



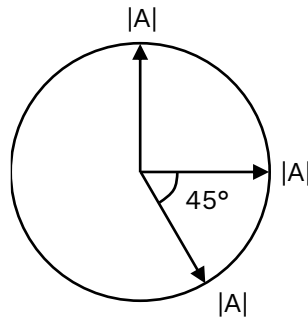
MATHEMATICS

- Find sum of solutions of the equation $8^{2\alpha} - 16.8^\alpha + 48 = 0$
- Find sum of diagonal elements of matrices A^{13} here $A = \begin{bmatrix} 2 & -1 \\ 1 & 1 \end{bmatrix}$
- Given $\sin x = -\frac{4}{5}$ where $\theta \in \text{III}^{\text{rd}}$ quadrant then find the value of $3\tan^2 x - \cos x$ is
- Solve $\int \frac{6dx}{\sin^2 x(1 - \cot^2 x)}$
- Let $f(x) = \cos x - x + 1 \forall x \in [0, \pi]$. let M and m be the maximum and minimum values of $f(x)$ then find $(M - m)$
- Find shortest distance between lines $\vec{r}_1 = (5 + \mu)\hat{i} + (1 - 3\mu)\hat{j} + (1 + 2\mu)\hat{k}$ and $\vec{r}_2 = (2 + \lambda)\hat{i} + (3 - 3\lambda)\hat{j} + (3 + 4\lambda)\hat{k}$
- Let A be 3×3 matrix where $A = \begin{bmatrix} 2 & a & 0 \\ 1 & 3 & 1 \\ 0 & 1 & b \end{bmatrix}$ and $A^3 = 3A^2 + 2I$, then find the value of $3a + b$?
- Find area where $A = \min\{\sin x, \cos x\}$ in $x \in [-\pi, \pi]$
- If $I_n = \int_0^1 (1 - x^k)^n dx$. If $147I_{21} = 148I_{20}$ then find the value of k .
- Find the value of the $\lim_{x \rightarrow 0} 2 \left[\frac{1 - \cos x \sqrt{\cos 2x} \cdot \sqrt[3]{\cos 3x} \dots \sqrt[10]{\cos 10x}}{x^2} \right]$
- A Differential Equation is given as $(1 + y^2) \cdot e^{\tan x} dx + (1 + e^{2 \tan x}) \cos^2 x dy = 0$ and $y(0) = 1$, then find the value of $y\left(\frac{\pi}{4}\right)$.
- Find the number of three digit numbers than can be formed using the digits $\{2, 3, 4, 5, 7\}$ which are not divisible by 3 where repetition is not allowed.
- Given $\text{Im}g\left(\frac{z+1}{z+2}\right) = \frac{1}{5}$ and $|z+2| = 1$ then find the value of $\left|\text{Re}\left(\overline{z+2}\right)\right|$

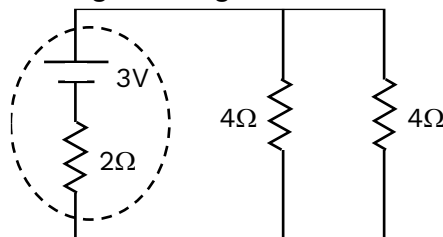
- 14.** There are two natural numbers 'A', 'B' such that their sum is 24 then find the probability that product of A and B is not less than the $\frac{3}{4}$ of maximum product of A and B.
- 15.** Range of $\frac{\sin^4 \theta + 3 \cos^2 \theta}{\sin^4 \theta + \cos^2 \theta}$ is $[\alpha, \beta]$. If first term of G.P. is 64 and common ratio is $\frac{\alpha}{\beta}$. Find the sum of infinite terms of G.P.
- 16.** Given that $A + 5B = 42$ where $A, B \in \mathbb{N}$ and number of pairs of (A, B) is m. If $\sum_{n=1}^m (1 - i^{n!}) = x + iy$ then find the value of $x + y + m$.
- 17.** Given a hyperbola $\frac{-x^2}{a^2} + \frac{y^2}{b^2} = 1$ and the eccentricity is $\sqrt{3}$, length of latus rectum of the given hyperbola is $4\sqrt{3}$ and a point $p(\alpha, \beta)$ lies on hyperbola, where product of distance from foci is β . Find the value of $\alpha^2 + \beta$.
- 18.** There are two circles: $C_1: (x - \alpha)^2 + (y - \beta)^2 = r_1^2$ and $C_2: (x - 8)^2 + \left(y - \frac{15}{2}\right)^2 = r_2^2$ both of them touch each other at (6, 6) and the common point divide the distance between the centre of the two circles in ratio 2 : 1. Find the value of $(\alpha^2 + \beta^2) + 4(r_1^2 + r_2^2)$
- 19.** If $f(x) = 4 \cos^3 x + 3\sqrt{3} \cos^2 x - 1$ then find the number of local maxima $\forall x \in (0, 2\pi)$.
- 20.** Given a triangle ABC such that equation of AB is $4x + 3y = 14$ and AC is $3x - 2y = 5$ and a point $P\left(2, -\frac{4}{3}\right)$ divides BC in the ratio 2 : 1 internally then find the equation of BC.

PHYSICS

1. If the resultant is $A\sqrt{x}$ then find x .

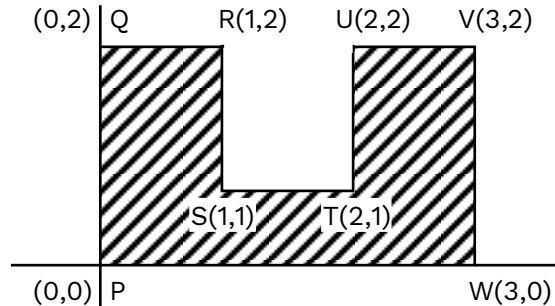


2. Initially a mass of 5 kg is at rest, after some time it breaks into two parts of mass m_1 and m_2 , the mass m_1 is moving with velocity V_1 and mass m_2 is moving with velocity V_2 and both velocities are in opposite directions. Find the ratio of their kinetic energies.
3. If the proton and electron have same de-Broglie wavelength, then what will be the ratio of their kinetic energy.
4. If a light ray is passing from denser medium (refractive index μ_1) to rarer medium having (refractive index μ_2) and having critical angle 45° , then find the value of μ_1/μ_2 .
5. A ball of mass 400 gram moving with initial velocity of 20 m/s is brought to rest in 0.1 seconds by the person catching the ball, then calculate the force experienced by him.
6. What will be the ratio of molar specific heat at constant volume for monoatomic & diatomic gas?
7. The ratio of frequency of 7th overtone for a closed and open organ pipe is $\frac{\alpha - 1}{\alpha}$. Then find the value of α .
8. Resistance of a wire at 0°C is 10Ω whereas at 100°C is 10.2Ω . Find the temperature (in kelvin) of wire when its resistance is 10.95Ω .
9. Find the value of terminal voltage in the given circuit:

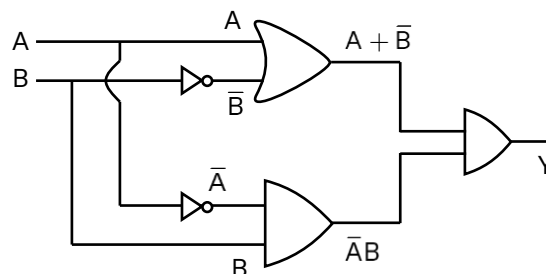


10. The length of second's hand and minute hand of the clock are 75 cm and 60 cm respectively. Then find the distance (in cm) between the tips of second and minute hand after half hour.
11. Which equation best describes Bernoulli's theorem?

12. If the kinetic energy of masses $m_1 = 0.4 \text{ kg}$, $m_2 = 1.2 \text{ kg}$, $m_3 = 1.6 \text{ kg}$ are same. Find the ratio of their linear momentum.
13. From a uniform rectangular plate PQVW of mass 10 Kg, section RSUT (as shown in the figure) is removed. If the coordinates of COM of the remaining plate is (X,Y) , then the value of $\frac{X}{Y}$ is:

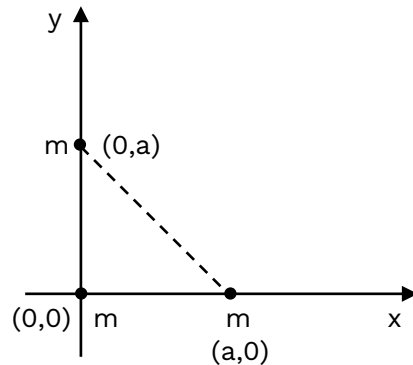


14. If the two planets of masses of m_1 and m_2 revolving around the sun in orbits of radius r_1 and r_2 have their angular momentum in the ratio 1 : 3, then the ratio of their time period will be:
15. Two spheres of radius a and b having charges Q_1 and Q_2 respectively are connected by a conducting wire. Find the correct relation if no charge flows through the wire.
16. In a series LCR circuit, the value of resistance is halved, if the circuit is in resonance then the new current amplitude (I_2) will satisfy: (I_1 is old current amplitude)
17. A loop having 30 turns of area $3.6 \times 10^{-3} \text{ m}^2$ and net resistance = 100Ω is placed in the uniform magnetic field of magnitude $5 \mu\text{T}$. The work done by the external agent if the loop is pulled out of the magnetic field region in 1 sec. (If given resistance 100Ω)
18. An electron is moving in a region of uniform magnetic field and electric field. The kinetic energy of electron is 5 eV and magnitude of magnetic field is $3 \mu\text{T}$. If the direction of magnetic field is perpendicular to the plane of motion of electron. Then the value of electric field if the electron moves undeviated.
19. Radiation of intensity 360 W/cm^2 is incident normally on the perfectly absorbing surface and the force experienced by the surface is $1.2 \times 10^{-4} \text{ N}$. Find the area of the surface.
20. Find output :

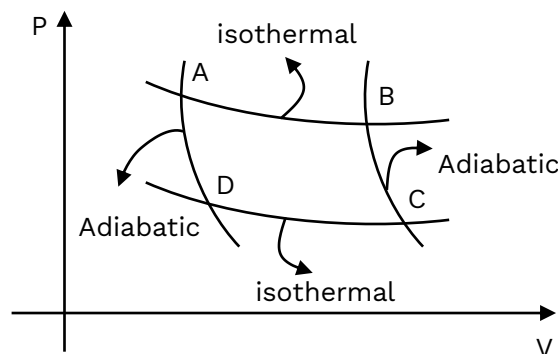


21. If a numerical value is given by $n = a \times 10^b$, then choose the correct option.
- (1) If $a \geq 5$ then magnitude of it is in order of b
 - (2) If $10 \geq a > 5$ then magnitude of it is in order of b
 - (3) If $a \leq 5$ then magnitude of it is in order of b
 - (4) If $b \geq 5$ then magnitude of it is in order of a

22. In a nuclear reaction Q-value is $18 \times 10^8 \text{J}$. Find mass defect?
23. Diameter of sphere is measured using vernier calipers. The least count of vernier caliper is 0.1 mm, main scale reading is 2 cm and vernier scale is 2 cm. If the mass of sphere is 8 kg, then find the density of material of sphere.
24. Find out the magnitude of the work done on the gas when 1 mole of an ideal gas undergoes compression from 9 litre to 1 litre through a reversible isothermal process. (in Joule) (Nearest integer).
25. In the given adjustment, find the distance of center of mass of the system from the origin.



26. Find the relation between $\frac{V_A}{V_D}$ and $\frac{V_B}{V_C}$. In the process shown below:



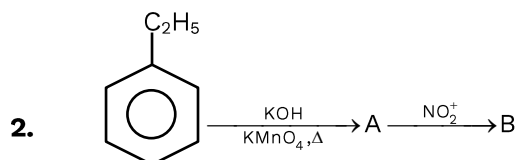
CHEMISTRY

1. $W \rightarrow X$ $K_1 = 1$
 $X \rightarrow Y$ $K_2 = 2$
 $Y \rightarrow Z$ $K_3 = 4$

Find K_{eq} for given below reaction:



- (1) 2 (2) 8 (3) 6 (4) 4



Number of π bonds in product B

3. Which of the following undergoes disproportionation reaction

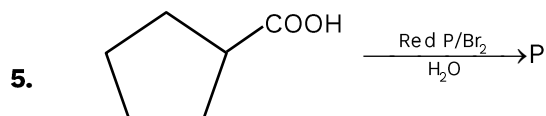
I_2, F_2, Cl_2, Br_2

- (1) F_2, Cl_2 (2) I_2, F_2, Br_2 (3) I_2, Cl_2, Br_2 (4) F_2, Cl_2, Br_2

4. $CoCl_3 \cdot xNH_3 + AgNO_3 \longrightarrow 2 \text{ mol } AgCl$;

Find the sum of n (oxidation states of cobalt) and x

- (1) 6 (2) 8 (3) 4 (4) 7

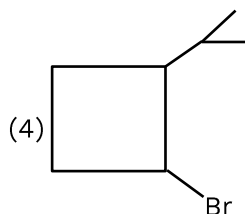
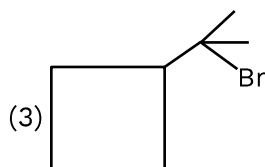
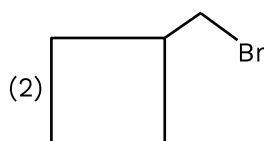
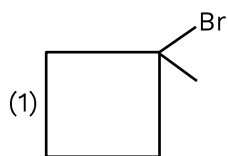


- (1)
- (2)
- (3)
- (4)

6. Count the numbers of optical isomers in



7. Which of the following will give fast S_N2 reaction



8. $A + B \rightarrow C$.

The time taken for $1/4^{\text{th}}$ reaction to occur is twice the time taken from next $1/4^{\text{th}}$ reaction.
Find order of reaction

9. Match the List:

List-I

- (A) Ammonium phospho Molybdate
- (B) $Fe_4[Fe(CN)_6]_3$
- (C) $K_3[Co(NO_2)_6]$
- (D) $[Fe(H_2O)_5(NO)]SO_4$

List-II

- (P) Blue colour
- (Q) Yellow
- (R) Brown
- (S) Canary yellow

- (1) $A \rightarrow S$; $B \rightarrow P$; $C \rightarrow Q$; $D \rightarrow R$
- (3) $A \rightarrow S$; $B \rightarrow Q$; $C \rightarrow P$; $D \rightarrow R$

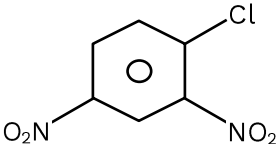
- (2) $A \rightarrow P$; $B \rightarrow S$; $C \rightarrow Q$; $D \rightarrow R$
- (4) $A \rightarrow R$; $B \rightarrow P$; $C \rightarrow Q$; $D \rightarrow S$

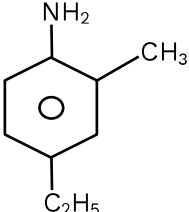
10. **Statement-I:** For 13th group element stability of oxidation state is: $Ga^+ < In^+ < Tl^+$

Statement-II: On moving down the group stability of lower oxidation state increases due to poor shielding of d & f electron

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 false
- (2) Statement-I is false but Statement-II is true
- (3) Both Statement I and Statement-II are true
- (4) Statement-I is true but Statement-II is false

11. **Statement-I:**  2,4-dinitro-1-chlorobenzene is the IUPAC name of the following.

- Statement-II:**  4-ethyl-2-methyl Aniline is the IUPAC name of the following.

- (1) Both Statement-I and Statement-II are false
 (2) Statement-I is false but Statement-II is true
 (3) Both Statement-I and Statement-II are true
 (4) Statement-I is true but Statement-II is false

12. Which of the following molecule follow octet rule:
 BeF_2 , BF_3 , H_2SO_4 , NO_2 , PCl_5 , BrF_5 , CO_2 , SiH_4 , CH_4 , NH_3 , CCl_4 , C_2H_6

13. Match the List:

List-I

- (A) F, O
 (B) S, Cl
 (C) $\text{Rb} < \text{Cs}$
 (D) $\text{Al} < \text{Ga}$

List-II

- (P) Most electronegative atom
 (Q) Having high electron gain enthalpy
 (R) Increasing order of size
 (S) Increasing order of ionisation energy

- (1) $\text{A} \rightarrow \text{Q}$; $\text{B} \rightarrow \text{P}$; $\text{C} \rightarrow \text{R}$; $\text{D} \rightarrow \text{S}$
 (3) $\text{A} \rightarrow \text{P}$; $\text{B} \rightarrow \text{Q}$; $\text{C} \rightarrow \text{S}$; $\text{D} \rightarrow \text{R}$

- (2) $\text{A} \rightarrow \text{R}$; $\text{B} \rightarrow \text{Q}$; $\text{C} \rightarrow \text{P}$; $\text{D} \rightarrow \text{S}$
 (4) $\text{A} \rightarrow \text{P}$; $\text{B} \rightarrow \text{Q}$; $\text{C} \rightarrow \text{R}$; $\text{D} \rightarrow \text{S}$

14. Match the List:

List-I

- (A) Borax bead test
 (B) Cobalt nitrate test
 (C) Charcoal cavity test
 (D) flame test

List-II

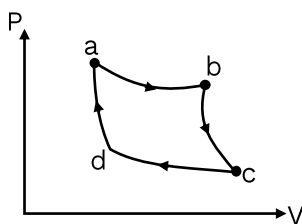
- (P) $\text{X} \xrightarrow{\text{Na}_2\text{CO}_3} \text{Y}$
 (Q) $\text{X} \xrightarrow{\text{NaBO}_2} \text{Y}$
 (R) $\text{X} \xrightarrow{\text{Co}(\text{NO}_3)_2} \text{Y}$
 (S) $\text{X} \xrightarrow{\Delta} \text{Y}$

- (1) $\text{A} \rightarrow \text{Q}$; $\text{B} \rightarrow \text{R}$; $\text{C} \rightarrow \text{P}$; $\text{D} \rightarrow \text{S}$
 (3) $\text{A} \rightarrow \text{S}$; $\text{B} \rightarrow \text{R}$; $\text{C} \rightarrow \text{P}$; $\text{D} \rightarrow \text{Q}$

- (2) $\text{A} \rightarrow \text{R}$; $\text{B} \rightarrow \text{Q}$; $\text{C} \rightarrow \text{P}$; $\text{D} \rightarrow \text{S}$
 (4) $\text{A} \rightarrow \text{Q}$; $\text{B} \rightarrow \text{P}$; $\text{C} \rightarrow \text{R}$; $\text{D} \rightarrow \text{S}$

15. Find the magnetic moment of MO_3^+ ; where 'M' is smallest among Sc, Ti, V, Cr, Mn

16. The PV curve shown in the diagram consists of two isothermal and two adiabatic curves. then:

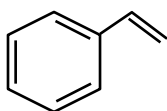


(1) $\frac{V_a}{V_d} = \frac{V_b}{V_c}$ (2) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^{-1}$ (3) $\frac{V_a}{V_d} = \left(\frac{V_b}{V_c}\right)^2$ (4) $\frac{V_a}{V_d} = \frac{V_c}{V_b}$

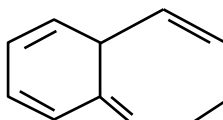
17. Find magnitude of work done in (Kcal) a reversible isothermal process at 27°C. If 1 mole of ideal gas is expanded from 10 ltr. to 90 ltr. (Nearest integer)

18. 100 gm of solid solute AB₂ (molar mass 200) is dissolved in 1000 gm of water. If boiling temperature of solution at 1 atm is 100.52°C. Find percentage of dissociation of solute ($k_b = 0.52$)

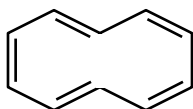
19.



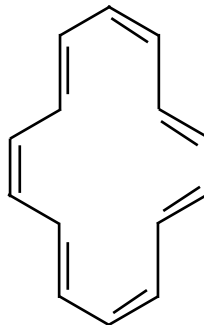
(A)



(B)



(C)

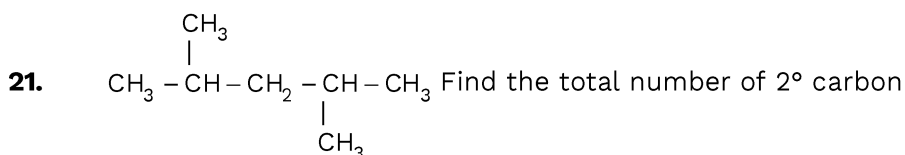


(D)

Identify Aromatic compounds among the following.

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

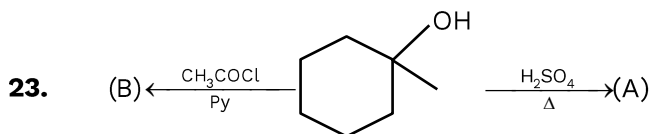
20. 279gm mass of aniline reacts with 1 eq. Diazonium chloride to form yellow dye. Find yellow ppt (in gram).



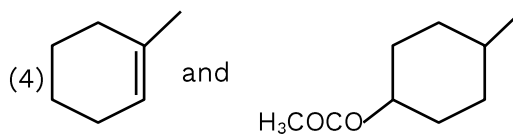
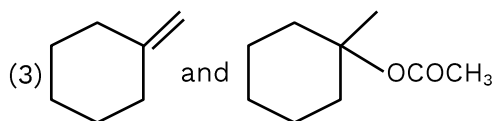
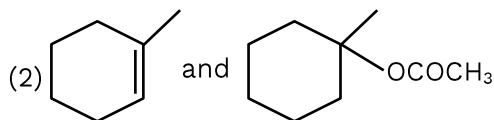
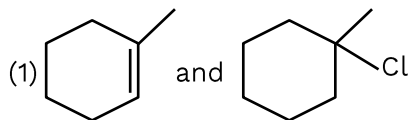
- (1) 1 (2) 2 (3) 3 (4) 4



22. Find the species in which even number of electrons are present in t_{2g} orbital.
 (1) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ (2) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ (3) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$



Identify A and B in the following reaction.



24. Match the List:

List-I

- (A) PCl_5
 (B) CH_4
 (C) NH_3
 (D) BrF_5

List-II

- (P) Square pyramidal
 (Q) Tetrahedral
 (R) trigonal pyramidal
 (S) trigonal bipyramidal

- (1) A→Q; B→S; C→R; D→P
 (3) A→P; B→Q; C→R; D→S

- (2) A→S; B→Q; C→R; D→P
 (4) A→S; B→R; C→Q; D→P