type : **MCQ**
Question ID : **87827055927**
Option 1 ID : **878270219760**
Option 2 ID : **878270219757**
Option 3 ID : **878270219758**
Option 4 ID : **878270219759**

Q.48 Pressure inside a soap bubble is greater than the pressure outside by an amount :
(given : R = Radius of bubble, S = Surface tension of bubble)

Options

1. $\frac{4R}{S}$
2. $\frac{2S}{R}$
3. $\frac{S}{R}$
4. $\frac{4S}{R}$

Question Type : **MCQ**
Question ID : **87827055915**
Option 1 ID : **878270219712**
Option 2 ID : **878270219709**
Option 3 ID : **878270219711**
Option 4 ID : **878270219710**

Q.49 A total of 48 J heat is given to one mole of helium kept in a cylinder. The temperature of helium increases by 2°C. The work done by the gas is :
Given, R = 8.3 J K^{-1} mol^{-1}.

Options

1. 48 J
2. 24.9 J
3. 72.9 J
4. 23.1 J

Question Type : **MCQ**
Question ID : **87827055916**
Option 1 ID : **878270219714**
Option 2 ID : **878270219713**
Option 3 ID : **878270219715**
Option 4 ID : **878270219716**

Q.50 The acceptor level of a p-type semiconductor is 6 eV. The maximum wavelength of light which can create a hole would be : Given hc = 1242 eV nm.

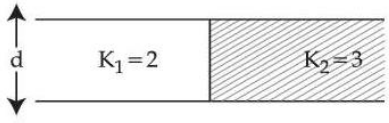
Options

1. 414 nm
2. 407 nm
3. 207 nm
4. 103.5 nm

Question Type : **MCQ**
Question ID : **87827055926**
Option 1 ID : **878270219755**
Option 2 ID : **878270219754**
Option 3 ID : **878270219753**
Option 4 ID : **878270219756**

Section : **Physics Section B**

Q.51 A capacitor of 10 μF capacitance whose plates are separated by 10 mm through air and each plate has area 4 cm^2 is now filled equally with two dielectric media of $K_1 = 2$, $K_2 = 3$ respectively as shown in figure. If new force between the plates is 8 N. The supply voltage is _____ V.



Question Type : **SA**
Question ID : **87827055929**

Q.52 Three balls of masses 2kg, 4kg and 6kg respectively are arranged at centre of the edges of an equilateral triangle of side 2 m. The moment of intertia of the system about an axis through the centroid and perpendicular to the plane of triangle, will be _____ kg m^2.

Question Type : **SA**
Question ID : **87827055933**

Q.53 A particle moves in a straight line so that its displacement x at any time t is given by $x^2=1+t^2$. Its acceleration at any time t is x^{-n} where n = _____.

Question Type : **SA**
Question ID : **87827055934**

Q.54 Two coherent monochromatic light beams of intensities I and 4 I are superimposed. The difference between maximum and minimum possible intensities in the resulting beam is x I. The value of x is _____.

Question Type : **SA**
Question ID : **87827055931**

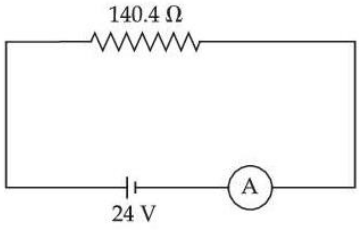
Q.55 Two open organ pipes of lengths 60 cm and 90 cm resonate at 6^{th} and 5^{th} harmonics respectively. The difference of frequencies for the given modes is _____ Hz.
(Velocity of sound in air = 333 m/s)

Question Type : **SA**
Question ID : **87827055928**

Q.56 A coil having 100 turns, area of 5×10^{-3} m^2, carrying current of 1 mA is placed in uniform magnetic field of 0.20 T such a way that plane of coil is perpendicular to the magnetic field. The work done in turning the coil through 90° is _____ **μJ.**

Question Type : **SA**
Question ID : **87827055935**

Q.57 In the given figure an ammeter A consists of a 240 Ω coil connected in parallel to a 10 Ω shunt. The reading of the ammeter is _____ mA.



Question Type : **SA**
Question ID : **87827055930**

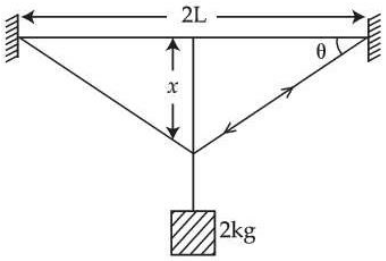
Q.58 In Franck-Hertz experiment, the first dip in the current-voltage graph for hydrogen is observed at 10.2 V. The wavelength of light emitted by hydrogen atom when excited to the first excitation level is _____ nm. (Given hc = 1245 eV nm, e = 1.6×10^{-19}C).

Question Type : **SA**
Question ID : **87827055932**

Q.59 For a given series LCR circuit it is found that maximum current is drawn when value of variable capacitance is 2.5 nF. If resistance of 200Ω and 100 mH inductor is being used in the given circuit. The frequency of ac source is _____ $\times 10^3$ Hz. (given $\pi^2 = 10$)

Question Type : **SA**
Question ID : **87827055936**

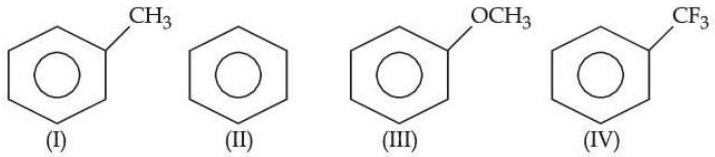
Q.60 A wire of cross sectional area A, modulus of elasticity 2×10^{11} Nm^{-2} and length 2 m is stretched between two vertical rigid supports. When a mass of 2 kg is suspended at the middle it sags lower from its original position making angle $\theta = \frac{1}{100}$ radian on the points of support. The value of A is _____ $\times$ 10^{-4} m^2 (consider x<<L).
(given : g = 10 m/s^2)



Question Type : **SA**
Question ID : **87827055937**

Section : **Chemistry Section A**

Q.61



The **correct** arrangement for decreasing order of electrophilic substitution for above compounds is :

Options

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

Question Type : **MCQ**
Question ID : **87827055951**
Option 1 ID : **878270219825**
Option 2 ID : **878270219823**
Option 3 ID : **878270219826**
Option 4 ID : **878270219824**

Q.62 The incorrect statement regarding the geometrical isomers of 2-butene is :

Options 1.

cis-2-butene has less dipole moment than trans-2-butene.

2. trans-2-butene is more stable than cis-2-butene.

3.

cis-2-butene and trans-2-butene are not interconvertible at room temperature.

4. cis-2-butene and trans-2-butene are stereoisomers.

Question Type : **MCQ**
Question ID : **87827055952**
Option 1 ID : **878270219830**
Option 2 ID : **878270219829**
Option 3 ID : **878270219828**
Option 4 ID : **878270219827**

Q.63 The ratio $\frac{K_P}{K_C}$ for the reaction :

$CO_{(g)} + \frac{1}{2} O_{2(g)} \rightleftharpoons CO_{2(g)}$ is :

Options

1. $(RT)^{1/2}$

2. RT

3. 1

4. $\frac{1}{\sqrt{RT}}$

Question Type : **MCQ**
Question ID : **87827055940**
Option 1 ID : **878270219780**
Option 2 ID : **878270219781**
Option 3 ID : **878270219782**
Option 4 ID : **878270219779**

Q.64

The correct IUPAC name of $[PtBr_2(PMe_3)_2]$ is :

Options

1. dibromodi(trimethylphosphine)platinum(II)
2. bis[bromo(trimethylphosphine)]platinum(II)
3. bis(trimethylphosphine)dibromoplatinum(II)
4. dibromobis(trimethylphosphine)platinum(II)

Question Type : **MCQ**
Question ID : **87827055947**
Option 1 ID : **878270219809**
Option 2 ID : **878270219810**
Option 3 ID : **878270219808**
Option 4 ID : **878270219807**

Q.65

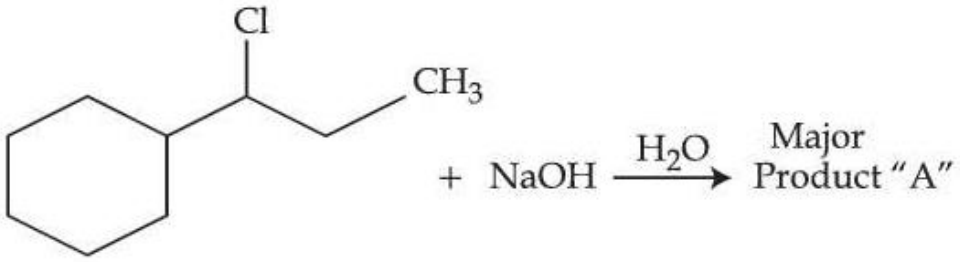
Molality (m) of 3 M aqueous solution of NaCl is :
(Given : Density of solution = 1.25 g mL^{-1}, Molar mass in g mol^{-1} : Na-23, Cl-35.5)

Options

1. 1.90 m
2. 2.79 m
3. 2.90 m
4. 3.85 m

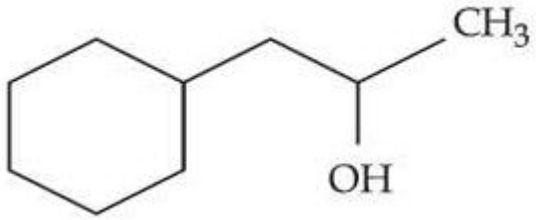
Question Type : **MCQ**
Question ID : **87827055938**
Option 1 ID : **878270219774**
Option 2 ID : **878270219771**
Option 3 ID : **878270219773**
Option 4 ID : **878270219772**

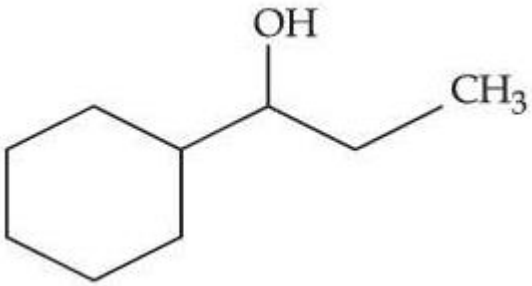
Q.66

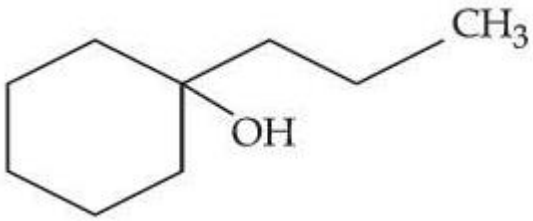


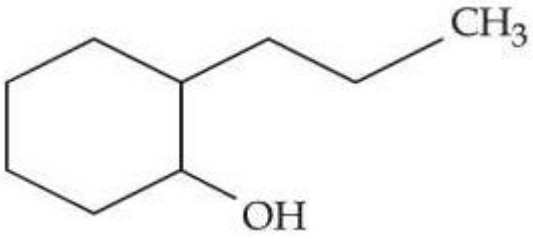
Consider the above chemical reaction. Product "A" is :

Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**
Question ID : **87827055953**
Option 1 ID : **878270219832**
Option 2 ID : **878270219831**
Option 3 ID : **878270219833**
Option 4 ID : **878270219834**

Q.67 Match **List - I** with **List - II**.

List - I **Reaction**		**List - II** **Type of redox reaction**
(A)	$N_{2(g)} + O_{2(g)} \rightarrow 2NO_{(g)}$	(I) Decomposition
(B)	$2Pb(NO_3)_{2(s)} \rightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$	(II) Displacement
(C)	$2Na_{(s)} + 2H_2O_{(l)} \rightarrow 2NaOH_{(aq.)} + H_{2(g)}$	(III) Disproportionation
(D)	$2NO_{2(g)} + 2^{-}OH(aq.) \rightarrow NO_{2(aq.)}^{-} + NO_{3(aq.)}^{-} + H_2O_{(l)}$	(IV) Combination

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

Options

1. (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
2. (A)-(II), (B)-(III), (C)-(IV), (D)-(I)
3. (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
4. (A)-(IV), (B)-(I), (C)-(II), (D)-(III)

Question Type : **MCQ**
Question ID : **87827055941**
Option 1 ID : **878270219785**
Option 2 ID : **878270219784**
Option 3 ID : **878270219786**
Option 4 ID : **878270219783**

Q.68 Match **List - I** with **List - II**.

List - I **Alkali Metal**		**List - II** **Emission Wavelength in nm**
(A)	Li	(I) 589.2
(B)	Na	(II) 455.5
(C)	Rb	(III) 670.8
(D)	Cs	(IV) 780.0

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

Options

1. (A)-(I), (B)-(IV), (C)-(III), (D)-(II)
2. (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
3. (A)-(IV), (B)-(II), (C)-(I), (D)-(III)
4. (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

Question Type : **MCQ**
Question ID : **87827055943**
Option 1 ID : **878270219791**
Option 2 ID : **878270219792**
Option 3 ID : **878270219794**
Option 4 ID : **878270219793**

Q.69 How can an electrochemical cell be converted into an electrolytic cell ?

Options

1. Reversing the flow of ions in salt bridge.

2. Applying an external opposite potential greater than E^0_{cell}.

3. Exchanging the electrodes at anode and cathode.

4. Applying an external opposite potential lower than E^0_{cell}.

Question Type : **MCQ**
Question ID : **87827055942**
Option 1 ID : **878270219788**
Option 2 ID : **878270219790**
Option 3 ID : **878270219787**
Option 4 ID : **878270219789**

Q.70 Evaluate the following statements related to group 14 elements for their correctness.
(A) Covalent radius decreases down the group from C to Pb in a regular manner.
(B) Electronegativity decreases from C to Pb down the group gradually.
(C) Maximum covalance of C is 4 whereas other elements can expand their covalance due to presence of d orbitals.
(D) Heavier elements do not form $p\pi$-$p\pi$ bonds.
(E) Carbon can exhibit negative oxidation states.
Choose the **correct** answer from the options given below :

Options

1. (C) and (D) Only

2. (A) and (B) Only

3. (C), (D) and (E) Only

4. (A), (B) and (C) Only

Question Type : **MCQ**
Question ID : **87827055945**
Option 1 ID : **878270219800**
Option 2 ID : **878270219799**
Option 3 ID : **878270219802**
Option 4 ID : **878270219801**

Q.71 The incorrect statements regarding enzymes are :

(A) Enzymes are biocatalysts.

(B) Enzymes are non-specific and can catalyse different kinds of reactions.

(C) Most Enzymes are globular proteins.

(D) Enzyme - oxidase catalyses the hydrolysis of maltose into glucose.

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

Options

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

Question Type : **MCQ**
Question ID : **87827055957**
Option 1 ID : **878270219849**
Option 2 ID : **878270219850**
Option 3 ID : **878270219847**
Option 4 ID : **878270219848**

Q.72 Given below are two statements :

Statement I : PF_5 and BrF_5 both exhibit sp^3d hybridisation.

Statement II : Both SF_6 and $[Co(NH_3)_6]^{3+}$ exhibit sp^3d^2 hybridisation.

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

Question Type : **MCQ**
Question ID : **87827055939**
Option 1 ID : **878270219778**
Option 2 ID : **878270219776**
Option 3 ID : **878270219777**
Option 4 ID : **878270219775**

Q.73 The correct statement among the following, for a "chromatography" purification method is :

Options 1.

Non-polar compounds are retained at top and polar compounds come down in column chromatography.

2.

R_f of a polar compound is smaller than that of a non-polar compound.

3.

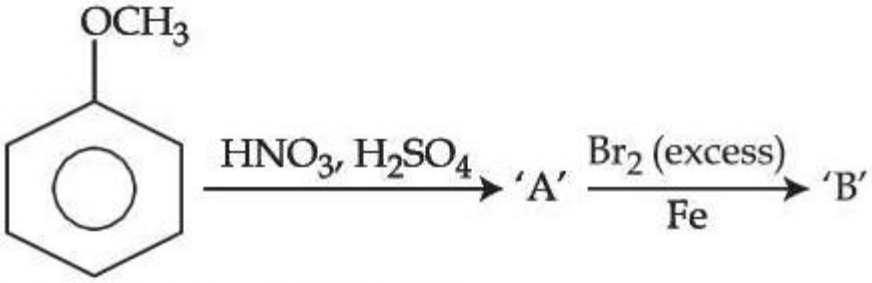
Organic compounds run faster than solvent in the thin layer chromatographic plate.

4. R_f is an integral value.

Question Type : **MCQ**
Question ID : **87827055950**
Option 1 ID : **878270219819**
Option 2 ID : **878270219822**
Option 3 ID : **878270219821**
Option 4 ID : **878270219820**

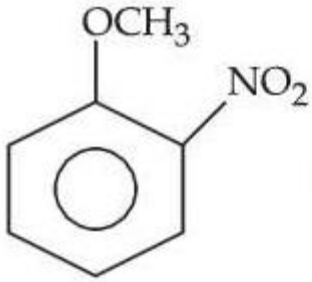
Q.74

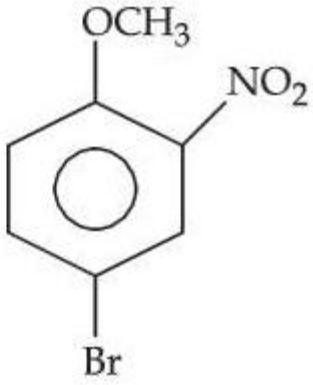
The major products formed :



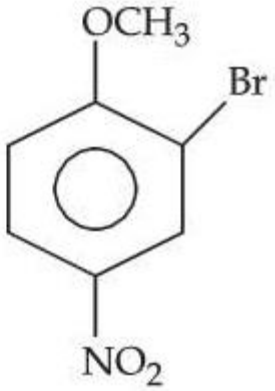
A and B respectively are :

Options

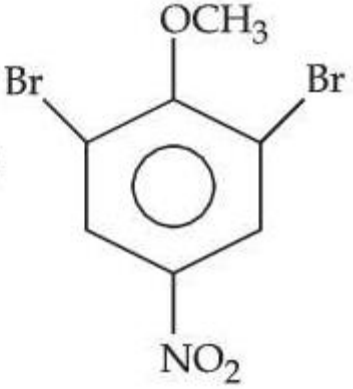
1. 

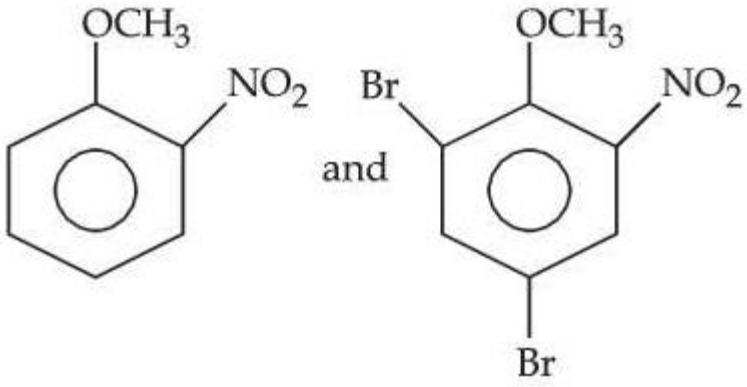
and


2. 

and


3. 

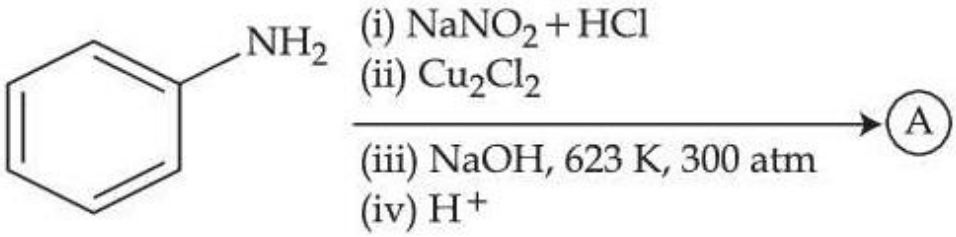
and


4. 

Question Type : **MCQ**
Question ID : **87827055956**
Option 1 ID : **878270219843**
Option 2 ID : **878270219844**
Option 3 ID : **878270219846**
Option 4 ID : **878270219845**

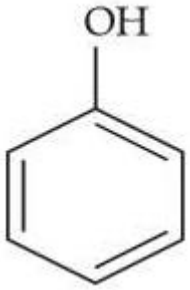
Q.75

Identify the product (A) in the following reaction.



Options

1. 

2. 

3. 

4. 

Question Type : **MCQ**

Question ID : **87827055954**
Option 1 ID : **878270219836**
Option 2 ID : **878270219837**
Option 3 ID : **878270219835**
Option 4 ID : **878270219838**

Q.76 Arrange the following elements in the increasing order of number of unpaired electrons in it.
(A) Sc
(B) Cr
(C) V
(D) Ti
(E) Mn
Choose the **correct** answer from the options given below :

Options

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

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

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

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

Question Type : **MCQ**
Question ID : **87827055946**
Option 1 ID : **878270219803**
Option 2 ID : **878270219804**
Option 3 ID : **878270219806**
Option 4 ID : **878270219805**

Q.77 The number of ions from the following that are expected to behave as oxidising agent is :
Sn^{4+}, Sn^{2+}, Pb^{2+}, Tl^{3+}, Pb^{4+}, Tl^{+}

Options

1. 1

2. 4

3. 2

4. 3

Question Type : **MCQ**
Question ID : **87827055944**
Option 1 ID : **878270219798**
Option 2 ID : **878270219797**
Option 3 ID : **878270219796**
Option 4 ID : **878270219795**

Q.78

Match **List - I** with **List - II**.

List - I **Tetrahedral Complex**		**List - II** **Electronic configuration**	
(A)	$TiCl_4$	(I)	e^2, t_2^0
(B)	$[FeO_4]^{2-}$	(II)	e^4, t_2^3
(C)	$[FeCl_4]^-$	(III)	e^0, t_2^0
(D)	$[CoCl_4]^{2-}$	(IV)	e^2, t_2^3

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

Options

1. (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
2. (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
3. (A)-(I), (B)-(III), (C)-(IV), (D)-(II)
4. (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

Question Type : **MCQ**
Question ID : **87827055948**
Option 1 ID : **878270219813**
Option 2 ID : **878270219811**
Option 3 ID : **878270219814**
Option 4 ID : **878270219812**

Q.79 Consider the given reaction, identify the major product P.

$$CH_3-COOH \xrightarrow[(iv)\ H_2O/\bar{O}H,\ \Delta]{(i)\ LiAlH_4\ \ (ii)\ PCC\ \ (iii)\ HCN/\bar{O}H} \text{“P”}$$

Options

1. $CH_3-CH_2-CH_2-OH$

2. $CH_3-\overset{\overset{O}{\|}}{C}-CH_2CH_3$

3. $CH_3-\overset{\overset{OH}{|}}{CH}-COOH$

4. $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-NH_2$

Question Type : **MCQ**
Question ID : **87827055955**
Option 1 ID : **878270219842**
Option 2 ID : **878270219840**
Option 3 ID : **878270219839**
Option 4 ID : **878270219841**

Q.80 During the detection of acidic radical present in a salt, a student gets a pale yellow precipitate soluble with difficulty in NH_4OH solution when sodium carbonate extract was first acidified with dil. HNO_3 and then $AgNO_3$ solution was added. This indicates presence of :

Options

1. I^-

2. Br^-

3. Cl^-

4. CO_3^{2-}

Question Type : **MCQ**
Question ID : **87827055949**
Option 1 ID : **878270219817**
Option 2 ID : **878270219816**
Option 3 ID : **878270219815**
Option 4 ID : **878270219818**

Section : **Chemistry Section B**

Q.81 Among VO_2^+, MnO_4^- and $Cr_2O_7^{2-}$, the spin-only magnetic moment value of the species with least oxidising ability is _____ BM (Nearest integer).
(Given atomic member V = 23, Mn = 25, Cr = 24)

Question Type : **SA**
Question ID : **87827055963**

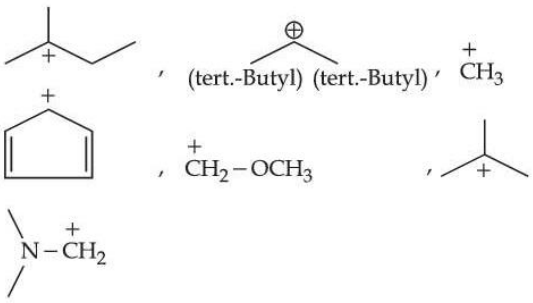
Q.82 For the reaction at 298 K, $2A + B \rightarrow C$. $\Delta H = 400$ kJ mol^{-1} and $\Delta S = 0.2$ kJ mol^{-1} K^{-1}. The reaction will become spontaneous above _____ K.

Question Type : **SA**
Question ID : **87827055960**

Q.83 An amine (X) is prepared by ammonolysis of benzyl chloride. On adding p-toluenesulphonyl chloride to it the solution remains clear. Molar mass of the amine (X) formed is _____ g mol^{-1}.
(Given molar mass in gmol^{-1} C : 12, H : 1, O : 16, N : 14)

Question Type : **SA**
Question ID : **87827055967**

Q.84 Number of carbocations from the following that are **not** stabilized by hyperconjugation is _____.



Question Type : **SA**
Question ID : **87827055965**

Q.85 For hydrogen atom, energy of an electron in first excited state is -3.4 eV, K.E. of the same electron of hydrogen atom is x eV. Value of x is _____ $\times 10^{-1}$ eV. (Nearest integer)

Question Type : **SA**
Question ID : **87827055958**

Q.86 Consider the two different first order reactions given below
$A + B \rightarrow C$ (Reaction 1)
$P \rightarrow Q$ (Reaction 2)
The ratio of the half life of Reaction 1 : Reaction 2 is 5 : 2. If t_1 and t_2 represent the time taken to complete $\frac{2}{3}^{rd}$ and $\frac{4}{5}^{th}$ of Reaction 1 and Reaction 2, respectively, then the value of the ratio $t_1 : t_2$ is _____ $\times 10^{-1}$ (nearest integer).
[Given : $\log_{10}(3) = 0.477$ and $\log_{10}(5) = 0.699$]

Question Type : **SA**
Question ID : **87827055962**

Q.87 Consider the following reactions

$$NiS + HNO_3 + HCl \rightarrow A + NO + S + H_2O$$

$$A + NH_4OH + H_3C-\underset{\underset{H_3C-C=N-OH}{|}}{C}=N-OH \longrightarrow B + NH_4Cl + H_2O$$

The number of protons that do not involve in hydrogen bonding in the product B is _____.

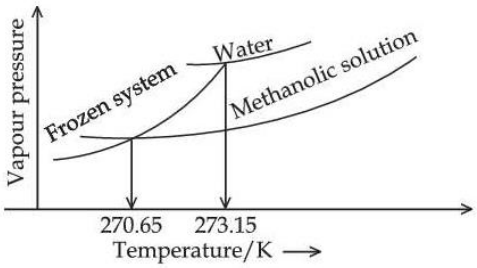
Question Type : **SA**
Question ID : **87827055964**

Q.88 Total number of species from the following with central atom utilising sp^2 hybrid orbitals for bonding is _____.

NH_3, SO_2, SiO_2, $BeCl_2$, C_2H_2, C_2H_4, BCl_3, HCHO, C_6H_6, BF_3, $C_2H_4Cl_2$

Question Type : **SA**
Question ID : **87827055959**

Q.89 When 'x' $\times 10^{-2}$ mL methanol (molar mass = 32 g; density = 0.792 g/cm^3) is added to 100 mL water (density = 1 g/cm^3), the following diagram is obtained.

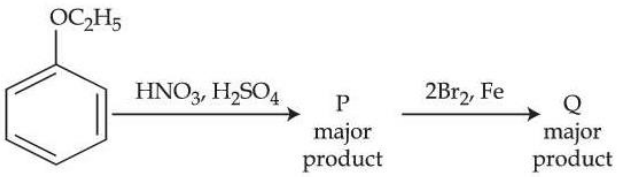


x = _____ (nearest integer).

[Given : Molal freezing point depression constant of water at 273.15 K is 1.86 K kg mol^{-1}]

Question Type : **SA**
Question ID : **87827055961**

Q.90



The ratio of number of oxygen atoms to bromine atoms in the product Q is _____ $\times 10^{-1}$.

Question Type : **SA**
Question ID : **87827055966**