

JEE-MAIN EXAM APRIL, 2025

Date: - 07-04-2025 (SHIFT-2)

MATHEMATICS

SECTION-A

- Consider the lines $L_1 : x-1=y-2=z$ and $L_2 : x-2=y=z-1$. Let the feet of the perpendiculars from the point $P(5,1,-3)$ on the lines L_1 and L_2 be Q and R respectively. If the area of the triangle PQR is A , then $4A^2$ is equal to:
 (1) 143 (2) 151 (3) 147 (4) 139
- Let the system of equations

$$x+5y-z=1$$
$$4x+3y-3z=7$$
$$24x+y+\lambda z=\mu$$

 $\lambda, \mu \in \mathbf{R}$, have infinitely many solutions. Then the number of the solutions of this system, if x, y, z are integers and satisfy $7 \leq x+y+z \leq 77$, is :
 (1) 3 (2) 5 (3) 6 (4) 4
- Let the length of a latus rectum of an ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ be 10. If its eccentricity is the minimum value of the function $f(t) = t^2 + t + \frac{11}{12}$, $t \in \mathbf{R}$, then $a^2 + b^2$ is equal to :
 (1) 126 (2) 115 (3) 125 (4) 120
- Let $\vec{a}$ and $\vec{b}$ be the vectors of the same magnitude such that $\frac{|\vec{a}+\vec{b}|+|\vec{a}-\vec{b}|}{|\vec{a}+\vec{b}|-|\vec{a}-\vec{b}|} = \sqrt{2} + 1$. Then $\frac{|\vec{a}+\vec{b}|^2}{|\vec{a}|^2}$ is :
 (1) $2+4\sqrt{2}$ (2) $4+2\sqrt{2}$ (3) $2+\sqrt{2}$ (4) $1+\sqrt{2}$
- If the equation of the line passing through the point $\left(0, -\frac{1}{2}, 0\right)$ and perpendicular to the lines $\vec{r} = \lambda(\hat{i} + \hat{a}\hat{j} + \hat{b}\hat{k})$ and $\vec{r} = (\hat{i} - \hat{j} - 6\hat{k}) + \mu(-\hat{b}\hat{i} + \hat{a}\hat{j} + 5\hat{k})$ is $\frac{x-1}{-2} = \frac{y+4}{d} = \frac{z-c}{-4}$, then $a+b+c+d$ is equal to :
 (1) 14 (2) 13 (3) 10 (4) 12

6. Let $A = \{(\alpha, \beta) \in \mathbf{R} \times \mathbf{R} : |\alpha - 1| \leq 4 \text{ and } |\beta - 5| \leq 6\}$ and $B = \{(\alpha, \beta) \in \mathbf{R} \times \mathbf{R} : 16(\alpha - 2)^2 + 9(\beta - 6)^2 \leq 144\}$. Then
 (1) $A \cup B = \{(x, y) : -4 \leq x \leq 4, -1 \leq y \leq 11\}$ (2) $B \subset A$
 (3) neither $A \subset B$ nor $B \subset A$ (4) $A \subset B$
7. Let a_n be the n^{th} term of an A.P. If $S_n = a_1 + a_2 + a_3 + \dots + a_n = 700$, $a_6 = 7$ and $S_7 = 7$, then a_n is equal to:
 (1) 64 (2) 70 (3) 56 (4) 65
8. If the range of the function $f(x) = \frac{5-x}{x^2-3x+2}$, $x \neq 1, 2$, is $(-\infty, \alpha] \cup [\beta, \infty)$, then $\alpha^2 + \beta^2$ is equal to:
 (1) 192 (2) 190 (3) 194 (4) 188
9. If the sum of the second, fourth and sixth terms of a G.P. of positive terms is 21 and the sum of its eighth, tenth and twelfth terms is 15309, then the sum of its first nine terms is :
 (1) 755 (2) 757 (3) 760 (4) 750
10. If the area of the region $\{(x, y) : 1 + x^2 \leq y \leq \min\{x + 7, 11 - 3x\}\}$ is A, then 3A is equal to
 (1) 46 (2) 47 (3) 49 (4) 50
11. If the locus of $z \in \mathbf{C}$, such that $\operatorname{Re}\left(\frac{z-1}{2z+i}\right) + \operatorname{Re}\left(\frac{\bar{z}-1}{2\bar{z}-i}\right) = 2$, is a circle of radius r and center (a,b), then $\frac{15ab}{r^2}$ is equal to :
 (1) 24 (2) 18 (3) 16 (4) 12
12. The number of solutions of the equation $\cos 2\theta \cos \frac{\theta}{2} + \cos \frac{5\theta}{2} = 2 \cos^3 \frac{5\theta}{2}$ in $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ is :
 (1) 5 (2) 7 (3) 9 (4) 6
13. If the orthocenter of the triangle formed by the lines $y = x + 1$, $y = 4x - 8$ and $y = mx + c$ is at $(3, -1)$, then $m - c$ is :
 (1) -1 (2) 4 (3) 0 (4) 2
14. The number of real roots of the equation $x|x-2| + 3|x-3| + 1 = 0$ is :
 (1) 3 (2) 2 (3) 1 (4) 4
15. Let $y = y(x)$ be the solution of the differential equation $(x^2 + 1)y' - 2xy = (x^4 + 2x^2 + 1)\cos x$, $y(0) = 1$. Then $\int_{-3}^3 y(x) dx$ is :
 (1) 24 (2) 30 (3) 18 (4) 36

16. Let p be the number of all triangles that can be formed by joining the vertices of a regular polygon P of n sides and q be the number of all quadrilaterals that can be formed by joining the vertices of P . If $p + q = 126$, then the eccentricity of the ellipse $\frac{x^2}{16} + \frac{y^2}{n} = 1$ is :
- (1) $\frac{\sqrt{7}}{4}$ (2) $\frac{1}{2}$ (3) $\frac{1}{\sqrt{2}}$ (4) $\frac{3}{4}$
17. Let $f : \mathbf{R} \rightarrow \mathbf{R}$ be a polynomial function of degree four having extreme values at $x = 4$ and $x = 5$. If $\lim_{x \rightarrow 0} \frac{f(x)}{x^2} = 5$, then $f(2)$ is equal to :
- (1) 10 (2) 8 (3) 12 (4) 14
18. Let a random variable X take values 0,1,2,3 with $P(X=0) = P(X=1) = p, P(X=2) = P(X=3)$ and $E(X^2) = 2E(X)$. Then the value of $8p - 1$ is:
- (1) 0 (2) 2 (3) 3 (4) 1
19. A bag contains 19 unbiased coins and one coin with head on both sides. One coin drawn at random is tossed and head turns up. If the probability that the drawn coin was unbiased, is $\frac{m}{n}, \gcd(m, n) = 1$, then $n^2 - m^2$ is equal to :
- (1) 72 (2) 64 (3) 60 (4) 80
20. Let e_1 and e_2 be the eccentricities of the ellipse $\frac{x^2}{b^2} + \frac{y^2}{25} = 1$ and the hyperbola $\frac{x^2}{16} - \frac{y^2}{b^2} = 1$, respectively. If $b < 5$ and $e_1 e_2 = 1$, then the eccentricity of the ellipse having its axes along the coordinate axes and passing through all four foci (two of the ellipse and two of the hyperbola) is :
- (1) $\frac{\sqrt{7}}{4}$ (2) $\frac{4}{5}$ (3) $\frac{\sqrt{3}}{2}$ (4) $\frac{3}{5}$

SECTION-B

21. For $t > -1$, let α_t and β_t be the roots of the equation $((t+2)^{1/7} - 1)x^2 + ((t+2)^{1/6} - 1)x + ((t+2)^{1/21} - 1) = 0$. If $\lim_{t \rightarrow -1^+} \alpha_t = a$ and $\lim_{t \rightarrow -1^+} \beta_t = b$ then $72(a+b)^2$ is equal to _____.
22. Let the lengths of the transverse and conjugate axes of a hyperbola in standard form be $2a$ and $2b$, respectively, and one focus and the corresponding directrix of this hyperbola be $(-5, 0)$ and $5x + 9 = 0$, respectively. If the product of the focal distances of a point $(\alpha, 2\sqrt{5})$ on the hyperbola is p , then $4p$ is equal to _____.

23. If the function $f(x) = \frac{\tan(\tan x) - \sin(\sin x)}{\tan x - \sin x}$ is continuous at $x = 0$, then $f(0)$ is equal to _____.
24. The sum of the series $2 \times 1 \times {}^{20}C_4 - 3 \times 2 \times {}^{20}C_5 + 4 \times 3 \times {}^{20}C_6 - 5 \times 4 \times {}^{20}C_7 + \dots + 18 \times 17 \times {}^{20}C_{20}$, is equal to _____.
25. If $\int \left(\frac{1}{x} + \frac{1}{x^3} \right) \left(\sqrt[23]{3x^{-24} + x^{-26}} \right) dx = -\frac{\alpha}{3(\alpha+1)} \left(3x^\beta + x^\gamma \right)^{\frac{\alpha+1}{\alpha}} + C, x > 0, (\alpha, \beta, \gamma \in \mathbf{Z})$, where C is the constant of integration, then $\alpha + \beta + \gamma$ is equal to _____.

NTA ANSWERS

- | | | | | | | | | | | | | | |
|-----|-------|-----|-----|-----|------|-----|------|-----|-----|-----|-----|-----|------|
| 1. | (3) | 2. | (1) | 3. | (1) | 4. | (3) | 5. | (1) | 6. | (2) | 7. | (1) |
| 8. | (3) | 9. | (2) | 10. | (4) | 11. | (2) | 12. | (2) | 13. | (3) | 14. | (3) |
| 15. | (1) | 16. | (3) | 17. | (1) | 18. | (2) | 19. | (4) | 20. | (4) | 21. | (98) |
| 22. | (189) | 23. | (2) | 24. | (34) | 25. | (19) | | | | | | |

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Date: - 07-04-2025 (SHIFT-2)

PHYSICS**SECTION-A**

1. A helicopter flying horizontally with a speed of 360 km/h at an altitude of 2 km , drops an object at an instant. The object hits the ground at a point O, 20 s after it is dropped. Displacement of 'O' from the position of helicopter where the object was released is : (use acceleration due to gravity $g = 10 \text{ m/s}^2$ and neglect air resistance)

- (1) $2\sqrt{5} \text{ km}$ (2) 7.2 km (3) 4 km (4) $2\sqrt{2} \text{ km}$

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

Assertion (A) : Magnetic monopoles do not exist.

Reason (R): Magnetic field lines are continuous and form closed loops.

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

- (1) (A) is correct but (R) is not correct
(2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(3) (A) is not correct but (R) is correct
(4) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

3. A photo-emissive substance is illuminated with a radiation of wavelength λ_i so that it releases electrons with de-Broglie wavelength λ_e . The longest wavelength of radiation that can emit photoelectron is λ_o . Expression for de-Broglie wavelength is given by : (m : mass of the electron, h : Planck's constant and c : speed of light)

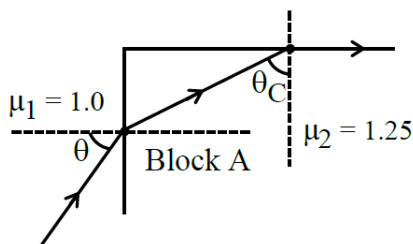
(1) $\lambda_e = \frac{h}{\sqrt{2mc\left(\frac{1}{\lambda_i} - \frac{1}{\lambda_o}\right)}}$

(2) $\lambda_e = \sqrt{\frac{h\lambda_i}{2mc}}$

(3) $\lambda_e = \sqrt{\frac{h}{2mc\left(\frac{1}{\lambda_i} - \frac{1}{\lambda_o}\right)}}$

(4) $\lambda_e = \sqrt{\frac{h\lambda_o}{2mc}}$

4. The unit of $\sqrt{\frac{2I}{\epsilon_0 C}}$ is : (I = intensity of an electromagnetic wave, c : speed of light)
- (1) Nm (2) Vm (3) NC (4) NC^{-1}
5. A transparent block A having refractive index $\mu = 1.25$ is surrounded by another medium of refractive index $\mu = 1.0$ as shown in figure. A light ray is incident on the flat face of the block with incident angle θ as shown in figure. What is the maximum value of θ for which light suffers total internal reflection at the top surface of the block?



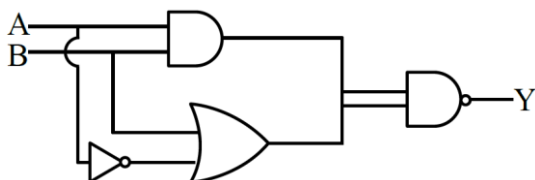
- (1) $\tan^{-1}(4/3)$ (2) $\cos^{-1}(3/4)$ (3) $\sin^{-1}(3/4)$ (4) $\tan^{-1}(3/4)$
6. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) : The density of the copper (${}^{64}_{29}\text{Cu}$) nucleus is greater than that of the carbon (${}^{12}_6\text{C}$) nucleus.

Reason (R): The nucleus of mass number A has a radius proportional to $A^{1/3}$.

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

- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
 (2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
 (3) (A) is correct but (R) is not correct
 (4) (A) is not correct but (R) is correct
7. Which one of the following forces cannot be expressed in terms of potential energy?
 (1) Restoring force (2) Frictional force (3) Coulomb's force (4) Gravitational force
8. Consider the following logic circuit.



The output is $Y = 0$ when :

- (1) $A = 0$ and $B = 1$ (2) $A = 0$ and $B = 0$
 (3) $A = 1$ and $B = 0$ (4) $A = 1$ and $B = 1$

9. Match List - I with List - II.

List – I

(A) Mass density

(B) Impulse

(C) Power

(D) Moment of inertia

List - II

(I) $[ML^2 T^{-3}]$

(II) $[MLT^{-1}]$

(III) $[ML^2 T^0]$

(IV) $[ML^{-3} T^0]$

Choose the correct answer from the options given below :

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

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

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

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

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

Assertion (A) : Refractive index of glass is higher than that of air.

Reason (R) : Optical density of a medium is directly proportionate to its mass density which results in a proportionate refractive index.

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

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

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

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

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

11. Match List - I with List - II.

List – I

(A) Isothermal

(B) Adiabatic

(C) Isobaric

(D) Isochoric

List - II

(I) ΔW (work done) = 0

(II) ΔQ (supplied heat) = 0

(III) ΔU (change in internal energy) $\neq 0$

(IV) $\Delta U = 0$

Choose the correct answer from the options given below :

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

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

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

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

12. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).
Assertion (A) : The outer body of an air craft is made of metal which protects persons sitting inside from lightning-strikes.
Reason (R): The electric field inside the cavity enclosed by a conductor is zero.
In the light of the above statements, choose the most appropriate answer from the options given below :
- (1) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
(2) Both (A) and (R) are correct and (R) is the correct explanation of (A)
(3) (A) is correct but (R) is not correct
(4) (A) is not correct but (R) is correct
13. An object with mass 500 g moves along x-axis with speed $v = 4\sqrt{x}$ m/s . The force acting on the object is :
(1) 8 N (2) 4 N (3) 6 N (4) 5 N
14. The equation of a wave travelling on a string is $y = \sin[20\pi x + 10\pi t]$, where x and t are distance and time in SI units. The minimum distance between two points having the same oscillating speed is :
(1) 5.0 cm (2) 20 cm (3) 10 cm (4) 2.5 cm
15. The dimension of $\sqrt{\frac{\mu_0}{\epsilon_0}}$ is equal to that of : (μ_0 = Vacuum permeability and ϵ_0 = Vacuum permittivity)
(1) Capacitance (2) Resistance (3) Inductance (4) Voltage
16. The helium and argon are put in the flask at the same room temperature (300K). The ratio of average kinetic energies (per molecule) of helium and argon is:
(Give : Molar mass of helium = 4 g/mol , Molar mass of argon = 40 g/mol)
(1) 1: 10 (2) 1: 1 (3) 10: 1 (4) 1: $\sqrt{10}$
17. A mirror is used to produce an image with magnification of $\frac{1}{4}$. If the distance between object and its image is 40 cm, then the focal length of the mirror is
(1) 10 cm (2) 15 cm (3) 12.7 cm (4) 10.7 cm
18. A capillary tube of radius 0.1 mm is partly dipped in water (surface tension 70dyn/cm and glass water contact angle $\approx 0^\circ$) with 30° inclined with the vertical. The length of water risen in the capillary is _____ cm . (Take $g = 9.8\text{m/s}^2$)
(1) $\frac{82}{5}$ (2) $\frac{57}{2}$ (3) $\frac{68}{5}$ (4) $\frac{71}{5}$

19. A dipole with two electric charges of $2\mu\text{C}$ magnitude each, with separation distance $0.5\mu\text{m}$, is placed between the plates of a capacitor such that its axis is parallel to an electric field established between the plates when a potential difference of 5 V is applied. Separation between the plates is 0.5 mm . If the dipole is rotated by 30° from the axis, it tends to realign in the direction due to a torque. The value of torque is :

(1) $2.5 \times 10^{-9}\text{ Nm}$ (2) $5 \times 10^{-9}\text{ Nm}$ (3) $2.5 \times 10^{-12}\text{ Nm}$ (4) $5 \times 10^{-3}\text{ Nm}$

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

Assertion (A) : The radius vector from the Sun to a planet sweeps out equal areas in equal intervals of time and thus areal velocity of planet is constant.

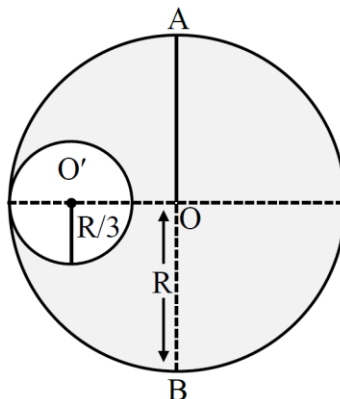
Reason (R): For a central force field the angular momentum is a constant.

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

- (1) (A) is not correct but (R) is correct
 (2) (A) is correct but (R) is not correct
 (3) Both (A) and (R) are correct and (R) is the correct explanation of (A)
 (4) Both (A) and (R) are correct but (R) is not the correct explanation of (A)

SECTION-B

21. A parallel plate capacitor has charge $5 \times 10^{-6}\text{ C}$. A dielectric slab is inserted between the plates and almost fills the space between the plates. If the induced charge on one face of the slab is $4 \times 10^{-6}\text{ C}$ then the dielectric constant of the slab is ____ .
22. M and R be the mass and radius of a disc. A small disc of radius $R/3$ is removed from the bigger disc as shown in figure. The moment of inertia of remaining part of bigger disc about an axis AB passing through the centre O and perpendicular to the plane of disc is $\frac{4}{x}MR^2$. The value of x is ____ .



23. The electric field in a region is given by $\vec{E} = (2\hat{i} + 4\hat{j} + 6\hat{k}) \times 10^3 \text{ N/C}$. The flux of the field through a rectangular surface parallel to x-z plane is $6.0 \text{ Nm}^2\text{C}^{-1}$. The area of the surface is _____ cm^2 .
24. An inductor of reactance 100Ω , a capacitor of reactance 50Ω , and a resistor of resistance 50Ω are connected in series with an AC source of 10V, 50Hz. Average power dissipated by the circuit is _____
25. Two cylindrical rods A and B made of different materials, are joined in a straight line. The ratios of lengths, radii and thermal conductivities of these rods are: $\frac{L_A}{L_B} = \frac{1}{2}$, $\frac{r_A}{r_B} = 2$ and $\frac{K_A}{K_B} = \frac{1}{2}$. The free ends of rods A and B are maintained at 400 K, 200 K, respectively. The temperature of rods interface is _____K, when equilibrium is established.

NTA ANSWER

- | | | | | | | | | | | | | | |
|-----|-----|-----|------|-----|-----|-----|-------|-----|-----|-----|-----|-----|-----|
| 1. | (4) | 2. | (2) | 3. | (3) | 4. | (4) | 5. | (3) | 6. | (4) | 7. | (2) |
| 8. | (4) | 9. | (4) | 10. | (1) | 11. | (2) | 12. | (2) | 13. | (2) | 14. | (1) |
| 15. | (2) | 16. | (2) | 17. | (4) | 18. | (1) | 19. | (2) | 20. | (3) | 21. | (5) |
| 22. | (9) | 23. | (15) | 24. | (1) | 25. | (360) | | | | | | |

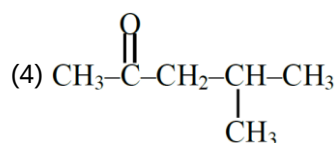
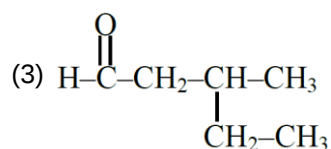
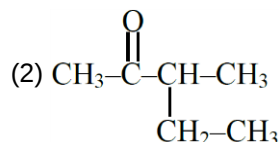
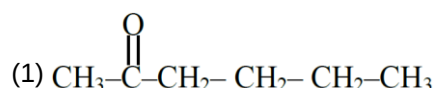
JEE-MAIN EXAM APRIL, 2025

Date: - 07-04-2025 (SHIFT-2)

CHEMISTRY

SECTION-A

1. "P" is an optically active compound with molecular formula $C_6H_{12}O$. When 'P' is treated with 2, 4-dinitrophenylhydrazine, it gives a positive test. However, in presence of Tollens reagent, "P" gives a negative test. Predict the structure of "P".



2. Match List - I with List - II.

List - I

- (A) Solution of chloroform and acetone
(B) Solution of ethanol and water
(C) Solution of benzene and toluene
(D) Solution of acetic acid in benzene

List - II

- (I) Minimum boiling azeotrope
(II) Dimerizes
(III) Maximum boiling azeotrope
(IV) $\Delta V_{\text{mix}} = 0$

Choose the correct answer from the options given below :

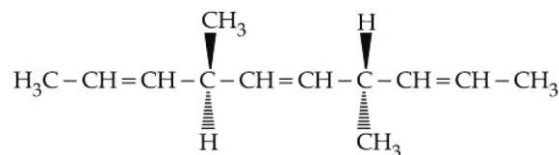
- (1) (A)-(III), (B)-(I), (C)-(IV), (D)-(II) (2) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(3) (A)-(III), (B)-(IV), (C)-(I), (D)-(II) (4) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)
3. The hydration energies of K^+ and Cl^- are $-x$ and $-y$ kJ/mol respectively. If lattice energy of KCl is $-z$ kJ/mol, then the heat of solution of KCl is :
- (1) $z - (x + y)$ (2) $x + y + z$ (3) $-z - (x + y)$ (4) $+x - y - z$
4. $A(g) \rightarrow B(g) + C(g)$ is a first order reaction.

Time	T	∞
P_{system}	P_t	P_{∞}

The reaction was started with reactant A only. Which of the following expression is correct for rate constant k ?

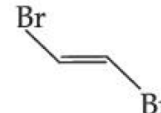
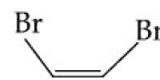
- (1) $k = \frac{1}{t} \ln \frac{p_{\infty}}{p_t}$ (2) $k = \frac{1}{t} \ln \frac{2(p_{\infty} - p_t)}{p_t}$ (3) $k = \frac{1}{t} \ln \frac{p_{\infty}}{(p_{\infty} - p_t)}$ (4) $k = \frac{1}{t} \ln \frac{p_{\infty}}{2(p_{\infty} - p_t)}$

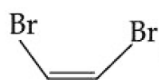
5. The number of optically active products obtained from the complete ozonolysis of the given compound is



- (1) 2 (2) 0 (3) 1 (4) 4
6. The correct statement amongst the following is :
- (1) $\Delta_f H_{500}^\theta$ is zero for $\text{O}_2(\text{g})$
- (2) The term 'standard state' implies that the temperature is 0°C .
- (3) $\Delta_f H_{298}^\theta$ is zero for $\text{O}(\text{g})$
- (4) The standard state of a pure gas is the pure gas at a pressure of 1 bar and temperature 273 K.
7. Given below are two statements :

Statement (I) :  is more polar than 

Statement (II) : Boiling point of  is lower than  but it is more polar than



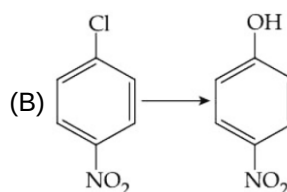
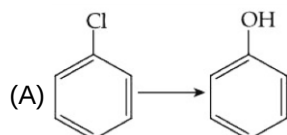
In the light of the above statements, choose the most appropriate answer from the options given below :

- (1) Both Statement I and Statement II are incorrect
- (2) Statement I is correct but Statement II is incorrect
- (3) Statement I is incorrect but Statement II is correct
- (4) Both Statement I and Statement II are correct

8. Match List - I with List - II.

List - I

Conversion

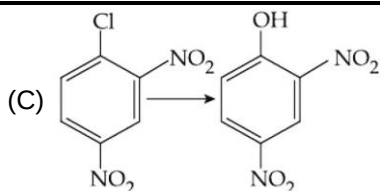


List - II

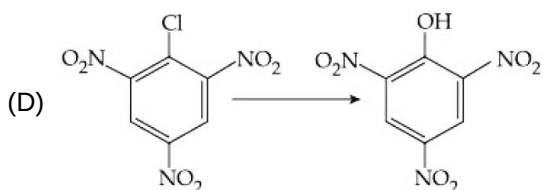
Reagents, Conditions used

(I) Warm, H_2O

(II) (a) NaOH , 368 K; (b) H_3O^+



(III) (a) NaOH, 443 K ; (b) H_3O^+



(IV) (a) NaOH, 623 K, 300 atm ; (b) H_3O^+

Choose the correct answer from the options given below :

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

9. The correct statements from the following are :

- (A) Tl^{3+} is a powerful oxidising agent
 (B) Al^{3+} does not get reduced easily
 (C) Both Al^{3+} and Tl^{3+} are very stable in solution
 (D) Tl^+ is more stable than Tl^{3+}
 (E) Al^{3+} and Tl^+ are highly stable

Choose the correct answer from the options given below :

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

10. In SO_2 , NO_2^- and N_3^- the hybridizations at the central atom are respectively :

- (1) sp^2 , sp^2 and sp (2) sp^2 , sp and sp (3) sp^2 , sp^2 and sp^2 (4) sp , sp^2 and sp

11. Given below are two statements :

1 M aqueous solutions of each of $\text{Cu}(\text{NO}_3)_2$, AgNO_3 , $\text{Hg}_2(\text{NO}_3)_2$; $\text{Mg}(\text{NO}_3)_2$ are electrolysed using inert electrodes. Given : $E_{\text{Ag}^+/\text{Ag}}^\theta = 0.80 \text{ V}$, $E_{\text{Hg}_2^{2+}/\text{Hg}}^\theta = 0.79 \text{ V}$, $E_{\text{Cu}^{2+}/\text{Cu}}^\theta = 0.24 \text{ V}$ and $E_{\text{Mg}^{2+}/\text{Mg}}^\theta = -2.37 \text{ V}$.

Statement (I): With increasing voltage, the sequence of deposition of metals on the cathode will be Ag, Hg and Cu .

Statement (II) : Magnesium will not be deposited at cathode instead oxygen gas will be evolved at the cathode.

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

- (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

12. Match List - I with List - II.

List-I Complex		List-II Primary valency and Secondary valency		
(A)	$[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$	(I)	3	6
(B)	$[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NO}_2)]$	(II)	3	4
(C)	$\text{Hg}[\text{Co}(\text{SCN})_4]$	(III)	2	6
(D)	$[\text{Mg}(\text{EDTA})]^{2-}$	(IV)	2	4

Choose the correct answer from the options given below :

- (1) (A)-(II), (B)-(III), (C)-(IV), (D)-(I) (2) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
 (3) (A)-(III), (B)-(I), (C)-(II), (D)-(IV) (4) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)
13. 'X' is the number of acidic oxides among VO_2 , V_2O_3 , CrO_3 , V_2O_5 and Mn_2O_7 . The primary valency of cobalt in $[\text{Co}(\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2)_3]_2(\text{SO}_4)_3$ is Y. The value of X + Y is ____.

- (1) 2 (2) 4 (3) 3 (4) 5

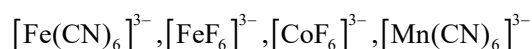
14. Liquid A and B form an ideal solution. The vapour pressures of pure liquids A and B are 350 and 750 mm Hg respectively at the same temperature. If x_A and x_B are the mole fraction of A and B in solution while y_A and y_B are the mole fraction of A and B in vapour phase then,

- (1) $\frac{x_A}{x_B} < \frac{y_A}{y_B}$ (2) $(x_A - y_A) < (x_B - y_B)$ (3) $\frac{x_A}{x_B} > \frac{y_A}{y_B}$ (4) $\frac{x_A}{x_B} = \frac{y_A}{y_B}$

15. Choose the incorrect trend in the atomic radii (r) of the elements.

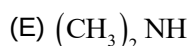
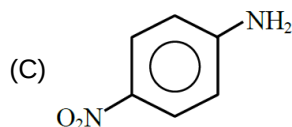
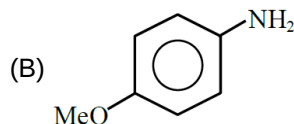
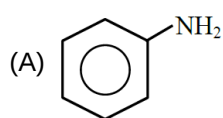
- (1) $r_{\text{At}} < r_{\text{CS}}$ (2) $r_{\text{Br}} < r_{\text{K}}$ (3) $r_{\text{Mg}} < r_{\text{Al}}$ (4) $r_{\text{Rb}} < r_{\text{CS}}$

16. The number of unpaired electrons responsible for the paramagnetic nature of the following complex species are respectively :



- (1) 1,1,4,2 (2) 1,4,4,2 (3) 1,5,4,2 (4) 1,5,5,2

17. The descending order of basicity of following amines is :



Choose the correct answer from the options given below :

- (1) $\text{E} > \text{D} > \text{B} > \text{A} > \text{C}$ (2) $\text{E} > \text{A} > \text{D} > \text{C} > \text{B}$
 (3) $\text{E} > \text{D} > \text{A} > \text{B} > \text{C}$ (4) $\text{B} > \text{E} > \text{D} > \text{A} > \text{C}$

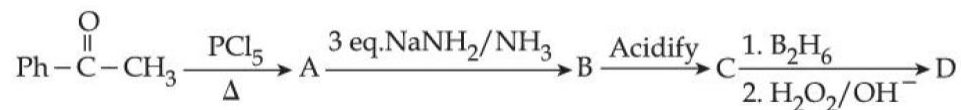
8. Mixture of 1 g each of chlorobenzene, aniline and benzoic acid is dissolved in 50 mL ethyl acetate and placed in a separating funnel. 5MNaOH(30mL) was added in the same funnel. The funnel was shaken vigorously and then kept aside. The ethyl acetate layer in the funnel contains :
- (1) benzoic acid and aniline (2) benzoic acid and chlorobenzene
(3) benzoic acid (4) chlorobenzene and aniline
19. The extra stability of half-filled subshell is due to :
- (A) Symmetrical distribution of electrons
(B) Smaller coulombic repulsion energy
(C) The presence of electrons with the same spin in non-degenerate orbitals
(D) Larger exchange energy
(E) Relatively smaller shielding of electrons by one another
- Identify the correct statements :
- (1) (B), (D) and (E) only (2) (A), (B), (D) and (E) only
(3) (B), (C) and (D) only (4) (A), (B) and (D) only
20. Given below are two statements :
- Statement (I) : On hydrolysis, oligo peptides give rise to fewer number of α -amino acids while proteins give rise to a large number of β -amino acids.
- Statement (II) : Natural proteins are denatured by acids which convert the water soluble form of fibrous proteins to their water insoluble form.
- In the light of the above statements, choose the most appropriate answer from the options given below :
- (1) Statement I is incorrect but Statement II is correct
(2) Both Statement I and Statement II are correct
(3) Statement I is correct but Statement II is incorrect
(4) Both Statement I and Statement II are incorrect

SECTION-B

21. The number of paramagnetic metal complex species among $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$, $[\text{MnCl}_6]^{3-}$, $[\text{Mn}(\text{CN})_6]^{3-}$, $[\text{CoF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{FeF}_6]^{3-}$ with same number of unpaired electrons is ____.
22. Butane reacts with oxygen to produce carbon dioxide and water following the equation given below.
- $$\text{C}_4\text{H}_{10}(\text{g}) + \frac{13}{2}\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 5\text{H}_2\text{O}(\text{l})$$
- If 174.0 kg of butane is mixed with 320.0 kg of O_2 , the volume of water formed in liters is ____.
- (Nearest integer)
- [Given : (a) Molar mass of C, H, O are 12, 1, 16 g mol^{-1} respectively, (b) Density of water = 1 g mL^{-1}]

23. In Dumas' method 292 mg of an organic compound released 50 mL of nitrogen gas (N_2) at 300 K temperature and 715 mm Hg pressure. The percentage composition of 'N' in the organic compound is _____ % (Nearest integer) (Aqueous tension at 300K = 15mmHg)

24. Identify the structure of the final product (D) in the following sequence of the reactions :



Total number of sp^2 hybridised carbon atoms in product D is_____.

25. One litre buffer solution was prepared by adding 0.10 mol each of NH_3 and NH_4Cl in deionised water. The change in pH on addition of 0.05 mol of HCl to the above solution is _____ $\times 10^{-2}$. (Nearest integer)

Given : pK_b of $\text{NH}_3 = 4.745$ and $\log_{10} 3 = 0.477$

NTA ANSWERS

1.	(2)	2.	(1)	3.	(1)	4.	(4)	5.	(2)	6.	(1)	7.	(2)
8.	(3)	9.	(4)	10.	(1)	11.	(3)	12.	(4)	13.	(4)	14.	(3)
15.	(3)	16.	(3)	17.	(1)	18.	(4)	19.	(2)	20.	(4)	21.	(2)
22.	(138)	23.	(18)	24.	(7)	25.	(48)						