

JEE MAINS PAPER 1 2025

Test Date	24/01/2025
Test Time	3:00 PM - 6:00 PM
Subject	B. Tech

Section : Mathematics Section A

Q.1 If $7 = 5 + \frac{1}{7}(5+\alpha) + \frac{1}{7^2}(5+2\alpha) + \frac{1}{7^3}(5+3\alpha) + \dots \infty$, then the value of α is :

- Options**
- 1
 - 6
 - $\frac{1}{7}$
 - $\frac{6}{7}$

Question Type : MCQ

Question ID : 656445456

Option 1 ID : 6564451553

Option 2 ID : 6564451551

Option 3 ID : 6564451554

Option 4 ID : 6564451552

Q.2 The number of real solution(s) of the equation $x^2 + 3x + 2 = \min\{|x-3|, |x+2|\}$ is :

- Options**
- 0
 - 3
 - 2
 - 1

Question Type : MCQ

Question ID : 656445453

Option 1 ID : 6564451539

Option 2 ID : 6564451542

Option 3 ID : 6564451541

Option 4 ID : 6564451540

Q.3 Let $(2, 3)$ be the largest open interval in which the function $f(x) = 2 \log_e(x-2) - x^2 + ax + 1$ is strictly increasing and (b, c) be the largest open interval, in which the function $g(x) = (x-1)^3(x+2-a)^2$ is strictly decreasing. Then $100(a+b-c)$ is equal to :

Options

1. 280
2. 360
3. 420
4. 160

Question Type : **MCQ**

Question ID : **656445468**

Option 1 ID : **6564451600**

Option 2 ID : **6564451601**

Option 3 ID : **6564451602**

Option 4 ID : **6564451599**

Q.4 Let $\vec{a} = 3\hat{i} - \hat{j} + 2\hat{k}$, $\vec{b} = \vec{a} \times (\hat{i} - 2\hat{k})$ and $\vec{c} = \vec{b} \times \hat{k}$. Then the projection of $\vec{c} - 2\hat{j}$ on $\vec{a}$ is :

Options

1. $2\sqrt{7}$
2. $3\sqrt{7}$
3. $\sqrt{14}$
4. $2\sqrt{14}$

Question Type : **MCQ**

Question ID : **656445465**

Option 1 ID : **6564451589**

Option 2 ID : **6564451590**

Option 3 ID : **6564451587**

Option 4 ID : **6564451588**

Q.5 Let the position vectors of three vertices of a triangle be $4\vec{p} + \vec{q} - 3\vec{r}$, $-5\vec{p} + \vec{q} + 2\vec{r}$ and $2\vec{p} - \vec{q} + 2\vec{r}$. If the position vectors of the orthocenter and the circumcenter of the triangle are $\frac{\vec{p} + \vec{q} + \vec{r}}{4}$ and $\alpha\vec{p} + \beta\vec{q} + \gamma\vec{r}$ respectively, then $\alpha + 2\beta + 5\gamma$ is equal to :

- Options**
1. 6
 2. 3
 3. 4
 4. 1

Question Type : **MCQ**

Question ID : **656445466**

Option 1 ID : **6564451594**

Option 2 ID : **6564451592**

Option 3 ID : **6564451593**

Option 4 ID : **6564451591**

Q.6 Suppose A and B are the coefficients of 30^{th} and 12^{th} terms respectively in the binomial expansion of $(1+x)^{2n-1}$. If $2A = 5B$, then n is equal to :

- Options**
1. 20
 2. 19
 3. 22
 4. 21

Question Type : **MCQ**

Question ID : **656445459**

Option 1 ID : **6564451564**

Option 2 ID : **6564451563**

Option 3 ID : **6564451566**

Option 4 ID : **6564451565**

Q.7 If the equation of the parabola with vertex $V\left(\frac{3}{2}, 3\right)$ and the directrix $x + 2y = 0$ is $\alpha x^2 + \beta y^2 - \gamma xy - 30x - 60y + 225 = 0$, then $\alpha + \beta + \gamma$ is equal to :

- Options**
1. 7
 2. 8
 3. 9
 4. 6

Question Type : **MCQ**

Question ID : **656445462**

Option 1 ID : **6564451576**

Option 2 ID : **6564451577**

Option 3 ID : **6564451578**

Option 4 ID : **6564451575**

Q.8 If the system of equations
 $x + 2y - 3z = 2$
 $2x + \lambda y + 5z = 5$
 $14x + 3y + \mu z = 33$
has infinitely many solutions, then $\lambda + \mu$ is equal to :

- Options**
1. 13
 2. 10
 3. 12
 4. 11

Question Type : **MCQ**

Question ID : **656445455**

Option 1 ID : **6564451550**

Option 2 ID : **6564451547**

Option 3 ID : **6564451549**

Option 4 ID : **6564451548**

Q.9

The function $f: (-\infty, \infty) \rightarrow (-\infty, 1)$, defined by $f(x) = \frac{2^x - 2^{-x}}{2^x + 2^{-x}}$ is :

Options

1. Both one-one and onto
2. Neither one-one nor onto
3. One-one but not onto
4. Onto but not one-one

Question Type : **MCQ**

Question ID : **656445451**

Option 1 ID : **6564451533**

Option 2 ID : **6564451534**

Option 3 ID : **6564451531**

Option 4 ID : **6564451532**

Q.10

The equation of the chord, of the ellipse $\frac{x^2}{25} + \frac{y^2}{16} = 1$, whose mid-point is (3, 1) is :

Options

1. $25x + 101y = 176$
2. $5x + 16y = 31$
3. $48x + 25y = 169$
4. $4x + 122y = 134$

Question Type : **MCQ**

Question ID : **656445463**

Option 1 ID : **6564451579**

Option 2 ID : **6564451581**

Option 3 ID : **6564451582**

Option 4 ID : **6564451580**

Q.11 Let $f: (0, \infty) \rightarrow \mathbf{R}$ be a function which is differentiable at all points of its domain and satisfies the condition $x^2 f'(x) = 2xf(x) + 3$, with $f(1) = 4$. Then $2f(2)$ is equal to :

Options

1. 29
2. 19
3. 39
4. 23

Question Type : **MCQ**

Question ID : **656445470**

Option 1 ID : **6564451610**

Option 2 ID : **6564451608**

Option 3 ID : **6564451607**

Option 4 ID : **6564451609**

Q.12 Let $A = [a_{ij}]$ be a square matrix of order 2 with entries either 0 or 1. Let E be the event that A is an invertible matrix. Then the probability P(E) is :

Options

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

Question Type : **MCQ**

Question ID : **656445458**

Option 1 ID : **6564451560**

Option 2 ID : **6564451559**

Option 3 ID : **6564451561**

Option 4 ID : **6564451562**

Q.13 Group A consists of 7 boys and 3 girls, while group B consists of 6 boys and 5 girls. The number of ways, 4 boys and 4 girls can be invited for a picnic if 5 of them must be from group A and the remaining 3 from group B, is equal to :

Options

1. 9100
2. 8575
3. 8750
4. 8925

Question Type : **MCQ**

Question ID : **656445460**

Option 1 ID : **6564451570**

Option 2 ID : **6564451567**

Option 3 ID : **6564451568**

Option 4 ID : **6564451569**

Q.14

Let the points $\left(\frac{11}{2}, \alpha\right)$ lie on or inside the triangle with sides $x + y = 11$, $x + 2y = 16$ and $2x + 3y = 29$.

Then the product of the smallest and the largest values of α is equal to :

Options

1. 33
2. 55
3. 22
4. 44

Question Type : **MCQ**

Question ID : **656445461**

Option 1 ID : **6564451572**

Option 2 ID : **6564451574**

Option 3 ID : **6564451571**

Option 4 ID : **6564451573**

Q.15 In an arithmetic progression, if $S_{40} = 1030$ and $S_{12} = 57$, then $S_{30} - S_{10}$ is equal to :

- Options**
1. 505
 2. 525
 3. 510
 4. 515

Question Type : **MCQ**

Question ID : **656445457**

Option 1 ID : **6564451555**

Option 2 ID : **6564451558**

Option 3 ID : **6564451556**

Option 4 ID : **6564451557**

Q.16 The area of the region enclosed by the curves $y = e^x$, $y = |e^x - 1|$ and y-axis is :

- Options**
1. $\log_e 2$
 2. $1 + \log_e 2$
 3. $2\log_e 2 - 1$
 4. $1 - \log_e 2$

Question Type : **MCQ**

Question ID : **656445469**

Option 1 ID : **6564451603**

Option 2 ID : **6564451604**

Option 3 ID : **6564451606**

Option 4 ID : **6564451605**

Q.17

Let $A = \left\{ x \in (0, \pi) - \left\{ \frac{\pi}{2} \right\} : \log_{(2/\pi)} |\sin x| + \log_{(2/\pi)} |\cos x| = 2 \right\}$ and

$B = \{ x \geq 0 : \sqrt{x}(\sqrt{x} - 4) - 3|\sqrt{x} - 2| + 6 = 0 \}$. Then $n(A \cup B)$ is equal to :

Options

1. 4
2. 8
3. 2
4. 6

Question Type : MCQ

Question ID : 656445452

Option 1 ID : 6564451536

Option 2 ID : 6564451538

Option 3 ID : 6564451535

Option 4 ID : 6564451537

Q.18

Let $[x]$ denote the greatest integer function, and let m and n respectively be the numbers of the points, where the function $f(x) = [x] + |x - 2|$, $-2 < x < 3$, is not continuous and not differentiable. Then $m + n$ is equal to :

Options

1. 8
2. 9
3. 6
4. 7

Question Type : MCQ

Question ID : 656445467

Option 1 ID : 6564451597

Option 2 ID : 6564451598

Option 3 ID : 6564451595

Option 4 ID : 6564451596

Q.19

For some a, b, let $f(x) = \begin{vmatrix} a + \frac{\sin x}{x} & 1 & b \\ a & 1 + \frac{\sin x}{x} & b \\ a & 1 & b + \frac{\sin x}{x} \end{vmatrix}$, $x \neq 0$, $\lim_{x \rightarrow 0} f(x) = \lambda + \mu a + \nu b$. Then

$(\lambda + \mu + \nu)^2$ is equal to :

Options

1. 25
2. 36
3. 9
4. 16

Question Type : **MCQ**

Question ID : **656445454**

Option 1 ID : **6564451545**

Option 2 ID : **6564451546**

Option 3 ID : **6564451543**

Option 4 ID : **6564451544**

Q.20

If $\alpha > \beta > \gamma > 0$, then the expression

$\cot^{-1} \left\{ \beta + \frac{(1 + \beta^2)}{(\alpha - \beta)} \right\} + \cot^{-1} \left\{ \gamma + \frac{(1 + \gamma^2)}{(\beta - \gamma)} \right\} + \cot^{-1} \left\{ \alpha + \frac{(1 + \alpha^2)}{(\gamma - \alpha)} \right\}$ is equal to :

Options

1. 0
2. $\frac{\pi}{2} - (\alpha + \beta + \gamma)$
3. 3π
4. π

Question Type : **MCQ**

Question ID : **656445464**

Option 1 ID : **6564451584**

Option 2 ID : **6564451585**

Option 3 ID : **6564451583**

Option 4 ID : **6564451586**

Section : Mathematics Section B

Q.21

Let $y = y(x)$ be the solution of the differential equation $2 \cos x \frac{dy}{dx} = \sin 2x - 4y \sin x$, $x \in \left(0, \frac{\pi}{2}\right)$. If

$y\left(\frac{\pi}{3}\right) = 0$, then $y'\left(\frac{\pi}{4}\right) + y\left(\frac{\pi}{4}\right)$ is equal to _____.

Question Type : **SA**

Question ID : **656445474**

- Q.22** If $\int \frac{2x^2 + 5x + 9}{\sqrt{x^2 + x + 1}} dx = x\sqrt{x^2 + x + 1} + \alpha\sqrt{x^2 + x + 1} + \beta \log_e \left| x + \frac{1}{2} + \sqrt{x^2 + x + 1} \right| + C$, where C is the constant of integration, then $\alpha + 2\beta$ is equal to _____.

Question Type : **SA**
Question ID : **656445473**

- Q.23** Number of functions $f: \{1, 2, \dots, 100\} \rightarrow \{0, 1\}$, that assign 1 to exactly one of the positive integers less than or equal to 98, is equal to _____.

Question Type : **SA**
Question ID : **656445471**

- Q.24** Let $H_1: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $H_2: -\frac{x^2}{A^2} + \frac{y^2}{B^2} = 1$ be two hyperbolas having length of latus rectums $15\sqrt{2}$ and $12\sqrt{5}$ respectively. Let their eccentricities be $e_1 = \sqrt{\frac{5}{2}}$ and e_2 respectively. If the product of the lengths of their transverse axes is $100\sqrt{10}$, then $25e_2^2$ is equal to _____.

Question Type : **SA**
Question ID : **656445475**

- Q.25** Let P be the image of the point Q(7, -2, 5) in the line $L: \frac{x-1}{2} = \frac{y+1}{3} = \frac{z}{4}$ and R(5, p, q) be a point on L. Then the square of the area of ΔPQR is _____.

Question Type : **SA**
Question ID : **656445472**

Q.26 Given below are two statements. One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : A electron in a certain region of uniform magnetic field is moving with constant velocity in a straight line path.

Reason (R) : The magnetic field in that region is along the direction of velocity of the electron.

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

Options 1.

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

2. (A) is true but (R) is false

3.

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

4. (A) is false but (R) is true

Question Type : **MCQ**

Question ID : **656445485**

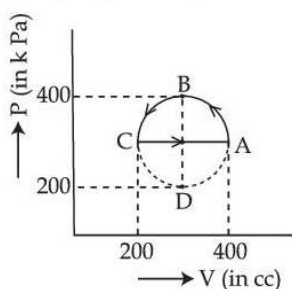
Option 1 ID : **6564451653**

Option 2 ID : **6564451654**

Option 3 ID : **6564451652**

Option 4 ID : **6564451655**

Q.27 The magnitude of heat exchanged by a system for the given cyclic process ABCA (as shown in figure) is (in SI unit) :



Options 1. zero

2. 40π

3. 5π

4. 10π

Question Type : **MCQ**

Question ID : **656445482**

Option 1 ID : **6564451640**

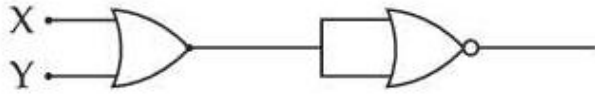
Option 2 ID : **6564451643**

Option 3 ID : **6564451641**

Option 4 ID : **6564451642**

Q.28

The output of the circuit is low (zero) for :



- (A) $X=0, Y=0$
- (B) $X=0, Y=1$
- (C) $X=1, Y=0$
- (D) $X=1, Y=1$

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

Options

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

Question Type : **MCQ**

Question ID : **656445495**

Option 1 ID : **6564451692**

Option 2 ID : **6564451694**

Option 3 ID : **6564451695**

Option 4 ID : **6564451693**

Q.29

A small uncharged conducting sphere is placed in contact with an identical sphere but having 4×10^{-8} C charge and then removed to a distance such that the force of repulsion between them is

9×10^{-3} N. The distance between them is (Take $\frac{1}{4\pi\epsilon_0}$ as 9×10^9 in SI units)

Options

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

Question Type : **MCQ**

Question ID : **656445487**

Option 1 ID : **6564451663**

Option 2 ID : **6564451661**

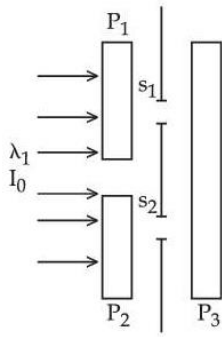
Option 3 ID : **6564451662**

Option 4 ID : **6564451660**

Q.30

In a Young's double slit experiment, three polarizers are kept as shown in the figure. The transmission axes of P_1 and P_2 are orthogonal to each other. The polarizer P_3 covers both the slits with its transmission axis at 45° to those of P_1 and P_2 . An unpolarized light of wavelength λ and intensity I_0 is incident on P_1 and P_2 . The intensity at a point after P_3 where the path difference

between the light waves from s_1 and s_2 is $\frac{\lambda}{3}$, is



Options

1. $\frac{I_0}{3}$
2. $\frac{I_0}{4}$
3. $\frac{I_0}{2}$
4. I_0

Question Type : **MCQ**

Question ID : **656445493**

Option 1 ID : **6564451686**

Option 2 ID : **6564451687**

Option 3 ID : **6564451685**

Option 4 ID : **6564451684**

Q.31 The temperature of a body in air falls from 40°C to 24°C in 4 minutes. The temperature of the air is 16°C. The temperature of the body in the next 4 minutes will be :

Options

1. $\frac{56}{3}^{\circ}\text{C}$
2. $\frac{42}{3}^{\circ}\text{C}$
3. $\frac{28}{3}^{\circ}\text{C}$
4. $\frac{14}{3}^{\circ}\text{C}$

Question Type : **MCQ**

Question ID : **656445481**

Option 1 ID : **6564451639**

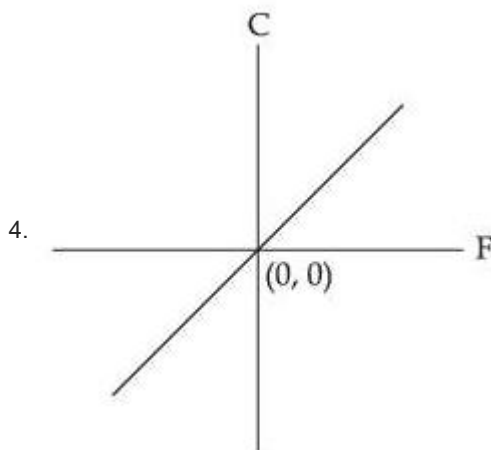
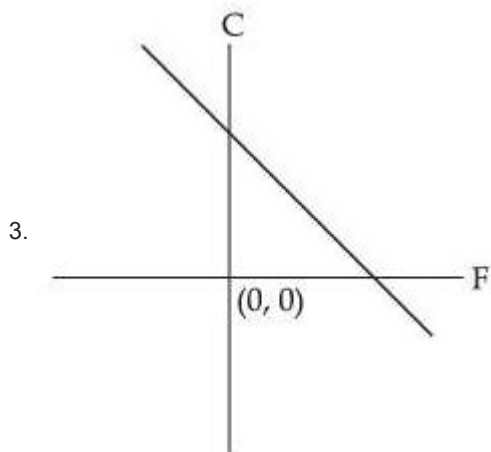
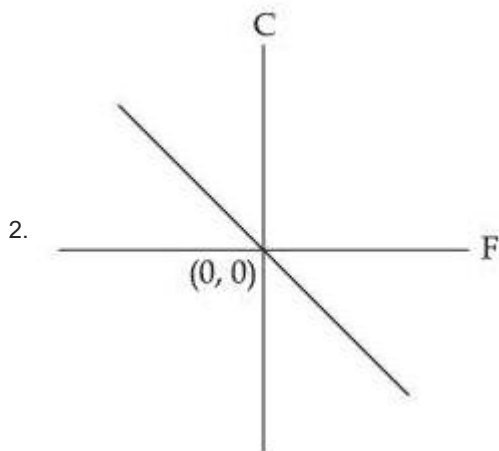
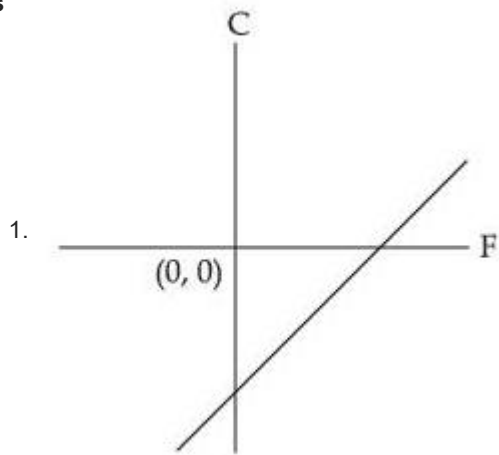
Option 2 ID : **6564451638**

Option 3 ID : **6564451636**

Option 4 ID : **6564451637**

Q.32 Which of the following figure represents the relation between Celsius and Fahrenheit temperatures ?

Options



Question Type : MCQ

Question ID : 656445477

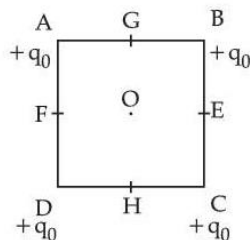
Option 1 ID : 6564451621

Option 2 ID : 6564451623

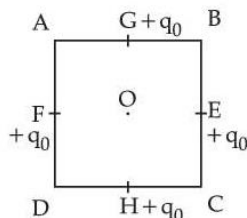
Option 3 ID : 6564451620

Option 4 ID : 6564451622

Q.33



Configuration (1)



Configuration (2)

In the first configuration (1) as shown in the figure, four identical charges (q_0) are kept at the corners A, B, C and D of square of side length 'a'. In the second configuration (2), the same charges are shifted to mid points G, E, H and F, of the square. If $K = \frac{1}{4\pi\epsilon_0}$, the difference between the potential energies of configuration (2) and (1) is given by :

Options

1. $\frac{Kq_0^2}{a}(3 - \sqrt{2})$
2. $\frac{Kq_0^2}{a}(3\sqrt{2} - 2)$
3. $\frac{Kq_0^2}{a}(4 - 2\sqrt{2})$
4. $\frac{Kq_0^2}{a}(4\sqrt{2} - 2)$

Question Type : MCQ

Question ID : 656445488

Option 1 ID : 6564451664

Option 2 ID : 6564451665

Option 3 ID : 6564451667

Option 4 ID : 6564451666

Q.34

Arrange the following in the ascending order of wavelength (λ) :

- (A) Microwaves (λ_1)
- (B) Ultraviolet rays (λ_2)
- (C) Infrared rays (λ_3)
- (D) X-rays (λ_4)

Choose the **most appropriate** answer from the options given below :

Options

1. $\lambda_4 < \lambda_2 < \lambda_3 < \lambda_1$
2. $\lambda_4 < \lambda_3 < \lambda_1 < \lambda_2$
3. $\lambda_3 < \lambda_4 < \lambda_2 < \lambda_1$
4. $\lambda_4 < \lambda_3 < \lambda_2 < \lambda_1$

Question Type : **MCQ**

Question ID : **656445490**

Option 1 ID : **6564451675**

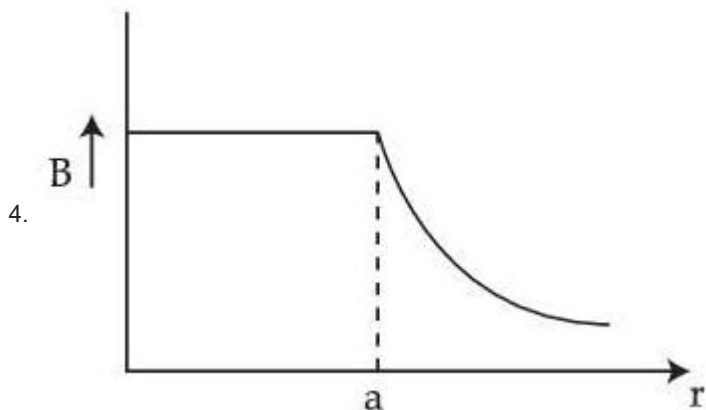
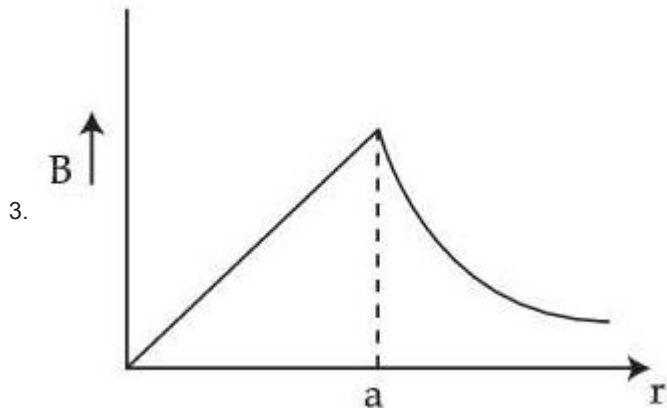
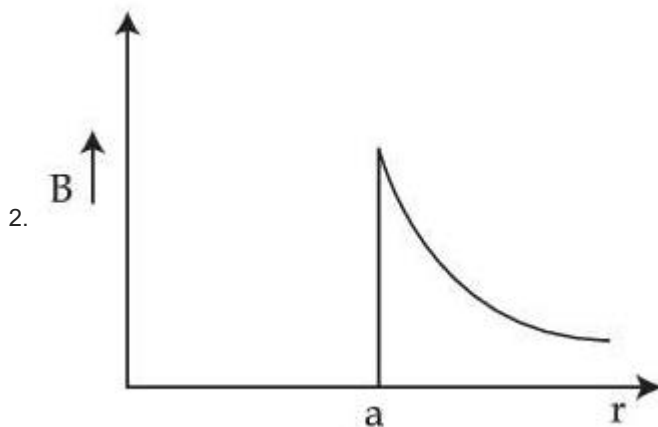
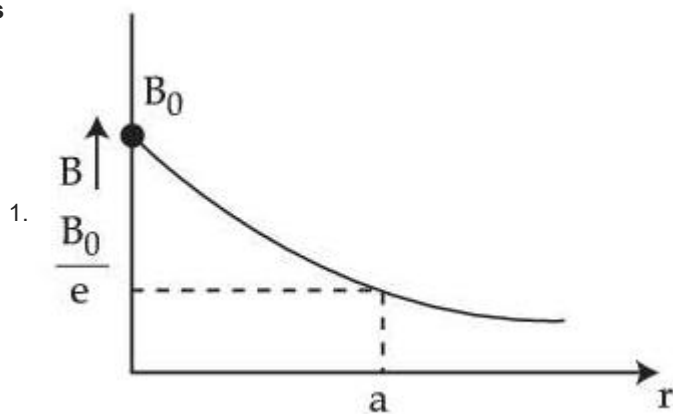
Option 2 ID : **6564451673**

Option 3 ID : **6564451672**

Option 4 ID : **6564451674**

Q.35 A long straight wire of a circular cross-section with radius ' a ' carries a steady current I . The current I is uniformly distributed across this cross-section. The plot of magnitude of magnetic field B with distance r from the centre of the wire is given by

Options



Question Type : MCQ

Question ID : 656445486

Option 1 ID : 6564451658

Option 2 ID : 6564451656

Option 3 ID : 6564451657

Option 4 ID : 6564451659

Q.36 The energy E and momentum p of a moving body of mass m are related by some equation. Given that c represents the speed of light, identify the correct equation

Options

1. $E^2 = pc^2 + m^2c^2$
2. $E^2 = p^2c^2 + m^2c^2$
3. $E^2 = p^2c^2 + m^2c^4$
4. $E^2 = pc^2 + m^2c^4$

Question Type : **MCQ**

Question ID : 656445476

Option 1 ID : 6564451619

Option 2 ID : 6564451616

Option 3 ID : 6564451618

Option 4 ID : 6564451617

Q.37 A solid sphere and a hollow sphere of the same mass and of same radius are rolled on an inclined plane. Let the time taken to reach the bottom by the solid sphere and the hollow sphere be t_1 and t_2 , respectively, then

Options

1. $t_1 = 2t_2$
2. $t_1 < t_2$
3. $t_1 > t_2$
4. $t_1 = t_2$

Question Type : **MCQ**

Question ID : 656445480

Option 1 ID : 6564451635

Option 2 ID : 6564451632

Option 3 ID : 6564451634

Option 4 ID : 6564451633

Q.38 Given below are two statements. One is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.

Assertion (A) : In an insulated container, a gas is adiabatically shrunk to half of its initial volume.
The temperature of the gas decreases.

Reason (R) : Free expansion of an ideal gas is an irreversible and an adiabatic process.

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

Options

1. **(A) is false but (R) is true**

2.

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

3.

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

4. **(A) is true but (R) is false**

Question Type : **MCQ**

Question ID : **656445483**

Option 1 ID : **6564451647**

Option 2 ID : **6564451644**

Option 3 ID : **6564451645**

Option 4 ID : **6564451646**

Q.39 In photoelectric effect, the stopping potential (V_0) v/s frequency (ν) curve is plotted.

(h is the Planck's constant and ϕ_0 is work function of metal)

(A) V_0 v/s ν is linear.

(B) The slope of V_0 v/s ν curve = $\frac{\phi_0}{h}$

(C) h constant is related to the slope of V_0 v/s ν line.

(D) The value of electric charge of electron is not required to determine h using the V_0 v/s ν curve.

(E) The work function can be estimated without knowing the value of h.

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

Options

1. **(A), (B) and (C) only**

2. **(D) and (E) only**

3. **(C) and (D) only**

4. **(A), (C) and (E) only**

Question Type : **MCQ**

Question ID : **656445494**

Option 1 ID : **6564451689**

Option 2 ID : **6564451690**

Option 3 ID : **6564451691**

Option 4 ID : **6564451688**

Q.40 A solid sphere is rolling without slipping on a horizontal plane. The ratio of the linear kinetic energy of the centre of mass of the sphere and rotational kinetic energy is :

Options

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

Question Type : **MCQ**

Question ID : **656445478**

Option 1 ID : **6564451624**

Option 2 ID : **6564451626**

Option 3 ID : **6564451627**

Option 4 ID : **6564451625**

Q.41 Young's double slit interference apparatus is immersed in a liquid of refractive index 1.44. It has slit separation of 1.5 mm. The slits are illuminated by a parallel beam of light whose wavelength in air is 690 nm. The fringe-width on a screen placed behind the plane of slits at a distance of 0.72 m, will be :

Options

1. 0.63 mm
2. 0.33 mm
3. 0.46 mm
4. 0.23 mm

Question Type : **MCQ**

Question ID : **656445492**

Option 1 ID : **6564451680**

Option 2 ID : **6564451681**

Option 3 ID : **6564451682**

Option 4 ID : **6564451683**

Q.42 A photograph of a landscape is captured by a drone camera at a height of 18 km. The size of the camera film is $2\text{ cm} \times 2\text{ cm}$ and the area of the landscape photographed is 400 km^2 . The focal length of the lens in the drone camera is :

Options

1. 2.5 cm
2. 0.9 cm
3. 1.8 cm
4. 2.8 cm

Question Type : **MCQ**

Question ID : **656445491**

Option 1 ID : **6564451677**

Option 2 ID : **6564451679**

Option 3 ID : **6564451678**

Option 4 ID : **6564451676**

Q.43 The position vector of a moving body at any instant of time is given as $\vec{r} = (5t^2\hat{i} - 5t\hat{j})\text{m}$. The magnitude and direction of velocity at $t=2\text{s}$ is,

Options

1. $5\sqrt{15}\text{ m/s}$, making an angle of $\tan^{-1}4$ with $-ve\text{ Y axis}$
2. $5\sqrt{15}\text{ m/s}$, making an angle of $\tan^{-1}4$ with $+ve\text{ X axis}$
3. $5\sqrt{17}\text{ m/s}$, making an angle of $\tan^{-1}4$ with $+ve\text{ X axis}$
4. $5\sqrt{17}\text{ m/s}$, making an angle of $\tan^{-1}4$ with $-ve\text{ Y axis}$

Question Type : **MCQ**

Question ID : **656445479**

Option 1 ID : **6564451630**

Option 2 ID : **6564451631**

Option 3 ID : **6564451629**

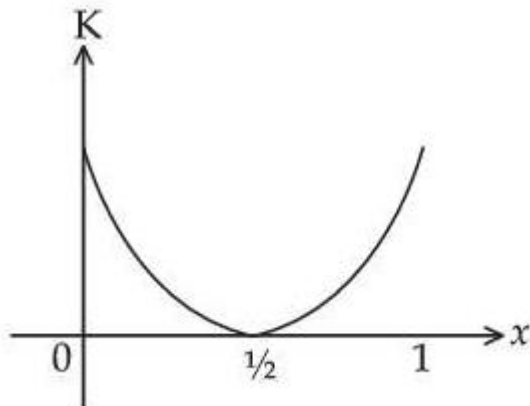
Option 4 ID : **6564451628**

Q.44

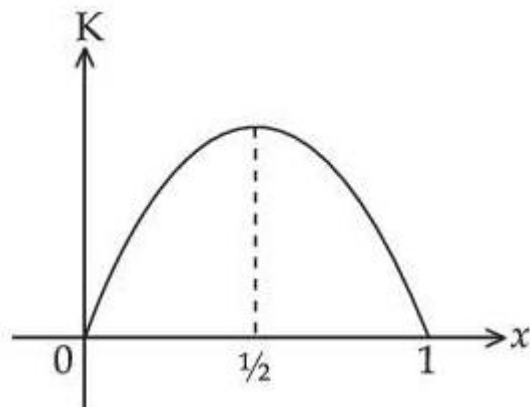
A particle oscillates along the x -axis according to the law, $x(t) = x_0 \sin^2\left(\frac{t}{2}\right)$ where $x_0 = 1$ m. The kinetic energy (K) of the particle as a function of x is correctly represented by the graph

Options

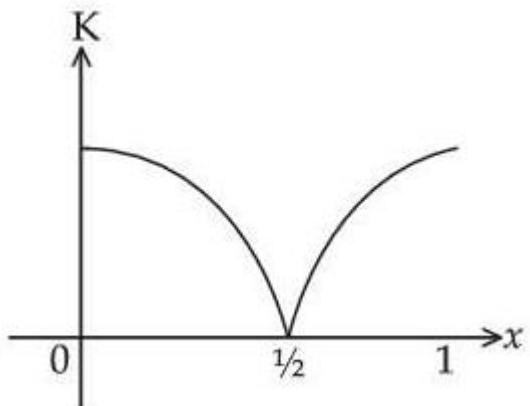
1.



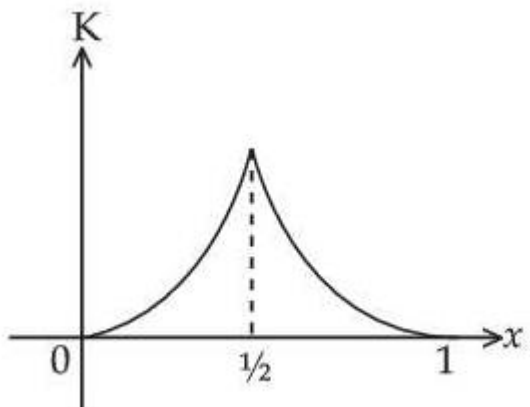
2.



3.



4.

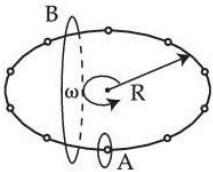


Question Type : MCQ

Question ID : 656445484

Option 1 ID : 6564451651

Q.45



N equally spaced charges each of value q , are placed on a circle of radius R . The circle rotates about its axis with an angular velocity ω as shown in the figure. A bigger Amperian loop B encloses the whole circle where as a smaller Amperian loop A encloses a small segment. The difference between enclosed currents, $I_A - I_B$, for the given Amperian loops is

Options

1. $\frac{N}{2\pi} q\omega$
2. $\frac{2\pi}{N} q\omega$
3. $\frac{N}{\pi} q\omega$
4. $\frac{N^2}{2\pi} q\omega$

Question Type : MCQ

Question ID : 656445489

Option 1 ID : 6564451671

Option 2 ID : 6564451670

Option 3 ID : 6564451668

Option 4 ID : 6564451669

Section : Physics Section B

Q.46 Acceleration due to gravity on the surface of earth is ' g '. If the diameter of earth is reduced to one third of its original value and mass remains unchanged, then the acceleration due to gravity on the surface of the earth is _____ g .

Question Type : SA

Question ID : 656445497

Q.47 The increase in pressure required to decrease the volume of a water sample by 0.2% is $P \times 10^5 \text{ Nm}^{-2}$. Bulk modulus of water is $2.15 \times 10^9 \text{ Nm}^{-2}$. The value of P is _____.

Question Type : SA

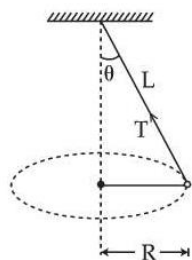
Question ID : 656445498

- Q.48** The ratio of the power of a light source S_1 to that the light source S_2 is 2. S_1 is emitting 2×10^{15} photons per second at 600 nm. If the wavelength of the source S_2 is 300 nm, then the number of photons per second emitted by S_2 is $\times 10^{14}$.

Question Type : **SA**

Question ID : **656445500**

Q.49



A string of length L is fixed at one end and carries a mass of M at the other end. The mass makes $\left(\frac{3}{\pi}\right)$ rotations per second about the vertical axis passing through end of the string as shown. The tension in the string is $\times ML$.

Question Type : **SA**

Question ID : **656445496**

- Q.50** A tightly wound long solenoid carries a current of 1.5 A. An electron is executing uniform circular motion inside the solenoid with a time period of 75 ns. The number of turns per metre in the solenoid is $\times 10^3$.

[Take mass of electron $m_e = 9 \times 10^{-31}$ kg, charge of electron $|q_e| = 1.6 \times 10^{-19}$ C,

$$\mu_0 = 4\pi \times 10^{-7} \frac{\text{N}}{\text{A}^2}, 1 \text{ ns} = 10^{-9} \text{ s}]$$

Question Type : **SA**

Question ID : **656445499**

Section : **Chemistry Section A**

- Q.51** When Ethane-1,2-diamine is added progressively to an aqueous solution of Nickel (II) chloride, the sequence of colour change observed will be :

Options

1. Green $\rightarrow$ Pale Blue $\rightarrow$ Blue $\rightarrow$ Violet
2. Violet $\rightarrow$ Blue $\rightarrow$ Pale Blue $\rightarrow$ Green
3. Pale Blue $\rightarrow$ Blue $\rightarrow$ Green $\rightarrow$ Violet
4. Pale Blue $\rightarrow$ Blue $\rightarrow$ Violet $\rightarrow$ Green

Question Type : **MCQ**

Question ID : **656445510**

Option 1 ID : **6564451737**

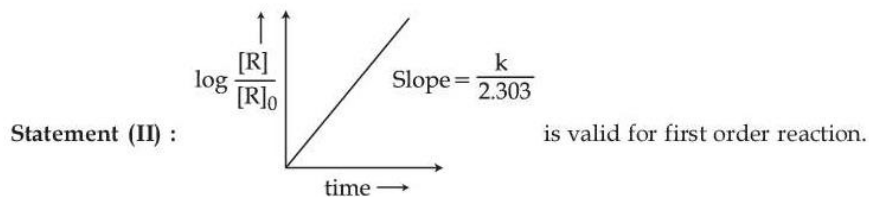
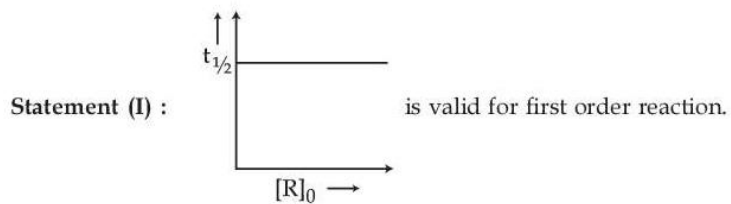
Option 2 ID : **6564451739**

Option 3 ID : **6564451738**

Option 4 ID : **6564451740**

Q.52

Given below are two statements :

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

Options

- Both **Statement I** and **Statement II** are false
- Statement I** is false but **Statement II** is true
- Both **Statement I** and **Statement II** are true
- Statement I** is true but **Statement II** is false

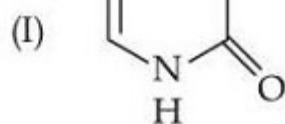
Question Type : **MCQ**Question ID : **656445507**Option 1 ID : **6564451726**Option 2 ID : **6564451728**Option 3 ID : **6564451725**Option 4 ID : **6564451727**

Match List - I with List - II.

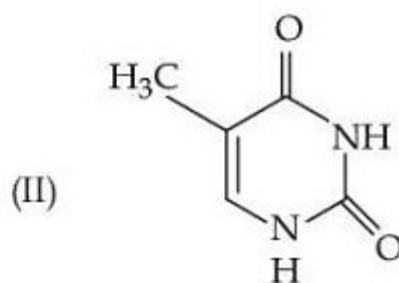
List - I

List - II

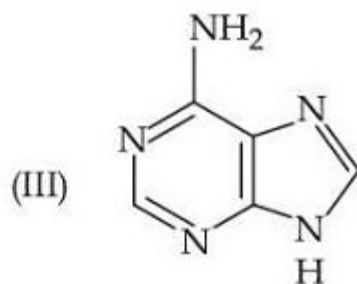
(A) Adenine



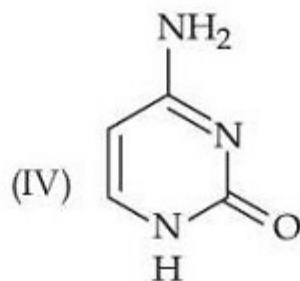
(B) Cytosine



(C) Thymine



(D) Uracil

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

Options

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

Option 1 ID : **6564451778**
Option 2 ID : **6564451777**
Option 3 ID : **6564451779**
Option 4 ID : **6564451780**

Q.54 Given below are two statements :

Statement (I) : The first ionization energy of Pb is greater than that of Sn.

Statement (II) : The first ionization energy of Ge is greater than that of Si.

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 false**
4. **Both Statement I and Statement II are true**

Question Type : **MCQ**

Question ID : **656445513**

Option 1 ID : **6564451751**

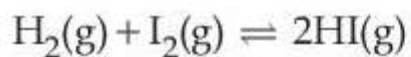
Option 2 ID : **6564451752**

Option 3 ID : **6564451750**

Option 4 ID : **6564451749**

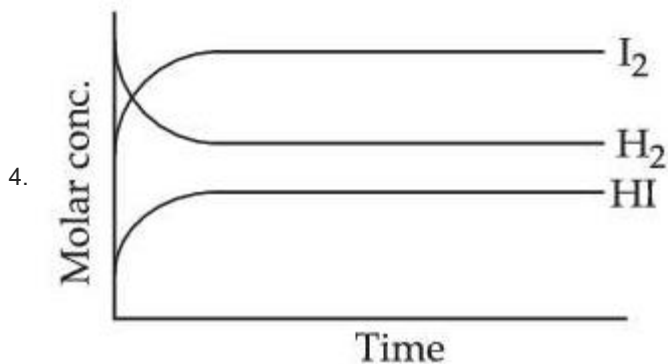
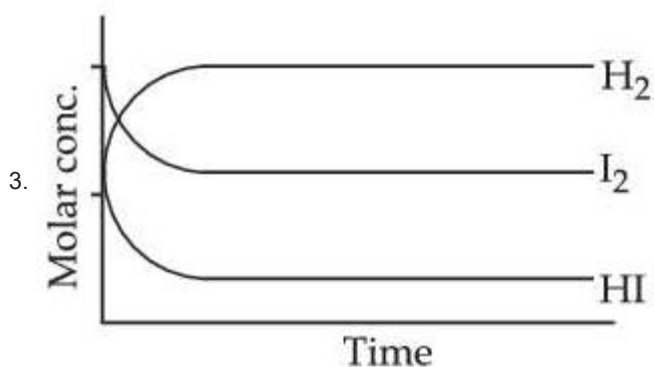
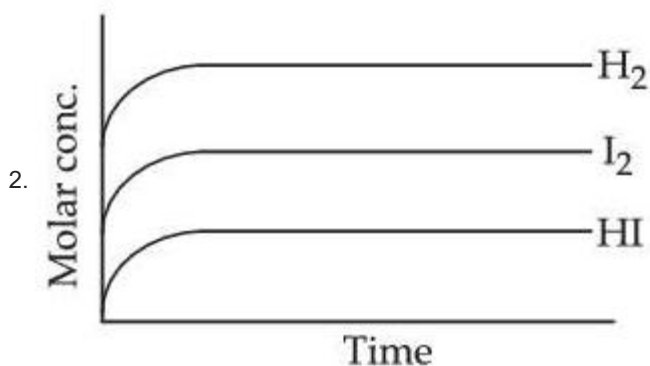
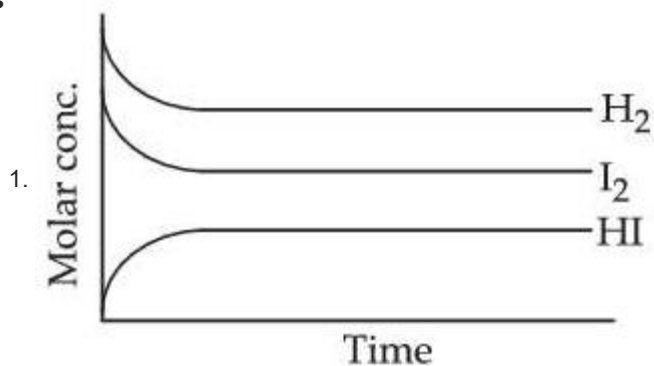
Q.55

For the reaction,



Attainment of equilibrium is predicted correctly by :

Options



Question Type : MCQ

Question ID : 656445505

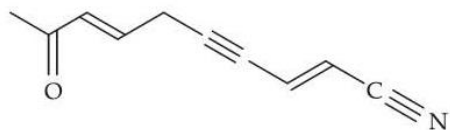
Option 1 ID : 6564451718

Option 2 ID : 6564451720

Option 3 ID : 6564451717

Option 4 ID : 6564451719

Q.56 In the given structure, number of sp and sp² hybridized carbon atoms present respectively are :



- Options**
1. 4 and 6
 2. 4 and 5
 3. 3 and 6
 4. 3 and 5

Question Type : **MCQ**

Question ID : **656445515**

Option 1 ID : **6564451759**

Option 2 ID : **6564451760**

Option 3 ID : **6564451758**

Option 4 ID : **6564451757**

Q.57 Given below are two statements :

Statement (I) : Experimentally determined oxygen-oxygen bond lengths in the O₃ are found to be same and the bond length is greater than that of a O=O (double bond) but less than that of a single (O–O) bond.

Statement (II) : The strong lone pair-lone pair repulsion between oxygen atoms is solely responsible for the fact that the bond length in ozone is smaller than that of a double bond (O=O) but more than that of a single bond (O–O).

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

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

Question Type : **MCQ**

Question ID : **656445508**

Option 1 ID : **6564451729**

Option 2 ID : **6564451731**

Option 3 ID : **6564451730**

Option 4 ID : **6564451732**

Q.58

For hydrogen atom, the orbital/s with lowest energy is/are :

- (A) $4s$
- (B) $3p_x$
- (C) $3d_{x^2-y^2}$
- (D) $3d_{z^2}$
- (E) $4p_z$

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

Options

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

Question Type : **MCQ**

Question ID : **656445502**

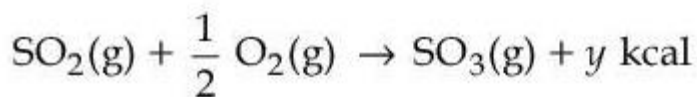
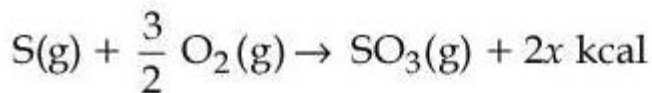
Option 1 ID : **6564451705**

Option 2 ID : **6564451706**

Option 3 ID : **6564451708**

Option 4 ID : **6564451707**

Q.59



The heat of formation of $\text{SO}_2(\text{g})$ is given by :

Options

1. $y - 2x \text{ kcal}$
2. $\frac{2x}{y} \text{ kcal}$
3. $x + y \text{ kcal}$
4. $2x + y \text{ kcal}$

Question Type : MCQ

Question ID : 656445504

Option 1 ID : 6564451713

Option 2 ID : 6564451716

Option 3 ID : 6564451715

Option 4 ID : 6564451714

Q.60

The conditions and consequence that favours the $t_{2g}^3 e_g^1$ configuration in a metal complex are :

Options

1. strong field ligand, high spin complex
2. strong field ligand, low spin complex
3. weak field ligand, low spin complex
4. weak field ligand, high spin complex

Question Type : MCQ

Question ID : 656445511

Option 1 ID : 6564451744

Option 2 ID : 6564451742

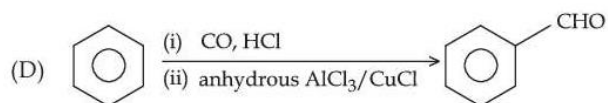
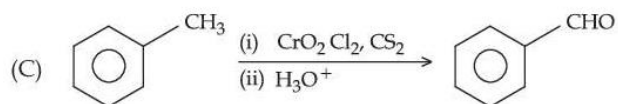
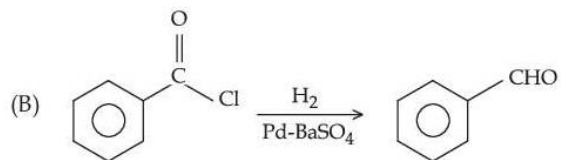
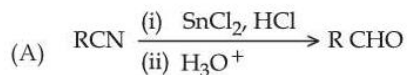
Option 3 ID : 6564451743

Option 4 ID : 6564451741

Q.61

Match List - I with List - II.

List - I



List - II

(I) Etard reaction

(II) Gatterman-Koch reaction

(III) Rosenmund reduction

(IV) Stephen reaction

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

Options

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

Question Type : MCQ

Question ID : 656445518

Option 1 ID : 6564451771

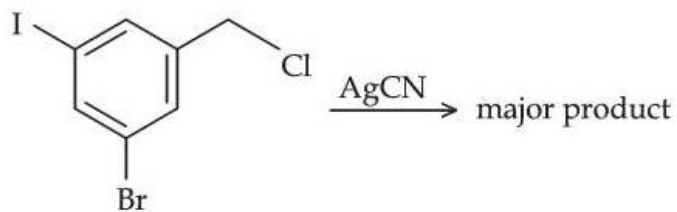
Option 2 ID : 6564451772

Option 3 ID : 6564451770

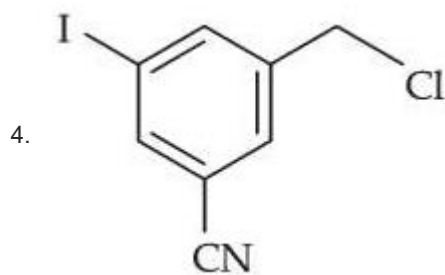
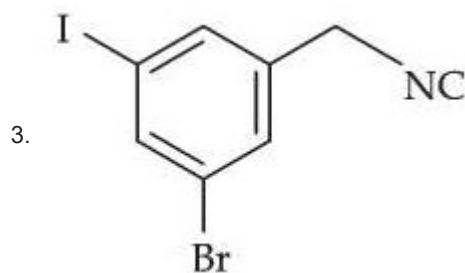
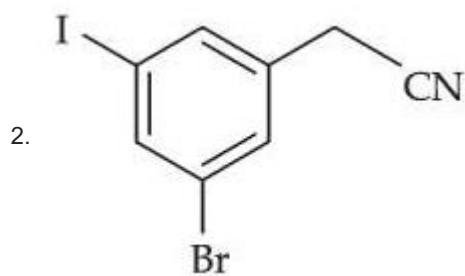
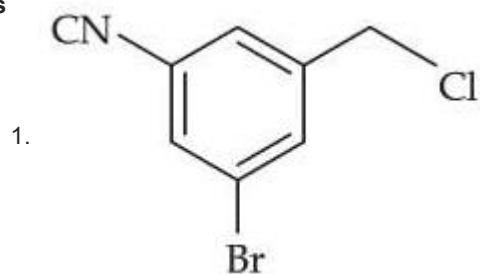
Option 4 ID : 6564451769

Q.62

The structure of the major product formed in the following reaction is :



Options



Question Type : MCQ

Question ID : 656445517

Option 1 ID : 6564451768

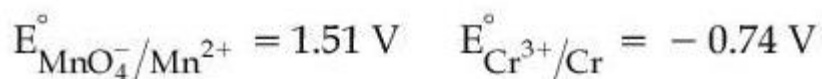
Option 2 ID : 6564451767

Option 3 ID : 6564451766

Option 4 ID : 6564451765

Q.63

Based on the data given below :



the strongest reducing agent is :

Options

1. MnO_4^-
2. Mn^{2+}
3. Cl^-
4. Cr

Question Type : MCQ

Question ID : 656445506

Option 1 ID : 6564451722

Option 2 ID : 6564451724

Option 3 ID : 6564451723

Option 4 ID : 6564451721

Q.64

The successive 5 ionisation energies of an element are 800, 2427, 3658, 25024 and 32824 kJ/mol, respectively. By using the above values predict the group in which the above element is present :

Options

1. Group 13
2. Group 4
3. Group 2
4. Group 14

Question Type : MCQ

Question ID : 656445514

Option 1 ID : 6564451753

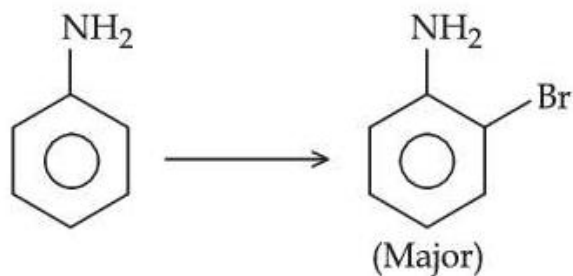
Option 2 ID : 6564451756

Option 3 ID : 6564451755

Option 4 ID : 6564451754

Q.65

For reaction



The correct order of set of reagents for the above conversion is :

Options

1. Ac_2O , Br_2 , $\text{H}_2\text{O}(\Delta)$, NaOH
2. H_2SO_4 , Ac_2O , Br_2 , $\text{H}_2\text{O}(\Delta)$, NaOH
3. Ac_2O , H_2SO_4 , Br_2 , NaOH
4. $\text{Br}_2 \mid \text{FeBr}_3$, $\text{H}_2\text{O}(\Delta)$, NaOH

Question Type : MCQ

Question ID : 656445519

Option 1 ID : 6564451773

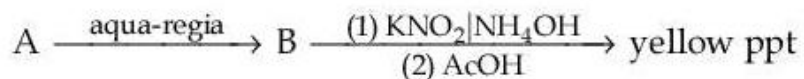
Option 2 ID : 6564451774

Option 3 ID : 6564451775

Option 4 ID : 6564451776

Q.66

Find the compound 'A' from the following reaction sequences.



Options

1. NiS
2. ZnS
3. MnS
4. CoS

Question Type : MCQ

Question ID : 656445509

Option 1 ID : 6564451733

Option 2 ID : 6564451736

Option 3 ID : 6564451735

Option 4 ID : 6564451734

Q.67 The elemental composition of a compound is 54.2% C, 9.2% H and 36.6% O.
If the molar mass of the compound is 132 g mol^{-1} , the molecular formula of the compound is :
[Given : The relative atomic mass of C : H : O = 12 : 1 : 16]

Options

1. $\text{C}_4 \text{H}_8 \text{O}_2$
2. $\text{C}_6 \text{H}_{12} \text{O}_6$
3. $\text{C}_4 \text{H}_9 \text{O}_3$
4. $\text{C}_6 \text{H}_{12} \text{O}_3$

Question Type : **MCQ**

Question ID : **656445501**

Option 1 ID : **6564451703**

Option 2 ID : **6564451702**

Option 3 ID : **6564451704**

Option 4 ID : **6564451701**

Q.68 Which of the following mixing of 1M base and 1M acid leads to the largest increase in temperature ?

Options

1. 30 mL CH_3COOH and 30 mL NaOH
2. 45 mL CH_3COOH and 25 mL NaOH
3. 30 mL HCl and 30 mL NaOH
4. 50 mL HCl and 20 mL NaOH

Question Type : **MCQ**

Question ID : **656445503**

Option 1 ID : **6564451710**

Option 2 ID : **6564451711**

Option 3 ID : **6564451712**

Option 4 ID : **6564451709**

Q.69

Match List - I with List - II.

List - I		List - II	
(Transition metal ion)		(Spin only magnetic moment (B.M.))	
(A)	Ti^{3+}	(I)	3.87
(B)	V^{2+}	(II)	0.00
(C)	Ni^{2+}	(III)	1.73
(D)	Sc^{3+}	(IV)	2.84

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

Options

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

Question Type : **MCQ**Question ID : **656445512**Option 1 ID : **6564451747**Option 2 ID : **6564451746**Option 3 ID : **6564451745**Option 4 ID : **6564451748**

Q.70

Identify correct statement/s :

- $-\text{OCH}_3$ and $-\text{NHCOCH}_3$ are activating group.
- $-\text{CN}$ and $-\text{OH}$ are meta directing group.
- $-\text{CN}$ and $-\text{SO}_3\text{H}$ are meta directing group.
- Activating groups act as ortho - and para directing groups.
- Halides are activating groups.

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

Options

- (A) only
- (A), (C) and (D) only
- (A), (B) and (E) only
- (A) and (C) only

Question Type : **MCQ**Question ID : **656445516**Option 1 ID : **6564451761**Option 2 ID : **6564451762**Option 3 ID : **6564451763**Option 4 ID : **6564451764**

Q.71 Consider a complex reaction taking place in three steps with rate constants k_1 , k_2 and k_3 respectively.

The overall rate constant k is given by the expression $k = \sqrt{\frac{k_1 k_3}{k_2}}$. If the activation energies of the three steps are 60, 30 and 10 kJ mol⁻¹ respectively, then the overall energy of activation in kJ mol⁻¹ is _____. (Nearest integer)

Question Type : **SA**Question ID : **656445522**

Q.72 The possible number of stereoisomers for 5-phenylpent-4-en-2-ol is _____.

Question Type : **SA**Question ID : **656445525**

Q.73 In Carius method of estimation of halogen, 0.25 g of an organic compound gave 0.15 g of silver bromide (AgBr). The percentage of Bromine in the organic compound is _____ $\times 10^{-1}\%$ (Nearest integer).

(Given : Molar mass of Ag is 108 and Br is 80 g mol⁻¹)

Question Type : **SA**Question ID : **656445523**

Q.74 The hydrocarbon (X) with molar mass 80 g mol⁻¹ and 90% carbon has _____ degree of unsaturation.

Question Type : **SA**Question ID : **656445524**

Q.75 The observed and normal molar masses of compound MX_2 are 65.6 and 164 respectively. The percent degree of ionisation of MX_2 is _____. (Nearest integer)

Question Type : **SA**Question ID : **656445521**