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CTIONS

mistry and Mathematics questions with

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Part I consists of 20 multiple choice numerical value type Questions.

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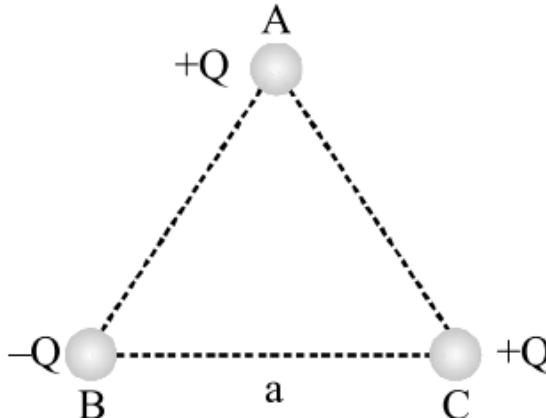
$$(b) \quad v = \sqrt{GM \left(\frac{1}{2R} - \frac{1}{r} \right)}$$

$$(c) \quad v = \sqrt{GM \left(\frac{1}{R} + \frac{1}{r} \right)}$$

$$(d) \quad v = \sqrt{GM \left(\frac{1}{2R} + \frac{1}{r} \right)}$$

2. A block of mass M is kept on a platform which is accelerated upward with a constant acceleration 'a' during the time interval T. The work done by

at the vertex A in a direction normal to BC is



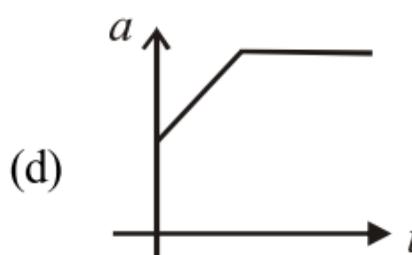
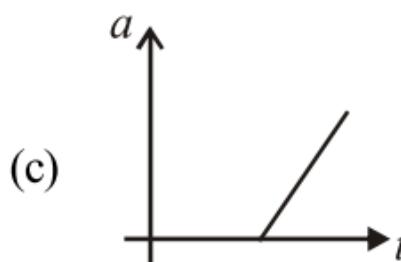
- (a) $Q^2 / (4\pi\epsilon_0 a^2)$
- (b) $-Q^2 / (4\pi\epsilon_0 a^2)$
- (c) Zero
- (d) $Q^2 / (2\pi\epsilon_0 a^2)$

5. Axis of a solid cylinder of infinite length and radius R lies along y -axis, it carries a uniformly distributed current i along $+y$ direction. Magnetic field at a point

$$\left(\frac{R}{2}, y, \frac{R}{2} \right) \text{ is}$$

- (a) $\frac{\mu_0 i}{4\pi R} (\hat{i} - \hat{k})$
- (b) $\frac{\mu_0 i}{2\pi R} (\hat{j} - \hat{k})$
- (c) $\frac{\mu_0 i}{4\pi R} \hat{j}$
- (d) $\frac{\mu_0 i}{4\pi R} (\hat{i} + \hat{k})$

6. Two identical short bar magnets, each having magnetic moment of 10 Am^2 , are arranged such that their axial lines are perpendicular to each other and their centres be along the same straight line in a horizontal plane. If the distance between their centres is 0.2 m , the



- 9.** A new system of units is proposed in which unit of mass is α kg, unit of length is β m and unit of time is γ s. What will be value of 5 J in this new system?

(a) $5\alpha\beta^2\gamma^{-2}$

(b) $5\alpha^{-1}\beta^{-2}\gamma^2$

(c) $5\alpha^{-2}\beta^{-1}\gamma^{-2}$

(d) $5\alpha^{-1}\beta^2\gamma^2$

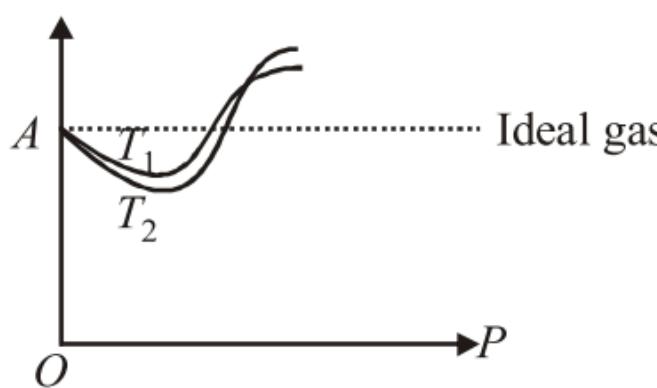
- 10.** Television signals on earth cannot be received at distances greater than 100 km from the transmission station. The reason behind this is that

(a) the receiver antenna is unable to detect the signal at a distance greater than 100 km

(b) the TV programme consists of both audio and video signals

(c) the TV signals are less powerful than radio signals

(d) the surface of earth is curved like a sphere



- (a) 0.259 J K^{-1} and $T_1 < T_2$
- (b) $8.314 \text{ J mol}^{-1} \text{ K}^{-1}$ and $T_1 > T_2$
- (c) 0.259 J K^{-1} and $T_1 > T_2$
- (d) 4.28 g JK^{-1} and $T_1 < T_2$

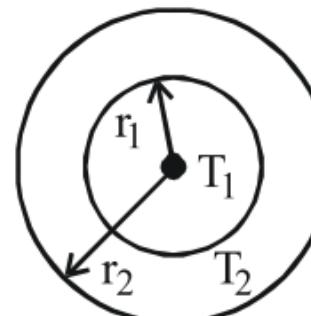
14. An observer moves towards a stationary source of sound with a speed $1/5$ th of the speed of sound. The wavelength and frequency of the sound emitted are λ and f respectively. The apparent frequency and wavelength recorded by the observer are respectively.

- (a) $0.8f, 0.8\lambda$
- (b) $1.2f, 1.2\lambda$
- (c) $1.2f, \lambda$
- (d) $f, 1.2\lambda$

15. The figure shows a system of two concentric spheres of radii r_1 and r_2 are kept at temperatures T_1 and T_2 , respectively. The radial rate of flow of heat in a substance between the two concentric spheres is proportional to

- (a) $\ln\left(\frac{r_2}{r_1}\right)$
- (b) $\frac{(r_2 - r_1)}{(r_1 r_2)}$
- (c) $(r_2 - r_1)$

- (d) $\frac{r_1 r_2}{(r_2 - r_1)}$



18. Which of the following has/have zero average value in a plane electromagnetic wave ?
- (a) Both magnetic and electric field
 - (b) Electric field only
 - (c) Magnetic energy
 - (d) Electric energy
19. Two inductors L_1 (inductance 1 mH, internal resistance 3Ω) and L_2 (inductance 2 mH, internal resistance 4Ω), and a resistor R (resistance 12Ω) are all connected in parallel across a 5V battery. The circuit is switched on at time $t = 0$. The ratio of the maximum to the minimum current (I_{\max}/I_{\min}) drawn from the battery is
- (a) 8
 - (b) 10
 - (c) 12
 - (d) 14

20. In a diffraction pattern due to a single slit of width 'a', the first minimum is observed at an angle 30° when light of wavelength 5000 \AA is incident on the slit. The first secondary maximum is observed at an angle of :
- (a) $\sin^{-1}\left(\frac{1}{4}\right)$
 - (b) $\sin^{-1}\left(\frac{2}{3}\right)$
 - (c) $\sin^{-1}\left(\frac{1}{2}\right)$
 - (d) $\sin^{-1}\left(\frac{3}{4}\right)$

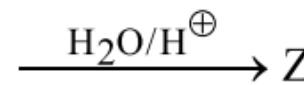
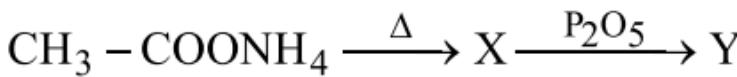
PART-II (Numerical Answer Questions)

21. Figure shows use of potentiometer for comparison of two resistances. The balance point with standard resistance $R = 10\Omega$ is at 58.3 cm, while that with unknown resistance X is 68.5 cm. Find X (in Ω).

CHEMISTRY

PART-I (Multiple Choice Questions)

26. Which of the following has the highest $p\pi - p\pi$ bonding tendency?
- (a) N (b) P
(c) As (d) Sb
27. Among the following, the compound that is both paramagnetic and coloured, is
- (a) KMnO_4
(b) CuF_2
(c) $\text{K}_2\text{Cr}_2\text{O}_7$
(d) All are coloured
28. The bond angle between two hybrid orbitals is 105° . The percentage of s -character of hybrid orbital is between
- (a) 50 - 55% (b) 9 - 12%
(c) 21 - 23% (d) 11 - 12%
29. Identify Z in the following sequence of reactions –



- (a) $\text{CH}_3 - \text{CH}_2 - \text{CO} - \text{NH}_2$
(b) $\text{CH}_3 - \text{CN}$
(c) $(\text{CH}_3\text{CO})_2\text{O}$
(d) $\text{CH}_3 - \text{COOH}$

30. Correct order of first IP among following elements Be, B, C, N, O is
- (a) $\text{B} < \text{Be} < \text{C} < \text{O} < \text{N}$
(b) $\text{B} < \text{Be} < \text{C} < \text{N} < \text{O}$
(c) $\text{Be} < \text{B} < \text{C} < \text{N} < \text{O}$
(d) $\text{Be} < \text{B} < \text{C} < \text{O} < \text{N}$

(d) At pH = 7 both amino and carboxylic groups exist in ionised form

35. Which of the following products are obtained when Na_2CO_3 is added to a solution of copper sulphate ?

- (a) Basic copper carbonate $[\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2]$, sodium sulphate and CO_2 .
- (b) Copper hydroxide, sodium sulphate and CO_2 .
- (c) Copper carbonate, sodium sulphate and CO_2 .
- (d) Copper carbonate and sodium sulphate.

36. Which of the following statement is incorrect with respect to metallic or electronic conductivity?

- (a) Metallic conductivity depends on the structure of metal and its characteristics.
- (b) Metallic conductivity depends on the number of electrons in the valence shell of atom of metal.
- (c) The electrical conductivity of metal increases with increase in temperature.
- (d) There is no change in the structure of metal during electrical conduction.

37. A solid has a structure in which 'W' atoms are located at the corners of a cubic lattice, 'O' atoms at the centre of edges and Na atoms at the centre of the cube. The formula for the compound is

- (a) Na_2WO_3 (b) Na_2WO_2
- (c) NaWO_2 (d) NaWO_3

- 43.** On reduction of KMnO_4 by oxalic acid in acidic medium, the oxidation number of Mn changes. What is the magnitude of this change?
(a) From 7 to 2 (b) From 6 to 2
(c) From 5 to 2 (d) From 7 to 4
- 44.** The half-life for radioactive decay of C–14 is 5730 years. An archaeological artifact containing wood had only 80% of the C–14 found in a living tree. The age of the sample is
(a) 1485 years (b) 1845 years
(c) 530 years (d) 4767 years.
- 45.** Which one of the following complexes is an outer orbital complex ?
(a) $[\text{Co}(\text{NH}_3)_6]^{3+}$
(b) $[\text{Mn}(\text{CN})_6]^{4-}$
(c) $[\text{Fe}(\text{CN})_6]^{4-}$
(d) $[\text{Ni}(\text{NH}_3)_6]^{2+}$
(Atomic nos. : Mn = 25; Fe = 26;
Co = 27, Ni = 28)

PART-II (Numerical Answer Questions)

- 46.** If pressure of a gas is reduced by 25%, then what should be the temperature required to make its volume twice at NTP?
- 47.** An aromatic compound of formula $\text{C}_7\text{H}_7\text{Cl}$ has in all isomers :
- 48.** Calculate the volume strength of 1.5 NH_2O_2 solution.
- 49.** A metal crystallizes into a lattice containing a sequence of layers of atoms of ABABAB.....What percentage by volume of this lattice has empty space?
- 50.** In an experiment, 4 g of M_2O_x oxide was reduced to 2.8 g of the metal. Calculate the number of O atoms in the oxide.
(Given : Atomic mass of the metal = 56 g mol⁻¹)

55. If $y = \tan^{-1} \left(\frac{\log_e(e/x^2)}{\log_e(ex^2)} \right)$

$$+ \tan^{-1} \left(\frac{3 + 2 \log_e x}{1 - 6 \log_e x} \right)$$

then $\frac{d^2y}{dx^2}$ is

56. If $\{ \}$ denotes the fractional part of x , the range of the function

$$f(x) = \sqrt{\{x\}^2 - 2\{x\}}$$

- (a) ϕ (b) $[0, 1/2]$
 (c) $\{0, 1/2\}$ (d) $\{0\}$

57. The length of the perpendicular from the origin to a line is 7 and line makes an angle of 150° with the positive direction of y -axis, then the equation of the line is

- (a) $\sqrt{3}x + y = 7$
 (b) $\sqrt{3}x - y = 14$
 (c) $\sqrt{3}x + y + 14 = 0$
 (d) $\sqrt{3}x + y - 14 = 0$

- 58.** $\int \frac{dx}{\cos x + \sqrt{3} \sin x}$ equals

- $$(a) \quad \log \tan \left(\frac{x}{2} + \frac{\pi}{12} \right) + C$$

- $$(b) \log \tan \left(\frac{x}{2} - \frac{\pi}{12} \right) + C$$

- $$(c) \quad \frac{1}{2} \log \tan \left(\frac{x}{2} + \frac{\pi}{12} \right) + C$$

- $$(d) \frac{1}{2} \log \tan \left(\frac{x}{2} - \frac{\pi}{12} \right) + C$$

- 63.** If $y = y(x)$ and it follows the relation $x\cos y + y\cos x = \pi$ then $y''(0) =$
- (a) 1 (b) -1
(c) π (d) $-\pi$
- 64.** ABC is triangular park with $AB = AC = 100$ m. A clock tower is situated at the mid-point of BC . The angles of elevation of the top of the tower at A and B are $\cot^{-1} 3.2$ and $\operatorname{cosec}^{-1} 2.6$ respectively. The height of the tower is
- (a) 50 m
(b) 25 m
(c) 40 m
(d) None of these
- 65.** If the vectors $\overrightarrow{AB} = -3\hat{i} + 4\hat{k}$ and $\overrightarrow{AC} = 5\hat{i} - 2\hat{j} + 4\hat{k}$ are the sides of a triangle ABC, then the length of the median through A is
- (a) $\sqrt{14}$ (b) $\sqrt{18}$
(c) $\sqrt{29}$ (d) 4
- 66.** The negation of the compound proposition $p \vee (\sim p \vee q)$ is
- (a) $(p \wedge \sim q) \wedge \sim p$
(b) $(p \wedge \sim q) \vee \sim p$
(c) $(p \vee \sim q) \vee \sim p$
(d) None of these

- (a) two
- (b) one
- (c) infinite
- (d) None of these

PART-II (Numerical Answer Questions)

71. A box contains two white balls, three black balls and four red balls. The number of ways such that three balls can be drawn from the box if at least one black ball is to be included in the draw is
72. Find the median from the following distribution.

Class	5–10	10–15	15–20	20–25	25–30
frequency	5	6	15	10	5

Class	30–35	35–40	40–45
frequency	4	2	2

73. If α, β are the roots of the equation $2x^2 + 3x + 5 = 0$, then the absolute value of the determinant
- $$\begin{vmatrix} 0 & \beta & \beta \\ \alpha & 0 & \alpha \\ \beta & \alpha & 0 \end{vmatrix}$$
- is

74. $\int_{-3}^{2} \{|x+1| + |x+2| + |x-1|\} dx$ is

75. The area bounded by the curve $y = 2x - x^2$ and the line $y = -x$ is

ANSWER SHEET

TRY

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MATHEMATICS

51. a b c d

52. a b c d

53. a b c d

54. a b c d

55. a b c d

56. a b c d

57. a b c d

58. a b c d

59. a b c d

60. a b c d

61. a b c d

62. a b c d

63. a b c d

64. a b c d

65. a b c d

66. a b c d

67. a b c d

68. a b c d

69. a b c d

70. a b c d

71. _____

72. _____

73. _____

74. _____

CTIONS

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ould be done in the rough sheet provided.

be its length, when the tension is 9N?

- (a) $2y+x$ (b) $2y-x$
(c) $7x-5y$ (d) $7x+5y$

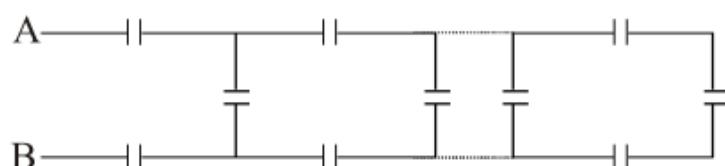
3. A rod of length L is placed on x-axis between $x=0$ and $x=L$. The linear density i.e., mass per unit length denoted by ρ , of this rod, varies as, $\rho = a + bx$. What should be the dimensions of b?

- (a) $M^2L^1T^0$
(b) $M^1L^{-2}T^0$
(c) $M^{-1}L^3T^1$
(d) $M^{-1}L^2T^3$

8. A bucket full of hot water is kept in a room and it cools from 75°C to 70°C in T_1 minutes, from 70°C to 65°C in T_2 minutes and from 65°C to 60°C in T_3 minutes. Then

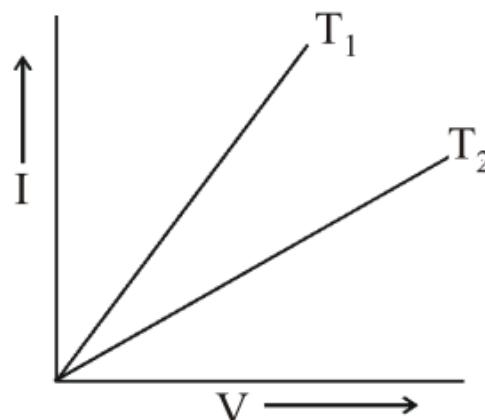
- (a) $T_1 = T_2 = T_3$
- (b) $T_1 < T_2 < T_3$
- (c) $T_1 > T_2 > T_3$
- (d) $T_1 < T_3 < T_2$

9. The equivalent capacity of the network, (with all capacitors having the same capacitance C)



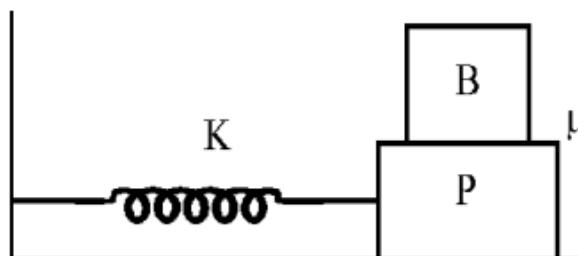
- (a) ∞
- (b) zero
- (c) $C[(\sqrt{3} - 1)/2]$
- (d) $C[(\sqrt{3} + 1)/2]$

10. The current I vs voltage V graphs for a given metallic wire at two different temperatures T_1 and T_2 are shown in the figure. It is concluded that



- (a) $T_1 > T_2$
- (b) $T_1 < T_2$
- (c) $T_1 = T_2$
- (d) $T_1 = 2T_2$

friction between the surface of B and P is μ . What is the maximum amplitude of oscillation that the plate block system can have if the block B is not to slip on the plate :



(a) $\frac{\mu g}{4\pi^2 V^2}$ (b) $\frac{\mu g}{4\pi^2 V}$

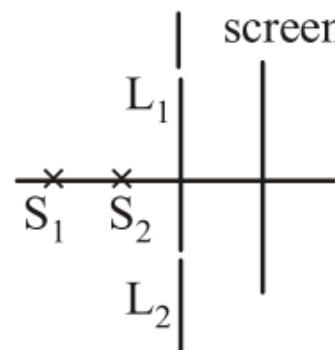
(c) $\frac{\mu}{4\pi^2 V^2 g}$ (d) $\frac{\mu g}{2\pi^2 V^2}$

- 14.** A glass slab has the left half of refractive index n_1 , and the right half of $n_2 = 3n_1$. The effective refractive index of the whole slab is

(a) $\frac{n_1}{2}$ (b) $2n$

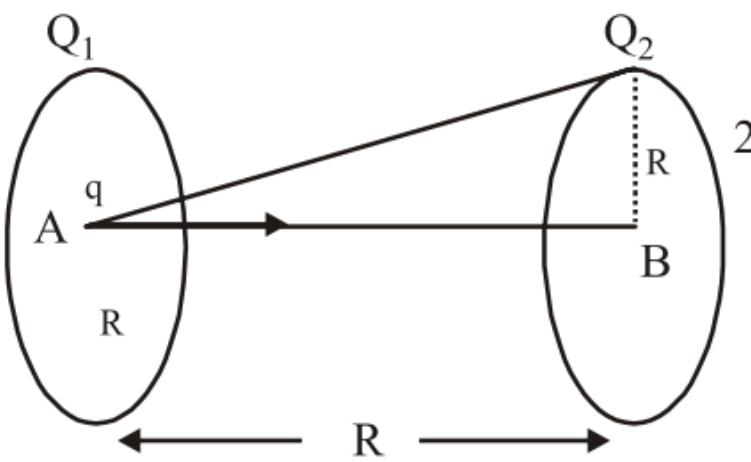
(c) $\frac{3n_1}{2}$ (d) $\frac{2n_1}{3}$

- 15.** In the arrangement shown L_1 , L_2 are slits and S_1 , S_2 two independent sources on the screen, interference fringes



- (a) He and Ar (b) He and O₂
 (c) O₂ and N₂ (d) O₂ and He

19. Two identical thin rings, each of radius R metres, are coaxially placed at a distance R metres apart. If Q₁ coulomb and Q₂ coulomb are respectively, the charges uniformly spread on the two rings, the work done in moving a charge q from the centre of one ring to that of the other is



- (a) zero
 (b) $q(Q_1 - Q_2)$
 $(\sqrt{2} - 1)/\sqrt{2} 4\pi\epsilon_0 R$
 (c) $q\sqrt{2} (Q_1 + Q_2)/4\pi\epsilon_0 R$
 (d) $q(Q_1 + Q_2)$
 $(\sqrt{2} + 1)/\sqrt{2} 4\pi\epsilon_0 R$

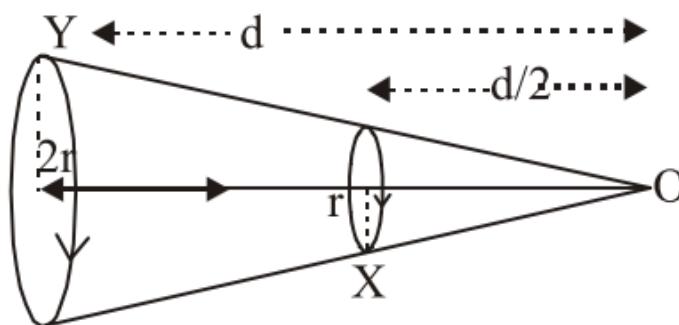
20. The ratio of the coefficient of volume expansion of a glass container to that of a viscous liquid kept inside the container is 1 : 4. What fraction of the inner volume of the container should the liquid occupy so that the volume of the remaining vacant space will be same at all temperatures ?

- (a) 2 : 5 (b) 1 : 4
 (c) 1 : 64 (d) 1 : 8

25. Two circular coils X and Y, having equal number of turns, carry equal currents in the same sense and subtend same solid angle at point O. If the smaller coil X is midway between O and Y, then if we represent the magnetic induction due to bigger coil Y at O as B_Y and due to smaller

coil X at O as B_X then the ratio $\frac{B_Y}{B_X}$

is



CHEMISTRY

PART-I (Multiple Choice Questions)

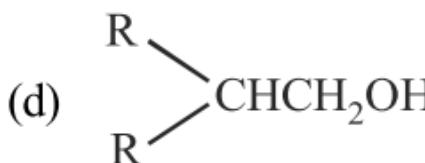
26. Which of the following structures does not contain any chiral C atom but represent the chirality in the structure.

- (a) 2 – Ethyl – 3 – hexene
- (b) 2, 3-Pentadiene
- (c) 1,3 – Butadiene
- (d) Pent – 3 – en – 1 – yne

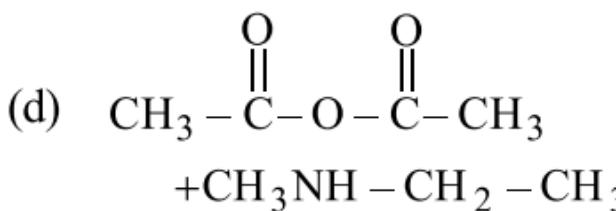
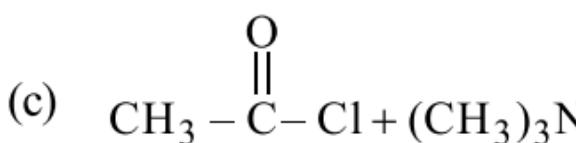
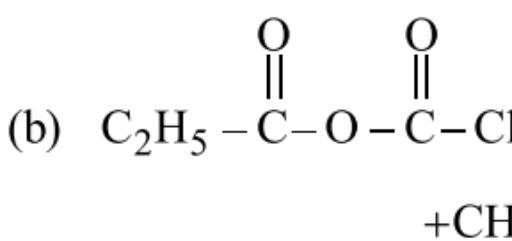
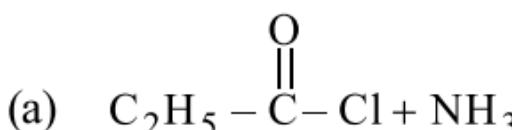
27. The root mean square speed of gas molecules at 25K & $1.5 \times 10^5 \text{ Nm}^{-2}$ is 100.5 ms^{-1} . If the temperature is raised to 100K & pressure to $6.0 \times 10^5 \text{ Nm}^{-2}$, the root mean square speed becomes.

- (a) 100.5 ms^{-1} (b) 201.0 ms^{-1}
- (c) 402 ms^{-1} (d) 1608 ms^{-1}

- (a) RCHOHR
- (b) RCHOHCH₃
- (c) RCH₂CH₂OH



32. Which reaction will not yield an amide?



33. How many different dipeptides can be formed by two different amino acids ?

- (a) 4
- (b) 1
- (c) 3
- (d) 2

34. When tert-butyl chloride is made to react with sodium methoxide, the major product is

- (a) dimethyl ether
- (b) di-tert-butyl ether
- (c) tert-butylmethyl ether
- (d) isobutylene

38. Removal of Fe, Cu, W from Sn metal after smelting is by because

- (a) Poling; of more affinity towards oxygen for impurities
- (b) Selective oxidation; of more affinity towards oxygen for impurities
- (c) Electrolytic refining; impurities undissolved in electrolyte
- (d) Liquation; Sn having low melting point compared to impurities.

39. Among KO_2 , AlO_2^- , BaO_2 and NO_2^+ , unpaired electron is present in

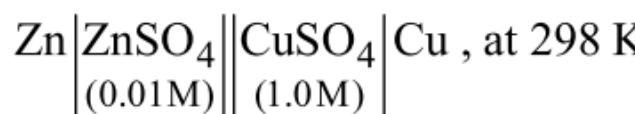
- (a) NO_2^+ and BaO_2
- (b) KO_2 and AlO_2^-
- (c) KO_2 only
- (d) BaO_2 only

40. If a 0.1 M solution of glucose (Mol. wt 180) and 0.1 molar solution of urea (Mol. wt. 60) are placed on two sided semipermeable membrane to equal heights, then it will be correct to say that

- (a) there will be no net movement across the membrane
- (b) glucose will flow across the membrane into urea solution
- (c) urea will flow across the membrane into glucose solution
- (d) water will flow from urea solution to glucose solution

- (c) NaHCO_3 is more soluble in water than KHCO_3 .
- (d) The size of hydrated ions of alkali metals increases from top to bottom.

45. The e.m.f. of a Daniell cell,



is E_1 . When the concentration of ZnSO_4 is 1.0 M and that of CuSO_4 is 0.01 M, the e.m.f. changed to E_2 . What is the relationship between E_1 and E_2 ?

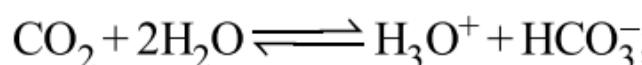
- (a) $E_1 < E_2$
- (b) $E_1 = E_2$
- (c) $E_2 = 0 \neq E_1$
- (d) $E_1 > E_2$

PART-II (Numerical Answer Questions)

46. The vapour pressure of benzene at a certain temperature is 640 mm of Hg. A non volatile and non electrolyte solid weighing 2.175 g is added to 39.08 g of benzene. If the vapour pressure of the solution is 600 mm of Hg, what is the molecular weight of solid substance?

47. What will be the uncertainty in the position of an electron (mass 9.1×10^{-28} g) moving with a velocity of 3.0×10^4 cm s $^{-1}$ accurate up to 0.011%

48. When CO_2 dissolves in water, the following equilibrium is established



for which the equilibrium constant is 3.8×10^{-6} and pH = 6.0. What would be the ratio of concentration of bicarbonate ion to carbon dioxide?

61. The set of points where $f(x) = (x - 1)^2 (x + |x - 1|)$ is thrice differentiable, is

- (a) \mathbb{R} (b) $\mathbb{R} - \{0\}$
(c) $\mathbb{R} - \{1\}$ (d) $\mathbb{R} - \{0, 1\}$

62. Let $f(x) = 1/(x - 1)$ and $g(x) = 1/(x^2 + x - 2)$. Then the set of points where $(gof)(x)$ is discontinuous, is

- (a) $\{1\}$ (b) $\{-2, 1\}$
(c) $\{1/2, 1, 2\}$ (d) $\{1/2, 1\}$

63. $\sum_{r=0}^m {}^{n+r} C_n$ is equal to :

- (a) ${}^{n+m+1} C_{n+1}$
(b) ${}^{n+m+2} C_n$
(c) ${}^{n+m+3} C_{n-1}$
(d) None of these

64. Let $f(x) = \frac{x - \{x + 1\}}{x - \{x + 2\}}$; where $\{x\}$ is the fractional part of x , then

$$\lim_{x \rightarrow 1/3} f(x)$$

- (a) has value 0
(b) has value 1
(c) has value $-\infty$
(d) has value ∞

65. The order of the differential equation

$$\left[1 + 5 \left(\frac{dy}{dx} \right)^2 \right]^{3/2} = 11 \left(\frac{d^2y}{dx^2} \right)^5 \text{ is}$$

- (a) 1 (b) 2
(c) 3 (d) 4

(a) $\frac{xyz}{[(1-x^2)(1-y^2)(1-z^2)]}$

(b) $\frac{-xyz}{[(1-x^2)(1-y^2)(1-z^2)]}$

(c) $\frac{8xyz}{[(1-x^2)(1-y^2)(1-z^2)]}$

(d) $\frac{-8xyz}{[(1-x^2)(1-y^2)(1-z^2)]}$

PART-II (Numerical Answer Questions)

71. If one root of the equation $x^2 + px + 12 = 0$ is 4 while the equation $x^2 + px + q = 0$ has equal roots, the value of q is

72. The value of $\cos 36^\circ \cos 42^\circ \cos 78^\circ$ is

$$\left[\begin{array}{l} \text{Given : } \sin 18^\circ = \frac{\sqrt{5}-1}{4} \text{ and} \\ \cos 36^\circ = \frac{\sqrt{5}+1}{4} \end{array} \right]$$

73. If $x = 1/5$, the absolute value of $\cos(\cos^{-1}x + 2\sin^{-1}x)$ is

74. If θ_1, θ_2 are the solutions of the equation $2\tan^2\theta - 4\tan\theta + 1 = 0$, then $\tan(\theta_1 + \theta_2)$ is equal to

75. In a $\triangle ABC$, if $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$, then

$$\sin^2 A + \sin^2 B + \sin^2 C =$$

ANSWER SHEET

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MATHEMATICS

51. a b c d

52. a b c d

53. a b c d

54. a b c d

55. a b c d

56. a b c d

57. a b c d

58. a b c d

59. a b c d

60. a b c d

61. a b c d

62. a b c d

63. a b c d

64. a b c d

65. a b c d

66. a b c d

67. a b c d

68. a b c d

69. a b c d

70. a b c d

71. _____

72. _____

73. _____

74. _____

CTIONS

mistry and Mathematics questions with

tion paper consisting of Physics (Q.no.1 and Mathematics (Q. no.51 to 75). Each

Part I consists of 20 multiple choice numerical value type Questions.

ce in the given four choices in Part I. For arded for correct choice, 1 mark will be Part I Questions and zero mark will be n. For Part II Questions 4 marks will be o for unattempted and incorrect answer. erial, mobile phones, calculator etc. is not for the test.

ould be done in the rough sheet provided.

- (a) 5890 \AA (b) 3680 \AA
(c) 9424 \AA (d) 15078 \AA

3. A space craft of mass ‘M’, moving with velocity ‘v’ suddenly breaks into two pieces. After the explosion mass ‘m’ becomes stationary. What is the velocity of the other part of the craft ?

- (a) $\frac{Mv}{M-m}$ (b) v
(c) $\frac{mv}{M}$ (d) $\frac{M-m}{m} v$

4. Using mass(M), length(L), time(T) and electric current (A) as fundamental quantities the dimensions of permittivity will be

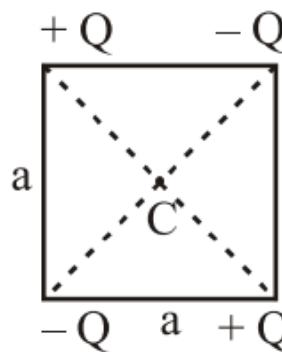
10. $y = 2 \text{ (cm)} \sin \left[\frac{\pi t}{2} + \phi \right]$

What is the maximum acceleration of the particle doing the SHM

(a) $\frac{\pi}{2} \text{ cm/s}^2$ (b) $\frac{\pi^2}{2} \text{ cm/s}^2$

(c) $\frac{\pi^2}{4} \text{ cm/s}^2$ (d) $\frac{\pi}{4} \text{ cm/s}^2$

11. What is the electric potential at the centre of the square?



- (a) zero
(b) $kq/a\sqrt{2}$
(c) kq/a^2
(d) None of these

12. A rectangular block of mass m and area of cross-section A floats in a liquid of density ρ . If it is given a small vertical displacement from equilibrium it undergoes oscillation with a time period T . Then

(a) $T \propto \frac{1}{\sqrt{A}}$ (b) $T \propto \frac{1}{\rho}$

(c) $T \propto \frac{1}{\sqrt{m}}$ (d) $T \propto \sqrt{\rho}$

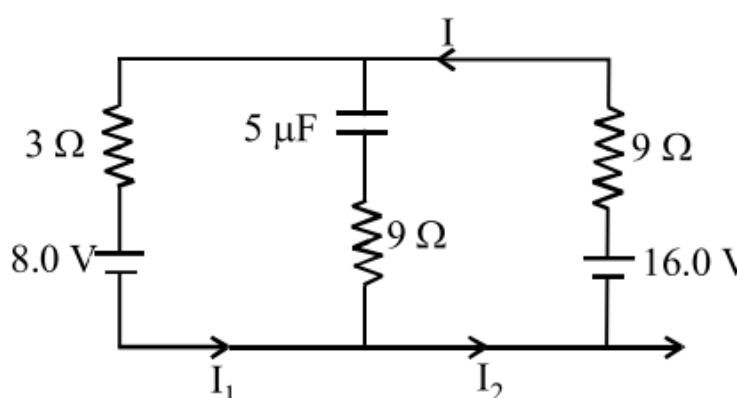
13. While determining the specific resistance of a wire using a metre bridge the formula used is (where X , D , L and ρ denote unknown resistance, diameter of the wire, the length of the wire and the specific resistance of the wire)

that all the emitted photoelectrons are collected by plate B and the work function of plate A remains constant at the value 2 eV.

No. of photoelectrons emitted up to 10 sec

- (a) 5×10^7 (b) 2×10^6
(c) 5×10^6 (d) 2×10^7

16. The circuit shown here has two batteries of 8.0 V and 16.0 V and three resistors $3\ \Omega$, $9\ \Omega$ and $9\ \Omega$ and a capacitor of $5.0\ \mu\text{F}$.



How much is the current I in the circuit in steady state?

- (a) 1.6 A (b) 0.67 A
(c) 2.5 A (d) 0.25 A

17. An electromagnetic wave of frequency 1×10^{14} hertz is propagating along z-axis. The amplitude of electric field is 4 V/m. If $\epsilon_0 = 8.8 \times 10^{-12}\ \text{C}^2/\text{N}\cdot\text{m}^2$, then average energy density of electric field will be:

- (a) $35.2 \times 10^{-10}\ \text{J}/\text{m}^3$
(b) $35.2 \times 10^{-11}\ \text{J}/\text{m}^3$
(c) $35.2 \times 10^{-12}\ \text{J}/\text{m}^3$
(d) $35.2 \times 10^{-13}\ \text{J}/\text{m}^3$

18. A block is placed on a frictionless horizontal table. The mass of the block is m and springs are attached on either side with force constants K_1 and K_2 . If the block is displaced a little and left to oscillate, then the angular frequency of oscillation will be

22. The temperature of reservoir of Carnot's engine operating with an efficiency of 70% is 1000 kelvin. The temperature (in kelvin) of its sink is
23. The escape velocity for a body of mass 1 kg from the earth surface is 11.2 kms^{-1} . The escape velocity (in kms^{-1}) for a body of mass 100 kg would be
24. At the centre of a circular coil of radius 5 cm carrying current, magnetic field due to earth is $0.5 \times 10^{-5} \text{ W/m}^2$. What should be the current (in A) flowing through the coil so that it annuls the earth's magnetic field
25. A beam of light of intensity 12 watt/cm² is incident on a totally reflecting plane mirror of area 1.5 cm², then the force (in newton) acting on the mirror will be

CHEMISTRY

PART-I (Multiple Choice Questions)

26. Ethylene dichloride and ethylidene chloride are isomeric compounds. The false statement about these isomers is that they :
- react with alcoholic potash and give the same product
 - are position isomers
 - contain the same percentage of chlorine
 - are both hydrolysed to the same product
27. An aqueous solution of sodium carbonate has a pH greater than 7 because :
- it contains more carbonate ions than H₂O molecules
 - contains more sodium ions than carbonate ions
 - Na⁺ ions react with water
 - carbonate ions react with H₂O

are 6, 5, 4, the primary valencies in (i), (ii) and (iii) are :

- (a) 6, 5, 4 (b) 3, 2, 1
(c) 0, 1, 2 (d) 3, 3, 3

34. Polyethylene is

- (a) Random copolymer
(b) Homopolymer
(c) Alternate copolymer
(d) Crosslinked copolymer

35. Which of the following is used in our body as a fuel for muscles and nerves and to build and repair body tissues?

- (a) Cane sugar (b) Fructose
(c) Proteins (d) Glucose

36. With a change in hybridization of the carbon bearing the charge, the stability of a carbanion decreases in the order :

- (a) $sp < sp^2 < sp^3$
(b) $sp < sp^3 < sp^2$
(c) $sp^3 < sp^2 < sp$
(d) $sp^2 < sp < sp^3$

37. In O_2^- , O_2 and O_2^{2-} molecular species, the total number of antibonding electrons respectively are :

- (a) 7, 6, 8 (b) 1, 0, 2
(c) 6, 6, 6 (d) 8, 6, 8

38. Which of the given sets of temperature and pressure will cause a gas to exhibit the greatest deviation from ideal gas behaviour?

- (a) 100 °C & 4 atm
(b) 100 °C & 2 atm
(c) -100 °C & 4 atm
(d) 0 °C & 2 atm

39. Which of the following pairs has heat of neutralisation equal to 13.7 kcals ?

- (a) HCl, NH_4OH
(b) HNO_3 , KOH
(c) NaOH, CH_3COOH
(d) H_2SO_4 , NH_4OH

- 45.** A fire of lithium, sodium and potassium can be extinguished by
(a) H_2O
(b) Nitrogen
(c) CO_2
(d) Asbestos blanket

PART-II (Numerical Answer Questions)

- 46.** What is the molarity of H_2SO_4 solution if 25ml is exactly neutralized with 32.63 ml of 0.164 M, NaOH ?
- 47.** 3.92 g of ferrous ammonium sulphate react completely with 50 ml $\frac{\text{N}}{10}$ KMnO_4 solution. What will be the percentage purity of the sample?
- 48.** An 'fcc' in a unit cell of aluminium contains the equivalent of how many atoms ?
- 49.** If K_{sp} of Ag_2CO_3 is 8, the molar solubility of Ag_2CO_3 in 0.1 M AgNO_3 is :
- 50.** When 5 litres of a gas mixture of methane and propane is perfectly combusted at 0 °C and 1 atmosphere, 16 litres of oxygen at the same temperature and pressure is consumed. The amount of heat released from this combustion in kJ
 $[\Delta H_{\text{comb.}}(\text{CH}_4)=890 \text{ kJ mol}^{-1},$
 $\Delta H_{\text{comb.}}(\text{C}_3\text{H}_8)=2220 \text{ kJ mol}^{-1}]$ is

- (a) If R and S are transitive, then $R \cup S$ is transitive.
- (b) If R and S are transitive, then $R \cap S$ is transitive.
- (c) If R and S are symmetric, then $R \cup S$ is symmetric.
- (d) If R and S are reflexive, Then $R \cap S$ is reflexive.

56. $\int \log 2x \, dx$ is

(a) $x \log 2x - \frac{x^2}{2}$

(b) $x \log 2x - \frac{x}{2}$

(c) $x^2 \log 2x - \frac{x}{2}$

(d) $x \log 2x - x + c$

57. For a given integer k, in the interval

$$\left[2\pi k + \frac{\pi}{2}, 2\pi k - \frac{\pi}{2} \right] \text{ the graph of } \sin x \text{ is}$$

- (a) increasing from -1 to 1
- (b) decreasing from -1 to 0
- (c) decreasing from 0 to 1
- (d) None of these

58. $\frac{dy}{dx} + y = 2e^{2x}$ then y is

(a) $ce^{-x} + \frac{2}{3}e^{2x}$

(b) $(1+x)e^{-x} + \frac{2}{3}e^{2x} + c$

(c) $ce^{-x} + \frac{2}{3}e^{2x} + c$

(d) $e^{-x} + \frac{2}{3}e^{2x} + c$

with replacement. The probability that the largest number appearing on a selected coupon is 9, is

(a) $\left(\frac{9}{16}\right)^6$ (b) $\left(\frac{8}{15}\right)^7$

(c) $\left(\frac{3}{5}\right)^7$

(d) None of these

63. If $a \leq 0$ then roots of

$$x^2 - 2a|x-a| - 3a^2 = 0 \text{ is}$$

(a) $(-1 + \sqrt{6})a$

(b) $(\sqrt{6} - 1)a$

(c) a

(d) None of these

64. If X and Y are two sets, then $X \cap (X \cup Y)^c$ equals.

(a) X

(b) Y

(c) \emptyset

(d) None of these

65. If $y = \log_2 \{\log_2(x)\}$, then $\frac{dy}{dx}$ is

(a) $\frac{\log_2 e}{x \ln x}$

(b) $\frac{2.3026}{x \ln x \ln 2}$

(c) $\frac{1}{\ln(2x)^x}$

(d) None of these

70. The x satisfying

$$\sin^{-1} x + \sin^{-1}(1-x) = \cos^{-1} x$$

are

(a) $1, 0$

(b) $1, -1$

(c) $0, \frac{1}{2}$

(d) None of these

PART-II (Numerical Answer Questions)

71. Area between curves $y = x^2$, $x = y^2$ is

72. The probability of A = Probability of

$$B = \text{Probability of } C = \frac{1}{4}$$

$$P(A) \cap P(B) \cap P(C) = 0, P(B \cap C) = 0$$

$$\text{and } P(A \cap C) = \frac{1}{8}, P(A \cap B) = 0$$

the probability that atleast one of the events A, B, C exists is

73. Coefficient of x^6 in the expansion

$$\left(x + \frac{1}{x^2}\right)^6 \text{ is}$$

74. $f(x) = \frac{\sin 3x}{\sin x}$, when $x \neq 0$

$$= k, \quad \text{when } x = 0$$

for the function to be continuous k should be

75. A line passes through (2,2) and is perpendicular to the line $3x + y = 3$ its y intercept is

ANSWER SHEET

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MATHEMATICS

51. a b c d

52. a b c d

53. a b c d

54. a b c d

55. a b c d

56. a b c d

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58. a b c d

59. a b c d

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62. a b c d

63. a b c d

64. a b c d

65. a b c d

66. a b c d

67. a b c d

68. a b c d

69. a b c d

70. a b c d

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73. _____

74. _____

CTIONS

chemistry and Mathematics questions with

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all calculations should be done in the rough sheet provided.



- (a) mg (b) $2mg$
(c) $\frac{2}{3}mg$ (d) $\frac{m^2g}{h}$

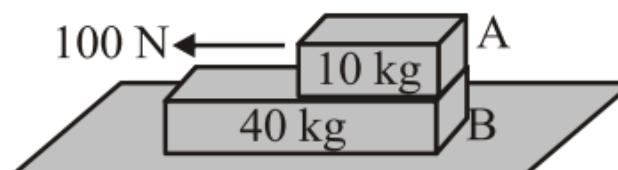
3. The density ρ of water of bulk modulus B at a depth y in the ocean is related to the density at surface ρ_0 by the relation

(a) $\rho = \rho_0 \left[1 - \frac{\rho_0 gy}{B} \right]$

inclined at 30° to the horizontal. After one more second, it is travelling horizontally. The magnitude and direction of its initial velocity are-

- (a) $2\sqrt{20}$ m/s 60°
- (b) $20\sqrt{3}$ m/s 60°
- (c) $6\sqrt{40}$ m/s 30°
- (d) $40\sqrt{6}$ m/s 30°

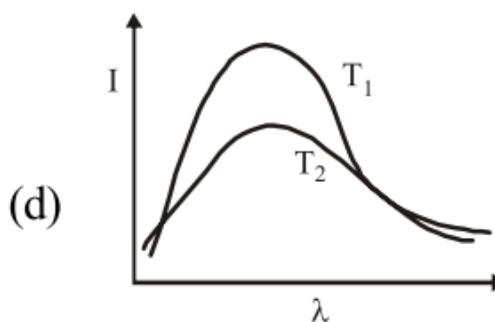
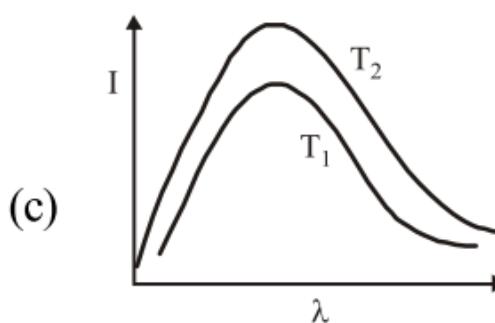
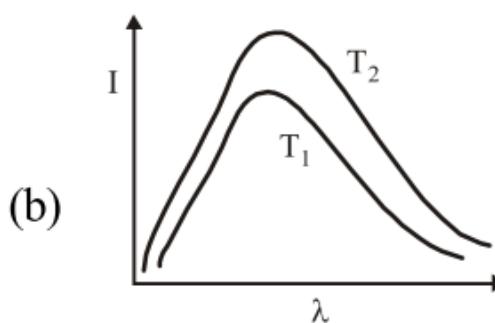
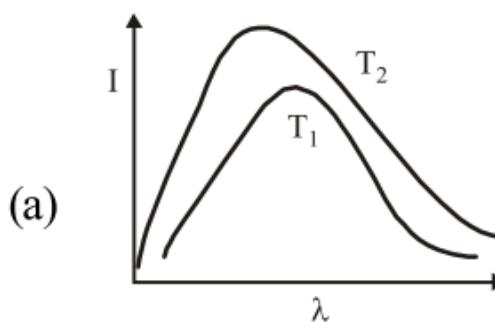
8. A 40 kg slab rests on a frictionless floor as shown in the figure. A 10 kg block rests on the top of the slab. The static coefficient of friction between the block and slab is 0.60 while the coefficient of kinetic friction is 0.40. The 10 kg block is acted upon by a horizontal force 100 N. If $g = 9.8$ m/s 2 , the resulting acceleration of the slab will be



- (a) 0.98 m/s 2
- (b) 1.47 m/s 2
- (c) 1.52 m/s 2
- (d) 6.1 m/s 2

9. Two cars P and Q start from a point at the same time in a straight line and their positions are represented by $x_P(t) = at + bt^2$ and $x_Q(t) = ft - t^2$. At what time do the cars have the same velocity

- (a) $\frac{f-a}{2(1+b)}$
- (b) $\frac{a-1}{1+b}$
- (c) $\frac{a+1}{2(b-1)}$
- (d) $\frac{a+f}{2(1+b)}$



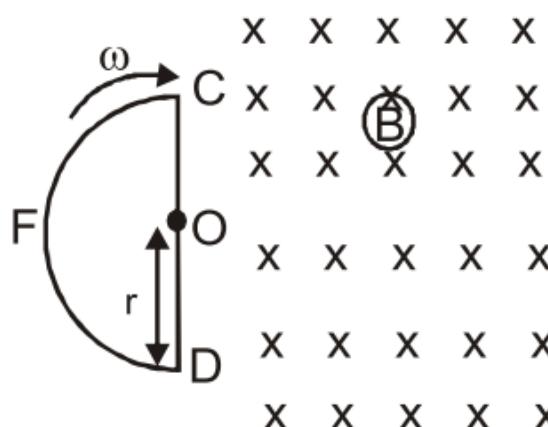
14. A forced oscillator is acted upon by a force $F = F_0 \sin \omega t$. The amplitude of oscillation is given by

$$\frac{55}{\sqrt{2\omega^2 - 36\omega + 9}}.$$

The resonant angular frequency is

- (a) 2 units (b) 9 units
 (c) 18 units (d) 36 units

15. Three closed vessels A , B and C are at the same temperature T and contain gases which obey the Maxwellian distribution of velocities. Vessel A contains only O_2 , B only N_2 and C a mixture of



The loop is rotated with a constant angular speed ω about an axis passing through the centre O, and perpendicular to the page. Then the induced current in the wire loop is

- (a) zero (b) $B\pi^2 \omega/R$
 (c) $B\pi^2 \omega/2R$ (d) $B\pi^2 \omega/R$

18. If $E = 100 \sin(100t)$ volt and $I = 100$

$$\sin \left(100t + \frac{\pi}{3} \right) mA$$

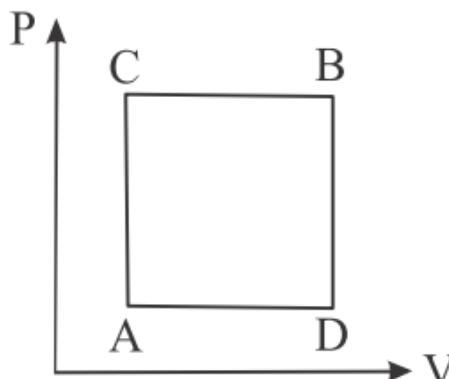
instantaneous values of voltage and current, then the r.m.s. values of voltage and current are respectively

- (a) 70.7V, 70.7 mA
 - (b) 70.7V, 70.7A
 - (c) 141.4V, 141.4mA
 - (d) 141.4V, 141.4A

19. A plane electromagnetic wave is incident on a plane surface of area A , normally and is perfectly reflected. If energy E strikes the surface in time t then average pressure exerted on the surface is ($c = \text{speed of light}$)

- (a) zero (b) E/Atc
 (c) $2E/Atc$ (d) E/c

- 24.** A gas can be taken from A to B via two different processes ACB and ADB.



When path ACB is used 60 J of heat flows into the system and 30J of work is done by the system. If path ADB is used work done by the system is 10 J. The heat flow (in joule) into the system in path ADB is :

- 25.** If 200 MeV energy is released per fission of U^{235} nuclei. Find the mass of U^{235} consumed (in mg) per day in a reactor of power 1MW assuming its efficiency is 80%.

CHEMISTRY

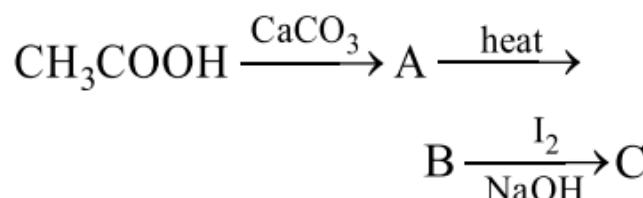
PART-I (Multiple Choice Questions)

- 26.** The reason for almost doubling the rate of reaction on increasing the temperature of the reaction system by 10°C is
- (a) The value of threshold energy increases
 - (b) Collision frequency increases
 - (c) The fraction of the molecule having energy equal to threshold energy or more increases
 - (d) Activation energy decreases

30. Which of the following substances has the greatest ionic character ?
(a) Cl_2O (b) NCl_3
(c) PbCl_2 (d) BaCl_2

31. An organic compound contains 49.3% carbon, 6.84% hydrogen and its vapour density is 73. Molecular formula of the compound is :
(a) $\text{C}_3\text{H}_5\text{O}_2$ (b) $\text{C}_4\text{H}_{10}\text{O}_2$
(c) $\text{C}_6\text{H}_{10}\text{O}_4$ (d) $\text{C}_3\text{H}_{10}\text{O}_2$

32. Consider the following transformations :



The molecular formula of C is

- (a) $\begin{array}{c} \text{OH} \\ | \\ \text{CH}_3 - \text{C} - \text{CH}_3 \\ | \\ \text{I} \end{array}$
- (b) $\text{ICH}_2 - \text{COCH}_3$
(c) CHI_3
(d) CH_3I

33. The values of ΔH and ΔS for the reaction,

$\text{C}(\text{graphite}) + \text{CO}_2(g) \rightarrow 2\text{CO}(g)$
are 170 kJ and 170 JK^{-1} , respectively. This reaction will be spontaneous at

- (a) 910K (b) 1110K
(c) 510K (d) 710K

34. Containers A and B have same gases. Pressure, volume and temperature of A are all twice that

37. Which is a dangerous radiological pollutant?

- (a) C^{14} (b) S^{35}
(c) Sr^{90} (d) P^{32}

38. A compound of formula A_2B_3 has the *hcp* lattice. Which atom forms the *hcp* lattice and what fraction of tetrahedral voids is occupied by the other atoms:

- (a) *hcp* lattice – A, $\frac{2}{3}$
Tetrahedral voids – B
- (b) *hcp* lattice – A, $\frac{1}{3}$
Tetrahedral voids – B
- (c) *hcp* lattice – B, $\frac{2}{3}$
Tetrahedral voids – A
- (d) *hcp* lattice – B, $\frac{1}{3}$
Tetrahedral voids – A

39. Of the four isomeric hexanes, the isomer which can give two monochlorinated compounds is

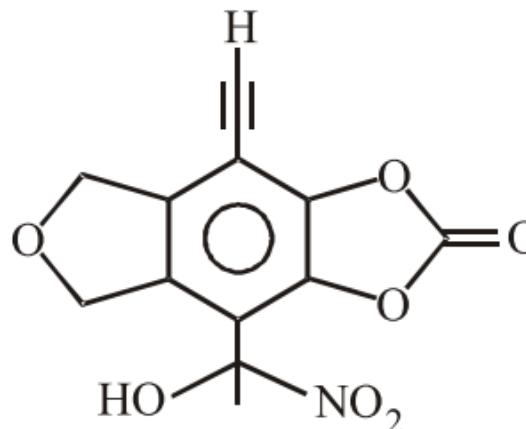
- (a) 2-methylpentane
(b) 2, 2-dimethylbutane
(c) 2, 3-dimethylbutane
(d) n-hexane

40. The solubility product of $PbCl_2$ is 1.7×10^{-5} . The solubility in moles per litre would be :

- (a) 1.62×10^{-4} (b) 1.62×10^{-8}
(c) 1.62×10^{-2} (d) 1.62×10^{-6}

41. Crystal field stabilization energy for high spin d^4 octahedral complex is:

- (a) $-1.8 \Delta_0$ (b) $-1.6 \Delta_0 + P$
(c) $-1.2 \Delta_0$ (d) $-0.6 \Delta_0$



48. In a metal oxide, there is 20% oxygen by weight. What is its equivalent weight?
49. Find the total number of possible isomers for the complex compound $[\text{Cu}^{\text{II}}(\text{NH}_3)_4][\text{Pt}^{\text{II}}\text{Cl}_4]$
50. Calculate the strength in % of labelled 10 volume H_2O_2 solution.

MATHEMATICS

PART-I (Multiple Choice Questions)

51. If $(7 - 4\sqrt{3})^{x^2 - 4x + 3} + (7 + 4\sqrt{3})^{x^2 - 4x + 3} = 14$,

then the value of x is given by

- (a) $2, 2 \pm \sqrt{2}$
- (b) $2 \pm \sqrt{3}, 3$
- (c) $3 \pm \sqrt{2}, 2$
- (d) None of these

52. The minimum value of the function

$$f(x) = x^{3/2} + x^{-3/2} - 4 \left(x + \frac{1}{x} \right) \text{ for}$$

all permissible real x , is

- (a) -10
- (b) -6
- (c) -7
- (d) -8

- (a) $\frac{13}{6}$ (b) $\frac{13}{2}$
 (c) $\frac{13}{5}$ (d) $\frac{13}{7}$

58. The sum of the series
 $3 + 33 + 333 + \dots + n$ terms is

- (a) $\frac{1}{27}(10^{n+1} + 9n - 28)$
 (b) $\frac{1}{27}(10^{n+1} - 9n - 10)$
 (c) $\frac{1}{27}(10^{n+1} + 10n - 9)$
 (d) None of these

59. If $\int \frac{1}{1 + \sin x} dx = \tan\left(\frac{x}{2} + a\right) + b$
 then

- (a) $a = -\frac{\pi}{4}$, $b \in \mathbf{R}$
 (b) $a = \frac{\pi}{4}$, $b \in \mathbf{R}$
 (c) $a = \frac{5\pi}{4}$, $b \in \mathbf{R}$
 (d) None of these

60. If $y = \tan^{-1}\left(\frac{2^x}{1 + 2^{2x+1}}\right)$, then

$$\frac{dy}{dx} \text{ at } x = 0 \text{ is}$$

- (a) $\frac{3}{5} \log 2$ (b) $\frac{2}{5} \log 2$
 (c) $-\frac{3}{2} \log 2$
 (d) None of these

(a) 0

(b) $\pm \frac{3}{2}(a^2 + b^2 + c^2)$

(c) $0, \pm \sqrt{\frac{3}{2}(a^2 + b^2 + c^2)}$

(d) $0, \pm \sqrt{(a^2 + b^2 + c^2)}$

66. If $I_1 = \int_0^1 2^{x^2} dx$, $I_2 = \int_0^1 2^{x^3} dx$,

$I_3 = \int_1^2 2^{x^2} dx$ and $I_4 = \int_1^2 2^{x^3} dx$

then

(a) $I_2 > I_1$ (b) $I_1 > I_2$

(c) $I_3 = I_4$ (d) $I_3 > I_4$

67. If $f: R \rightarrow R$ and $g: R \rightarrow R$ are defined by $f(x) = |x|$ and

$g(x) = [x - 3]$ for $x \in R$, then

$\left\{ g(f(x)) : -\frac{8}{5} < x < \frac{8}{5} \right\}$ is equal to

(a) $\{0, 1\}$ (b) $\{1, 2\}$

(c) $\{-3, -2\}$ (d) $\{2, 3\}$

68. If A and B are two events such that

$P(A) = \frac{1}{2}$ and $P(B) = \frac{2}{3}$, then

(a) $P(A \cup B) \geq \frac{2}{3}$

(b) $\frac{1}{6} \leq P(A \cap B) \leq \frac{1}{2}$

(c) $\frac{1}{6} \leq P(A' \cap B) \leq \frac{1}{2}$

(d) All of these

PART-II (Numerical Answer Questions)

71. The number of pairs (x, y) satisfying the equations $\sin x + \sin y = \sin(x+y)$ and $|x| + |y| = 1$ is
72. The value of

$$\lim_{x \rightarrow 0} \left\{ \frac{\sin x - x + \frac{x^3}{6}}{x^5} \right\} \text{ is } \frac{1}{k},$$

then k is

73. An edge of a variable cube is increasing at the rate cm/sec. Then, the state of increase in volume of the cube when the edge is 5 cm long, is
74. If $2x = -1 + \sqrt{3}i$, then the value of $(1 - x^2 + x)^6 - (1 - x + x^2)^6$ is
75. Sum of all three digit numbers (no digit being zero) having the property that all digits are perfect squares, is

ANSWER SHEET

TRY

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c d

MATHEMATICS

51. a b c d

52. a b c d

53. a b c d

54. a b c d

55. a b c d

56. a b c d

57. a b c d

58. a b c d

59. a b c d

60. a b c d

61. a b c d

62. a b c d

63. a b c d

64. a b c d

65. a b c d

66. a b c d

67. a b c d

68. a b c d

69. a b c d

70. a b c d

71. _____

72. _____

73. _____

74. _____

CTIONS

chemistry and Mathematics questions with

tion paper consisting of Physics (Q.no.1 to 50) and Mathematics (Q. no.51 to 75). Each

Part I consists of 20 multiple choice numerical value type Questions.

ence in the given four choices in Part I. For each correct choice, 1 mark will be awarded for Part I Questions and zero mark will be awarded for Part II Questions. For Part II Questions 4 marks will be awarded for unattempted and incorrect answer. Material, mobile phones, calculator etc. is not allowed for the test.

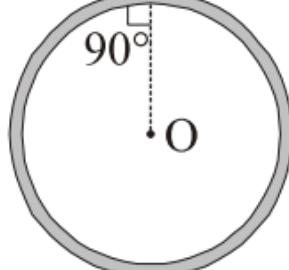
should be done in the rough sheet provided.

(a) $\sqrt{3}/4$ (b) $4/\sqrt{3}$

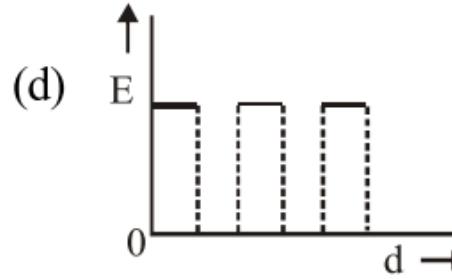
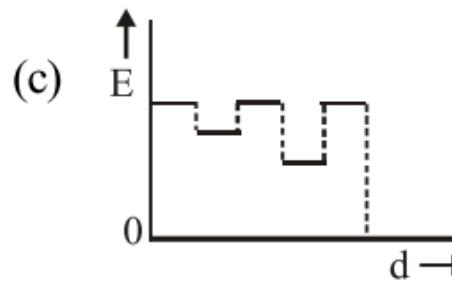
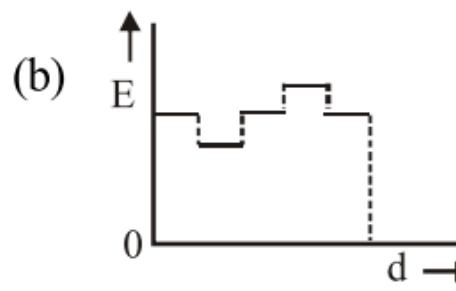
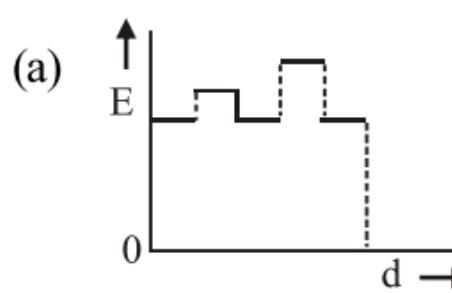
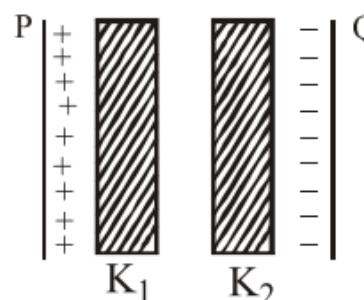
(c) $1/\sqrt{3}$ (d) $\sqrt{3}$

2. A thin wire of length L and uniform linear mass density ρ is bent into a circular loop with centre at O as shown. The moment of inertia of the loop about the axis XX' is

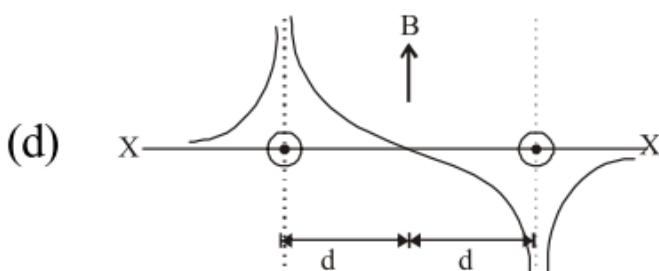
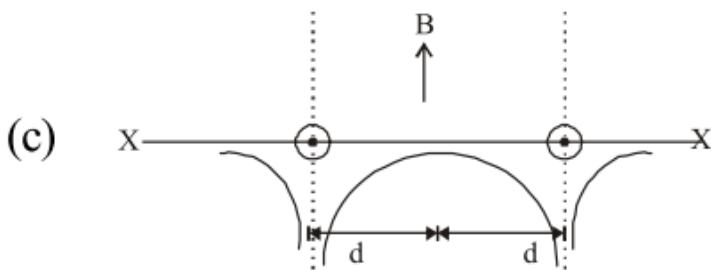
XX' —————— X'



of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :



5. Two identical capacitors having plate separation d_0 are connected parallel to each other across points A and B as shown in figure. A charge Q is imparted to the



7. If dimensions of critical velocity v_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^z]$, where η , ρ and r are the coefficient of viscosity of liquid, density of liquid and radius of the tube respectively, then the values of x , y and z are given by :
- (a) -1, -1, 1 (b) -1, -1, -1
 (c) 1, 1, 1 (d) 1, -1, -1

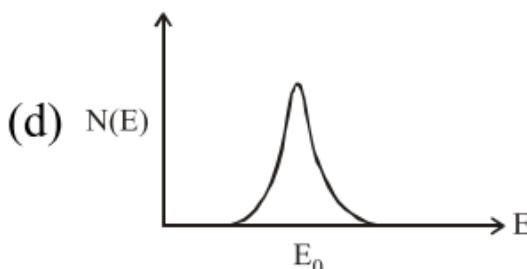
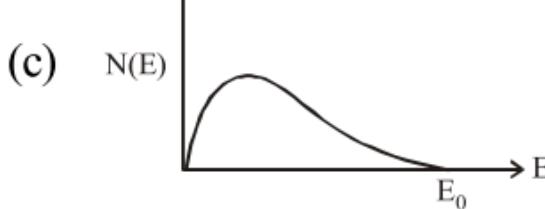
8. A car accelerates from rest at a constant rate α for some time, after which it decelerates at a constant rate β and comes to rest. If the total time elapsed is t , then the maximum velocity acquired by the car is

(a) $\left(\frac{\alpha^2 + \beta^2}{\alpha\beta} \right) t$

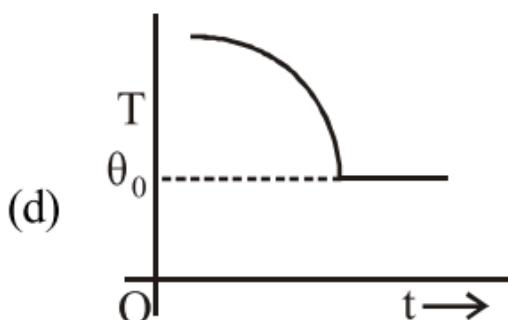
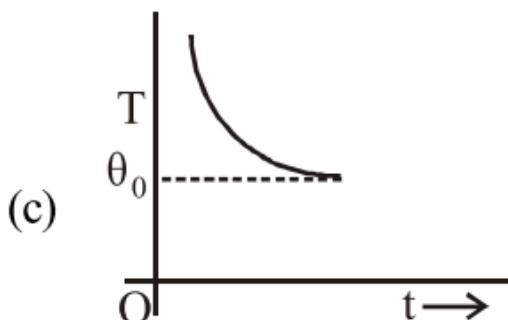
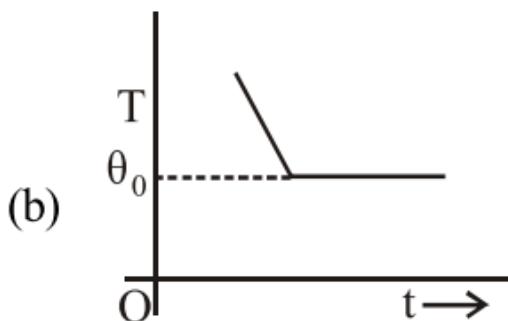
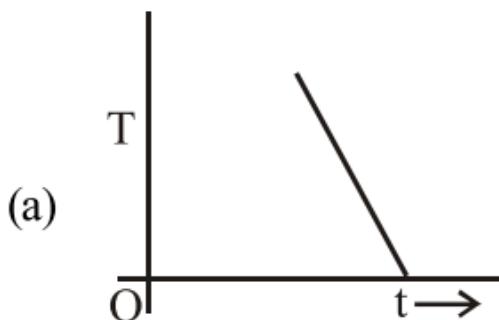
(b) $\left(\frac{\alpha^2 - \beta^2}{\alpha\beta} \right) t$

(c) $\frac{(\alpha + \beta)t}{\alpha\beta}$

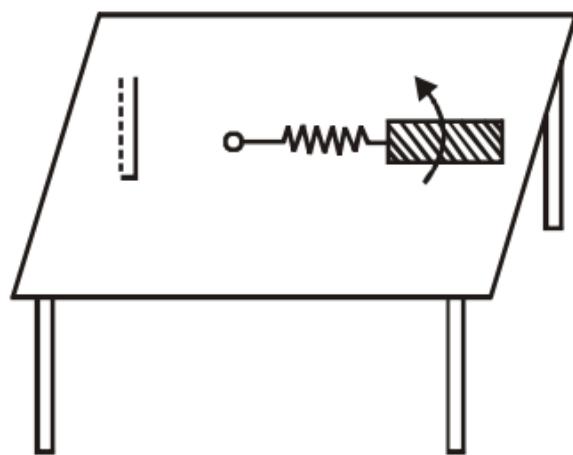
(d) $\frac{\alpha\beta t}{\alpha + \beta}$



13. If a piece of metal is heated to temperature θ and then allowed to cool in a room which is at temperature θ_0 , the graph between the temperature T of the metal and time t will be closest to

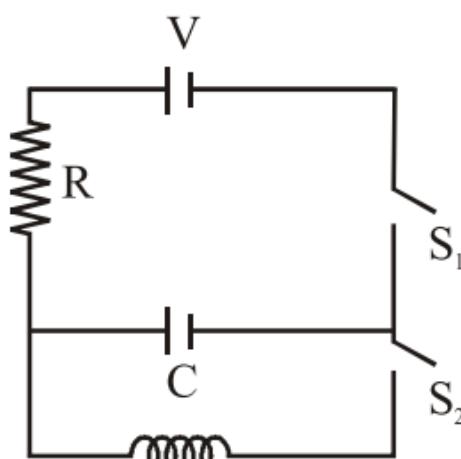


17. A metallic rod of length ' ℓ ' is tied to a string of length 2ℓ and made to rotate with angular speed ω on a horizontal table with one end of the string fixed. If there is a vertical magnetic field 'B' in the region, the e.m.f. induced across the ends of the rod is



- (a) $\frac{2B\omega\ell^2}{2}$ (b) $\frac{3B\omega\ell^2}{2}$
 (c) $\frac{4B\omega\ell^2}{2}$ (d) $\frac{5B\omega\ell^2}{2}$

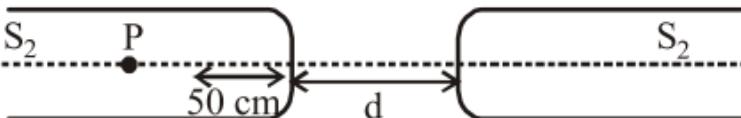
18. In an LCR circuit as shown below both switches S_1 and S_2 are open initially. Now switch S_1 is closed, S_2 kept open. (q is charge on the capacitor and $\tau = RC$ is capacitive time constant). Which of the following statements is correct ?



- (a) Work done by the battery is half of the energy dissipated in the resistor

PART-II (Numerical Answer Questions)

21. Combination of two identical capacitors, a resistor R and a DC voltage source of voltage 6 V is used in an experiment on C-R circuit. It is found that for a parallel combination of the capacitor the time in which the voltage of the fully charged combination reduces to half its original voltage is 10 s. For series combination the time (in sec) needed for reducing the voltage of the fully charged series combination by half is
22. Escape velocity for earth surface is 11 km/s. If the radius of any planet is two times the radius of the earth but average density is same as that of earth. Then the escape velocity (in km/s) at the planet will be
23. Two identical glass rods S_1 and S_2 (refractive index = 1.5) have one convex end of radius of curvature 10 cm. They are placed with the curved surfaces at a distance d as shown in the figure, with their axes (shown by the dashed line) aligned. When a point source of light P is placed inside rod S_1 on its axis at a distance of 50 cm from the curved face, the light rays emanating from it are found to be parallel to the axis inside S_2 . The distance d (in cm) is



- 28.** In a reversible reaction the energy of activation of the forward reaction is 50 kcal. The energy of activation for the reverse reaction will be
- (a) < 50 kcal
 - (b) either greater than or less than 50 kcal
 - (c) 50 kcal
 - (d) > 50 kcal
- 29.** The method not used in metallurgy to refine the impure metal is
- (a) Mond's process
 - (b) van-Arkel process
 - (c) Amalgamation process
 - (d) Liquation
- 30.** When PbO_2 reacts with conc. HNO_3 the gas evolved is
- (a) NO_2
 - (b) O_2
 - (c) N_2
 - (d) N_2O
- 31.** Soap helps in cleaning clothes, because
- (a) chemical of soap change
 - (b) it increases the surface tension of the solution
 - (c) it absorbs the dirt
 - (d) it lowers the surface tension of the solution
- 32.** Orthoboric acid –
- (a) donate proton to form H_2BO_3^-
 - (b) accept proton of form H_4BO_3^+
 - (c) donate OH^- to form H_2BO_2^+
 - (d) accept OH^- to form $[\text{B}(\text{OH})_4]^-$

- (a) 1.0×10^1
- (b) 1.0×10^5
- (c) 1.0×10^{10}
- (d) 1.0×10^{30}

36. Calomel (Hg_2Cl_2) on reaction with ammonium hydroxide gives

- (a) HgO
- (b) Hg_2O
- (c) $\text{NH}_2 - \text{Hg} - \text{Hg} - \text{Cl}$
- (d) $\text{Hg}_2\text{NH}_2\text{Cl}$

37. If one strand of DNA has the sequence ATGCTTGA, the sequence in the complimentary strand would be

- (a) TCCGAACT
- (b) TACGTAGT
- (c) TACGAACT
- (d) TAGCTAGT

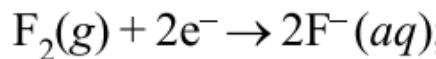
38. Bromination of toluene gives

- (a) only *m*-substituted product
- (b) only *p*-substituted product
- (c) mixture of *o*-and *p*-substituted products
- (d) mixture of *o*-and *m*-substituted products

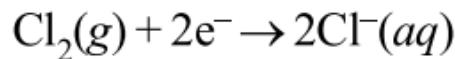
39. In sodium fusion test of organic compounds, the nitrogen of the organic compound is converted into

- (a) sodamide
- (b) sodium cyanide
- (c) sodium nitrite
- (d) sodium nitrate

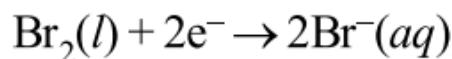
44. Standard reduction potentials of the half reactions are given below:



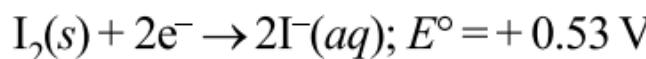
$$E^\circ = +2.85 \text{ V}$$



$$E^\circ = +1.36 \text{ V}$$



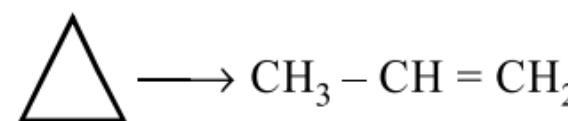
$$E^\circ = +1.06 \text{ V}$$



The strongest oxidising and reducing agents respectively are :

- (a) F_2 and I^-
- (b) Br_2 and Cl^-
- (c) Cl_2 and Br^-
- (d) Cl_2 and I_2

45. Cyclopropane rearranges to form propene



This follows first order kinetics. The rate constant is $2.714 \times 10^{-3} \text{ s}^{-1}$. The initial concentration of cyclopropane is 0.29 M. What will be the concentration of cyclopropane after 100 s?

- (a) 0.035 M
- (b) 0.22 M
- (c) 0.145 M
- (d) 0.0018 M

PART-II (Numerical Answer Questions)

46. What is the order of reaction of the formation of gas at the surface of tungsten due to adsorption?

47. 1.0 g of metal nitrate gave 0.86 g of metal sulphate. Calculate equivalent wt. of metal in grams.

- (a) Straight line
- (b) Circle
- (c) Parabola
- (d) None of these

53. Let $f(x) = \begin{cases} (x-1) \sin \frac{1}{x-1} & \text{if } x \neq 1 \\ 0 & \text{if } x = 1 \end{cases}$

Then which one of the following is true?

- (a) f is differentiable at $x = 0$ and $x = 1$
- (b) f is differentiable at $x = 0$ but not at $x = 1$
- (c) f is differentiable at $x = 1$ but not at $x = 0$
- (d) f is neither differentiable at $x = 0$ nor at $x = 1$

- 54.** In a town of 10,000 families it was found that 40% family buy newspaper A, 20% buy newspaper B and 10% families buy newspaper C, 5% families buy A and B, 3% buy B and C and 4% buy A and C. If 2% families buy all the three newspapers, then number of families which buy A only is
- (a) 3100 (b) 3300
 - (c) 2900 (d) 1400

- 55.** The numbers P, Q and R for which the function

$f(x) = Pe^{2x} + Qe^x + Rx$ satisfies the conditions

$$f(0) = -1, f'(\log 2) = 31 \text{ and}$$

$$\int_0^{\log 4} [f(x) - Rx] dx = \frac{39}{2}$$

are given by

59. The equation of the normal to the curve

$$y = (1+x)^y + \sin^{-1}(\sin^2 x) \text{ at}$$

$x=0$ is

- (a) $x+y=1$
- (b) $x+y+1=0$
- (c) $2x-y+1=0$
- (d) $x+2y+2=0$

60. If a circles $x^2 + y^2 = a^2$ and the rectangular hyperbola $xy = c^2$

intersect in four points, $\left(ct_r, \frac{c}{t_r} \right)$,
 $r=1, 2, 3, 4$ then $t_1 t_2 t_3 t_4$ is equal to
(a) -1 (b) 1
(c) c^4 (d) $-c^4$

61. $\int (32x^3 (\log x)^2 dx)$ is equal to :

- (a) $8x^4(\log x)^2 + C$
- (b) $x^4\{8(\log x)^2 - 4(\log x) + 1\} + C$
- (c) $x^4\{8(\log x)^2 - 4(\log x)\} + C$
- (d) $x^3\{(\log x)^2 - 2\log x\} + C$

62. Differential coefficient of

$\tan^{-1} \frac{2x}{1-x^2}$ with respect to
 $\sin^{-1} \frac{2x}{1+x^2}$ will be

- (a) 1 (b) -1
- (c) $-1/2$ (d) x

67. Two fixed points are $A(a, 0)$ and $B(-a, 0)$. If $\angle A - \angle B = \theta$, then the locus of point C of triangle ABC will be

- (a) $x^2 + y^2 + 2xy \tan \theta = a^2$
- (b) $x^2 - y^2 + 2xy \tan \theta = a^2$
- (c) $x^2 + y^2 + 2xy \cot \theta = a^2$
- (d) $x^2 - y^2 + 2xy \cot \theta = a^2$

68. The equation of the planes passing through the line of intersection of the planes $3x - y - 4z = 0$ and $x + 3y + 6 = 0$ whose distance from the origin is 1, are

(a) $x - 2y - 2z - 3 = 0,$

$$2x + y - 2z + 3 = 0$$

(b) $x - 2y + 2z - 3 = 0,$

$$2x + y + 2z + 3 = 0$$

(c) $x + 2y - 2z - 3 = 0,$

$$2x - y - 2z + 3 = 0$$

(d) None of these

69. In a triangle the length of the two larger sides are 10 and 9, respectively. If the angles are in A.P., then the length of the third side can be :

(a) $\sqrt{91}$

(b) $3\sqrt{3}$

(c) 5

(d) None of these

which the sum of the diagonal entries of $M^T M$ is 5

73. For all complex numbers z_1 , z_2 satisfying $|z_1|=12$ and $|z_2-3-4i|=5$, the minimum value of $|z_1-z_2|$ is
74. The number of positive integral solution of the equation $x_1 x_2 x_3 x_4 x_5 = 1050$ is
75. Two numbers are selected at random from 1, 2, 3..... 100 and are multiplied, then the probability correct to two places of decimals that the product thus obtained is divisible by 3, is

ANSWER SHEET

TRY

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MATHEMATICS

51. a b c d

52. a b c d

53. a b c d

54. a b c d

55. a b c d

56. a b c d

57. a b c d

58. a b c d

59. a b c d

60. a b c d

61. a b c d

62. a b c d

63. a b c d

64. a b c d

65. a b c d

66. a b c d

67. a b c d

68. a b c d

69. a b c d

70. a b c d

71. _____

72. _____

73. _____

74. _____

TEST-1**SICS**

are negligible when they are at a distance r , of the system is zero. Therefore, the initial

$$\left) = -\frac{GM^2}{r}$$

of each star and r is initial separation be-

centres will be at a distance twice the radius

two stars collide. Then total energy of the collision is given by

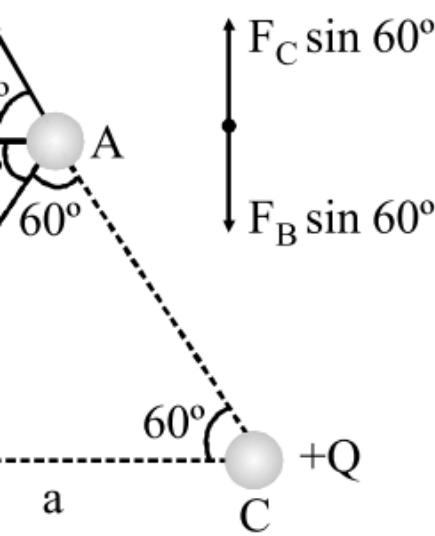
$$\left) = Mv^2 - \frac{GM^2}{2R}$$

on of mechanical energy,

$$GM \left(\frac{1}{2R} - \frac{1}{r} \right)$$

$$\left(\frac{1}{r} - \frac{1}{R} \right)$$

water $S = 1$ and $d = 1$)

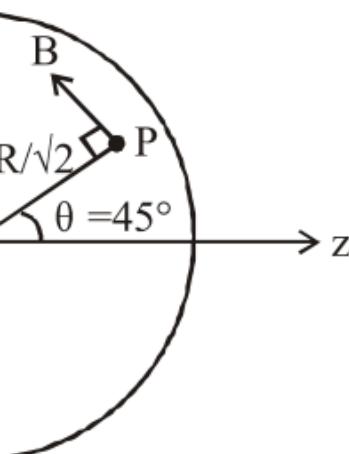


charge at A in the direction normal to BC

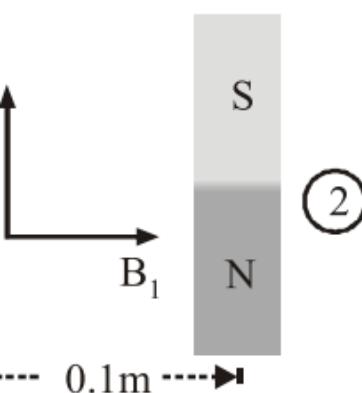
eld at P $\left(\frac{R}{2}, y, \frac{R}{2} \right)$ is

$$\frac{\mu_0 i}{2\pi R}$$

on y-coordinate)



ines)



$$\frac{10}{(0.1)^3} = \sqrt{5} \times 10^{-3} \text{ tesla}$$

X

ven by

....(1)

ion (1), we get

....(2)

h the boy at B is given by

$$\frac{\text{along Y-axis}}{\text{Y-axis}}$$

$$\therefore \sqrt{\frac{a}{1 - \left(\frac{v_1}{v}\right)^2}} \quad [\text{From equation (1)}]$$

$$\sqrt{\frac{a^2}{v^2 - v_1^2}}$$

system

?

$= \alpha \text{ kg}$

$\beta \text{ m}$

$\gamma \text{ s}$

is comparing with, $[M^a L^b T^c]$, we get

}^c

$$\frac{5\gamma^2}{\alpha\beta^2} = \frac{5\gamma^2}{\alpha\beta^2} = 5\alpha^{-1}\beta^{-2}\gamma^2$$

24.75 mA

$\times 10^3 = 61.9 \text{ mW}$

=40.05%

$J_0)_B$

$E_B - (W_0)_A = 1.95 \text{ eV}$

$$\frac{h}{kT} \Rightarrow \lambda \propto \frac{1}{\sqrt{K}}$$

$$= 0.5 \Rightarrow T_A = 2 \text{ eV}$$

values of P .

ight line.

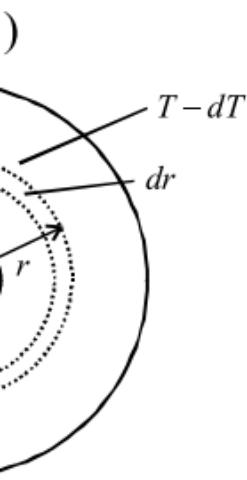
$$\text{mol}^{-1}\text{K}^{-1} = 0.259 \text{ J K}^{-1}$$

1.2f

(unchanged) in this case.

dr) and of radii (r) and the temperature of
shell be T , $(T - dT)$

ugh it



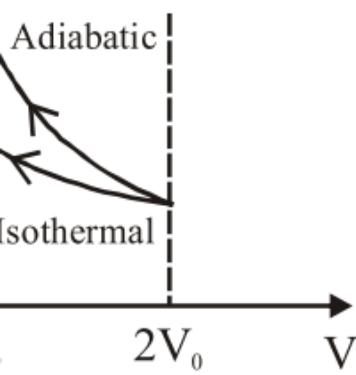
In heat flow, integration technique is used, through which heat will flow is not constant.

$$dT$$

$$[T_2 - T_1]$$

$$\text{1) } \therefore \frac{dQ}{dt} \propto \frac{r_1 r_2}{(r_2 - r_1)}$$

Volume-axis



B.

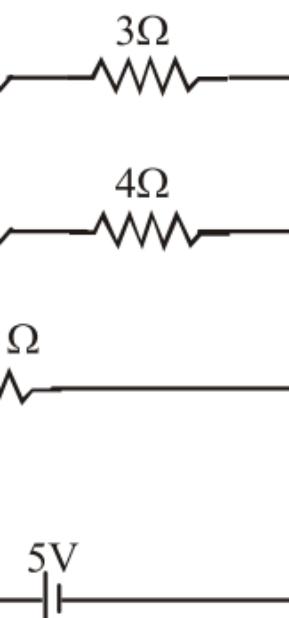
$$= \frac{\sqrt{3}}{2}$$

$$= 60^\circ$$

fields have zero average value in a plane e.m.

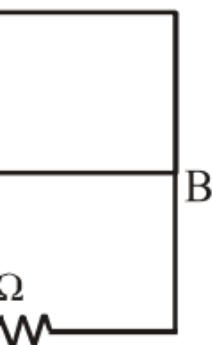
in 12Ω resistance

as conductign wires



at

drops across R and X so



$$= 11.75\Omega$$

$$= 15 \text{ ms}^{-1}$$

$$\Rightarrow \alpha = \frac{100}{45}$$

brakes to the wheel

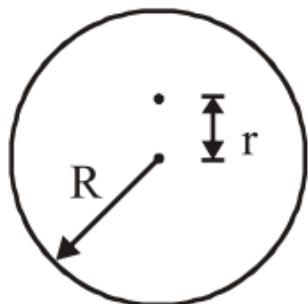
$$\text{m}^2\text{s}^{-2}$$

$$2 \text{ V}, dt = 0.5 \text{ sec.}$$

tion and when it is reduced to 20%

$$2 = \frac{4(B_1 - 0.2 B_1)}{0.5}$$

al pendulum is



ss of the pendulum and h is the distance
mass.

scillates as a physical pendulum about an
of the disc at a distance r from its centre.

$$\left(\frac{R}{4}\right)^2 = \frac{mR^2}{2} + \frac{mR^2}{16}$$

4s

$$\frac{5R}{36}$$

8.9nm.

ISTRY

and coloured.

hybrid orbital), bond angle is 109.5° , for hybrid orbital), bond angle is 120° and for d orbital), bond angle is 180° .

decreases below 109.5° , the s-character

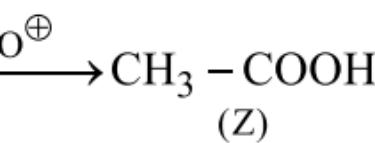
$$109.5^\circ = 10.5^\circ$$

$$-25 = 8.3$$

$$= 109.5^\circ - 105^\circ = 4.5^\circ$$

ster

decrease by about 3.56% i.e., s-character



$1s^22s^22p^2$; N – $1s^22s^22p^3$; O – $1s^22s^22p^4$. IP
IP of Be > B. Further IP of O < N because
d orbitals are most stable and hence have

that keeping (B) const, [A] is doubled, rate
rate is independent of [A]. From 1 and 4,
doubled, rate become 8 times. Hence rate

ence its pH is lowest among the others.

acid and strong base so it is not hydrolysed



and pH is less than that of 0.1 M HCl.

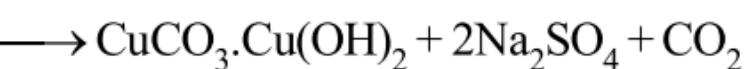


and pH is more than that of 0.1 M HCl.

case in pH is



-form but they may be present in form of



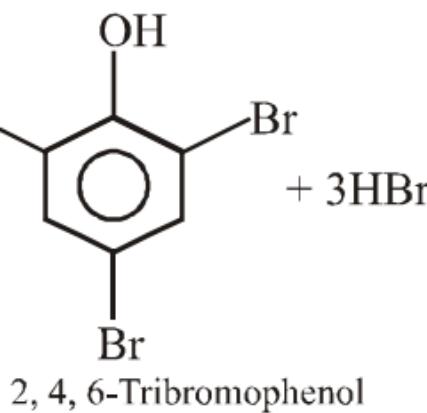
eases, resistance increases and hence con-

$$\text{corner} = \frac{1}{8} \times 8 = 1$$

$$\text{s} = \frac{1}{4} \times 12 = 3$$

$$\text{cube} = 1$$

, 4, 6-tribromophenol.



2, 4, 6-Tribromophenol

contact process of manufacturing H_2SO_4
rical molecule is zero.

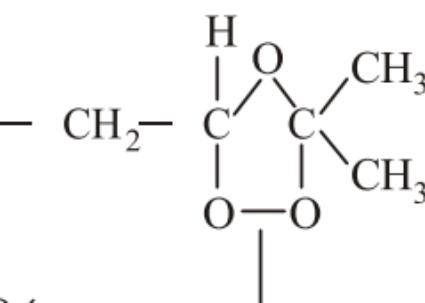
F



nar (symmetrical molecule)

$\text{J}^{-3}\text{kJ K}^{-1}\text{mol}^{-1}$

$\text{J}^{-3} = 1059\text{K.}$



1st order kinetics. therefore,

$$= \frac{0.693}{5730}$$

$$R = 80$$

$$\left(\frac{0.693}{5730} \right) \log \frac{100}{80}$$

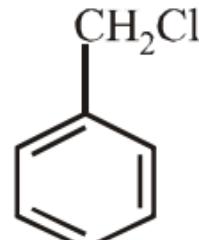
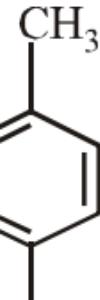
45 years

or orbital complex.

equation,

reducing by 25%)

?



strength

5.6

= 5.6 volumes.

H_2O_2

packing (*hcp*) in which space occupied = 74

Metal

f Metal

$$= \frac{1}{20} \Rightarrow 2x = 6 \Rightarrow x = 3$$

MATICS

$$\text{C}_3 \quad x^{n-6} \left(\frac{\alpha}{2} \right)^3 = 20$$

$$\Rightarrow \alpha = 2$$

$$= 0$$

$$^{\circ} = -p$$

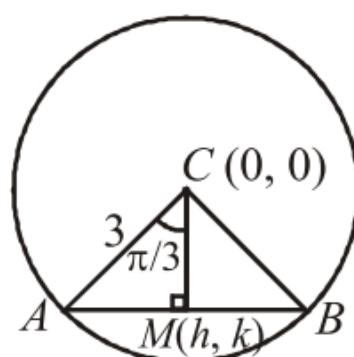
$$15^{\circ} = q$$

$$= \frac{-p}{1-q} = 1$$

), $(c+a)(b+c)$.. are also in

are in A.P.

$-a)$]



$$= \frac{9}{4}$$

$$= \frac{9}{4}$$

$$^{-1} \left(\frac{3 + 2 \log_e x}{1 - 6 \log_e x} \right)$$

$$\frac{3 + 2 \log_e x}{1 - 3.2 \log_e x} \right)$$

$$\tan^{-1}(2 \log_e x)$$

only one element 0.

X

$$= \frac{1}{2} \int \frac{dx}{\sin\left(x + \frac{\pi}{6}\right)}$$

| + C

$$\frac{-\sqrt{3}}{-\sqrt{3}} = \frac{1+\sqrt{3}}{1-\sqrt{3}}$$

$\tau + \alpha$]

$$\frac{7\pi}{36}$$

rm on $y^2 = 4Ax$ is

... (i)

$$\left[\begin{array}{l} \because y^2 = x \\ \therefore A = \frac{1}{4} \end{array} \right]$$

en, $4m \times a - 4 \times 0 - m^3 - 2m = 0$

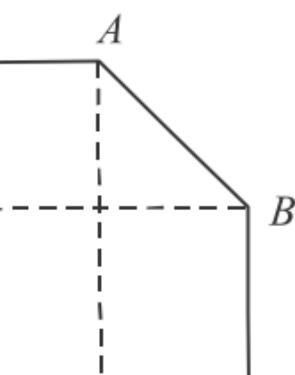
$$2 \quad [\because m^2 > 0]$$

es are formed $ADEH, GFCH$.

$$= 2$$

$$C_4$$

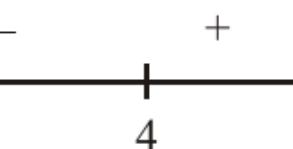
$$= \frac{1}{35}$$



$$-6x - 24 > 0$$

$$-2x - 8 > 0$$

$$x^2 - 6x - 24,$$



$$y + y \cos x = \pi \dots \text{(i)}$$

Set to x , we get,

$$y \sin x = 0$$

$$\dots \text{(ii)}$$

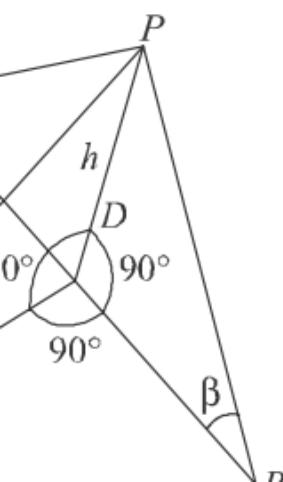
Set to x , we get,

$$y'(\cos x - x \sin y)$$

$$. y' (y \sin x - \cos y)$$

$$\sin y)^2$$

Let the middle point D of BC .



$$\overline{(5.76)} = 2.4$$

$$, h \cot \beta = 2.4 \ h$$

$$^2 = AD^2 + BD^2$$

$$16 \ h^2 \Rightarrow h = 25 \text{ m.}$$

$$4\hat{k}$$

$$\underline{4+4)\hat{k}}$$

$$\hat{k}$$

$$= \sqrt{18}$$

$$p \vee q)$$

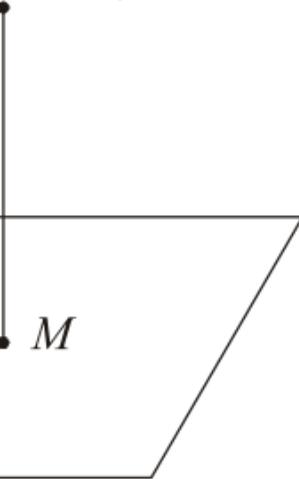
$$)=0, x=0$$

ous function

$$\lim_{x \rightarrow 0} \frac{f(x) - f(0)}{x - 0} \text{ exists}$$

uous function at $x = 0$ but not differentiable.
 lular from $(7, 14, 5)$ to the given plane, then
 o, its d.r.'s are $2, 4, -1$. Since PM passes
 .r.'s $2, 4, -1$.

, $14, 5)$



$$\frac{7}{4} = \frac{y-14}{4} = \frac{z-5}{-1} = r,$$

$$= -r + 5$$

$$4r + 14, -r + 5)$$

$$-4y - z = 2, \text{ therefore}$$

$$5) = 2 \Rightarrow r = -3$$

perpendicular are $M(1, 2, 8)$.

from P

$$\sqrt{(3-5)^2} = 3\sqrt{21}.$$

$$(1+x^2) - \sin x \cos x$$

$$\frac{x^2 - \sin x \cos x}{x}$$

$$\frac{y+1}{x-x} = 3$$

[and y are positive]

, 2

(2, 7)}

include at least one black ball, can be made
clusive ways

$$\begin{aligned}C_1 \times {}^6C_2 &= 3 \times 15 = 45 \\={}^3C_2 \times {}^6C_1 &= 3 \times 6 = 18 \\={}^3C_3 \times {}^6C_0 &= 1 \\- 18 + 1 &= 64.\end{aligned}$$

Cumulative Frequency

5

11

26

36

41

45

47

49

N = 49

$$= 24.5$$

greater than N/2 is 26 and corresponding
the median class such that $\ell = 15, f = 15, F$

h

$$x^2+3x+5=0$$

$$)= -\frac{3}{2}$$

$$\frac{5}{2}.$$

$$\epsilon^2-0\,|\,$$

$$-1|\Big\}\,\mathrm{d}x$$

$$+\int\limits_{-1}^1f(x)\,\mathrm{d}x+\int\limits_1^2f(x)\,\mathrm{d}x$$

$$|x-1|$$

$$)- (x-1) \big] \mathrm{d}x$$

$$x\Big]_{-3}^{-2}=\frac{7}{2}$$

$$-1)\big]\mathrm{d}x$$

$$|^{-1}$$

$$-(-2 - 4)$$

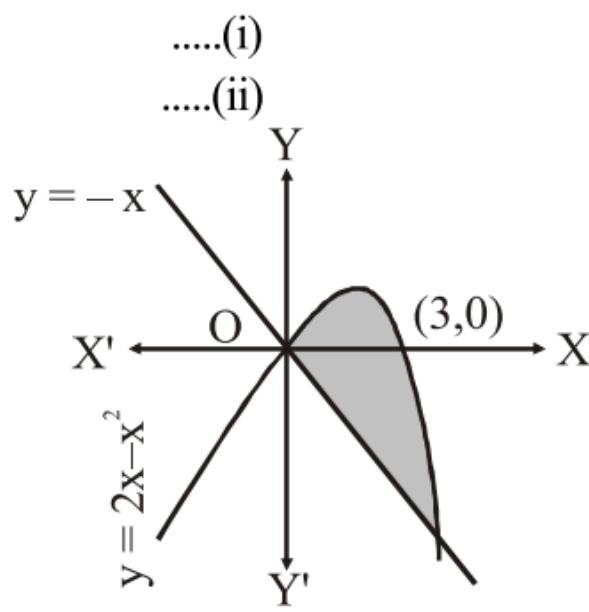
$$1) \int dx$$

$$= 8$$

·1

$$1) \int dx]$$

$$_1^2 = \frac{13}{2}$$



TEST-2

SICS

v. Then

$$v = 20 \text{ m/s}$$

length and constant respectively.

$$\dots\dots(1)$$

$$\dots\dots(2)$$

$$\dots\dots(3)$$

$$(x)$$

$$x$$

$$[x];$$

per unit length and x is distance, therefore

hence, v at A = 0. At point B there are two

$$v_B = 2v.$$

$$\Rightarrow \pi r^2 dg = 2T.$$

$$fL.$$

one point w.r.t. other.

distance between them.

$$C_p - C_v = R \text{ for all gases.}$$

more is the rate of cooling.

or

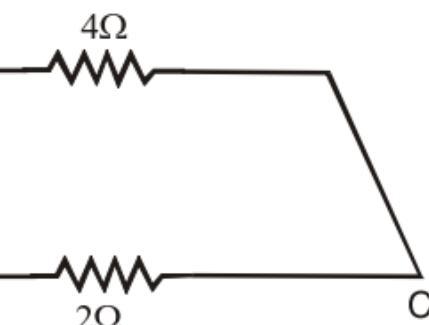
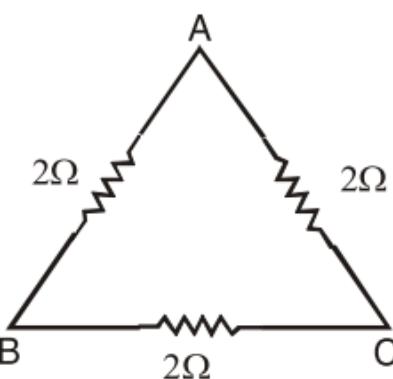
with decrease in temperature difference
g.

$$\frac{\alpha}{(C)}$$

mp:

ope of T_1 is more i.e. $\frac{1}{R_1}$ is more, hence R_1 will be less than T_2 as R_1 is less than R_2 .

$$\frac{2}{+2} = \frac{8}{6} = \frac{4}{3} \Omega$$



$$= \frac{100}{10} = 10 \text{ and } i_C = \frac{V_0}{X_C} = \frac{100}{20} = 5$$

$$= \sqrt{5^2 + 5^2} = 5\sqrt{2} \text{ amp.}$$

$$\Delta\omega^2 = 4\pi^2 A V^2 = \mu g .$$

nce d is :

$$\frac{d}{n_{\text{eff}}} ; \quad n_2 = 3n_1 \Rightarrow n_{\text{eff}} = \frac{3}{2} n_1$$

are equal magnitude because of random changes will be seen.

$$mv_r = \frac{nh}{2\pi} \quad (\text{where } n = 1)$$

....(1)

....(2)

$$\frac{v}{n} = \frac{1}{1} = 1 : 1$$

$$= \lambda N_t$$

$$N_1,$$

$$N_2$$

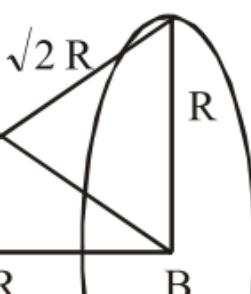
in time

$$\frac{R_2}{R_1} = \frac{(R_1 - R_2)T}{0.693}$$

Curve 2 is greater than the slope of curve 1.

to helium and curve 1 corresponds to

$$V_B = \frac{1}{4\pi \epsilon_0} \left[\frac{Q_2}{R} + \frac{Q_1}{\sqrt{2}R} \right]$$



$$-Q_2 - \frac{Q_1}{\sqrt{2}} \Big]$$

-V_B)

$$-Q_2 - \frac{Q_1}{\sqrt{2}} \Big]$$

$$_1 + Q_2 - \sqrt{2}Q_2 - Q_1 \Big]$$

quid level in vessel then $\gamma'_{\text{real}} = \gamma'_{\text{vessel}}$
relative to vessel

$$_1 - \gamma'_{\text{vessel}})$$

→ T

→ $\mu m_A g$

→ T

→ $\mu(m_A + m_B)g$

.....(1)

.....(2)

$$\begin{aligned} & m_B g \\ & + m_B) \\ & 10N \end{aligned}$$

stance r_1 to a distance r_2 away from centre
is m, is,

$0R_e]$

is same. Hence,

$$= 300 \text{ K}$$

$$\times 0.7 = 166$$

3.3%

to coil Y is given by,

$$\dots\dots(1)$$

tion at O due to coil X is given by

$$\dots\dots(2)$$

$$= \frac{1}{2}$$

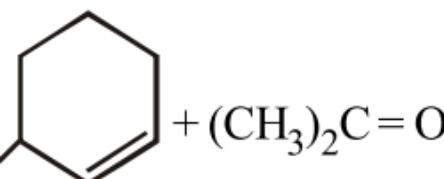
ISTRY

does not have any chiral C but at the same
or plane which makes the molecule chiral.
nge in velocity

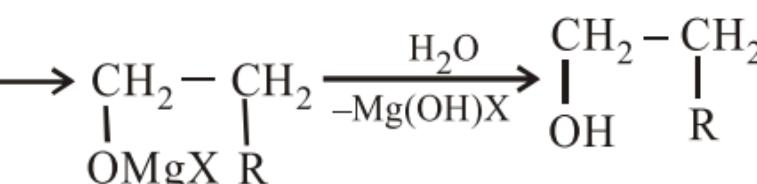
M)

4 times &

4 times. Both of these reinforce each other



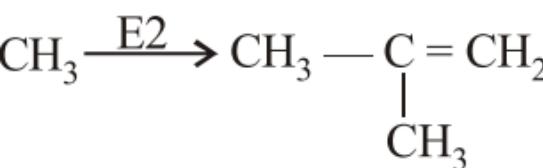
electron hence it is paramagnetic.



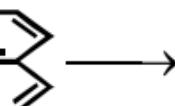
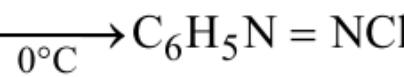
hydrogen atom to replace Cl. Hence it will form chloride.

of amino acids i.e., $2^2 = 4$ dipeptides can

react with base, such as sodium methoxide, readily in the formation of alkenes. (Williamson's



; $s_2 = K_{\text{sp}} / 0.01 \text{ M}$; $s_3 = K_{\text{sp}} / 0.05 \text{ M}$



tendency with carbon and nitrogen decreases

stable,

loses readily whereas,

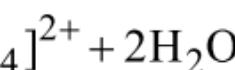
exist

and on difference in melting points.

electron is removed. In peroxides (O_2^{2-}) no net as the antibonding pi M.O.'s acquired

pairing. AlO_2^- containing Al^{3+} ($2s^2 p^6$)

hence there will be no movement of H_2O .
ink coloured and contains octahedral
partially dehydrated by heating, then blue
 $[\text{Hg}(\text{H}_2\text{O})_4]^{2+}$ are formed.



$4s^0$) has no unpaired electrons.

o unpaired electrons.

aired electrons in *d*-orbitals, so it is both

as no unpaired electron.

Arrhenius equation)

straight line with slope $-E_a/2.303R$

re or superoxide due to its small size.

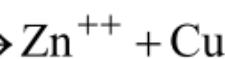
and bicarbonates increases on moving

size of hydrated ions of alkali metals is

Cs^+

electric cells due to its low I.E. Hence

correct choice.



$$\therefore E_1 = (E_{\text{cell}}^\circ + 0.059) V$$

as, $E_1 > E_2$.

$$(0)/640 = wM/mW$$

$$40 = 69.458 \cong 69.60$$

$$= 6.0[\text{H}_3\text{O}]^+ = 10^{-6}$$

is in excess, therefore its conc. remains

$$\times 10^{-6} \over 10^{-6} = 3.8$$

ies

$$\times 9 = 136800 \text{ cm}^{-1}$$

$$\frac{\Delta H_c}{\text{mol. wt.}} = \frac{2658}{58} = 45.8 \text{ kJ/g}$$

ane means 14000 g of butane

/g

$$\times 45.8 = 641200 \text{ kJ}$$

$$\text{for } \frac{641200}{20,000} = 32.06 \text{ days}$$

MATICS

-cd)p

$$^2 + d^2 \leq 0$$

$$(c^2 - 2bcd + b^2) \leq 0$$

$$2bcd + b^2 \leq 0$$

$$(b-d)^2 \leq 0$$

$$b-d = 0$$

$c - a)$,

$c - a) + c(a - b)]$

of the log.

$_{yz}^{zx}$

$_{yz}(x^2 \cdot y^2 \cdot z^2)$

$\beta.$

$\beta \Big)$

$$-1 = \frac{1 - \omega^n}{1 - \omega}$$

)

$$\frac{\pi}{2n} \cos \frac{\pi}{2n}$$

$$\left[\frac{\pi}{2n} \right]$$

$$= \frac{i \left(\frac{\cos \pi}{2n} - i \sin \frac{\pi}{2n} \right)}{\sin \frac{\pi}{2n}}$$

$$\cot(\pi/2n)$$

$$= 1$$

For 3, $|kA| = k^3 |A|$ because each element is multiplied by k and hence in this case we will have k^3

$$)(3) = -81$$

Since A^{-1} exists and

$$\mathbf{B}^2$$

$$f \ AB = BA \ .$$

$$\cdot \neq 0 \text{ or } \lambda \neq -\frac{4}{5}$$

$$= 4$$

ative.

$$\left[\frac{\sin \theta}{\sin^2 \theta} \right]$$

$$\left[\frac{2 \tan \phi}{1 - \tan^2 \phi} \right]$$

$$= 2 \tan^{-1} b$$

a and

$$b$$

$$+ \sin^{-1} \left[\frac{2b}{1+b^2} \right]$$

$$\tan^{-1} b$$

$$b$$

$$\begin{bmatrix} \cos^2 \phi & \cos \phi \sin \phi \\ \cos \phi \sin \phi & \sin^2 \phi \end{bmatrix}$$

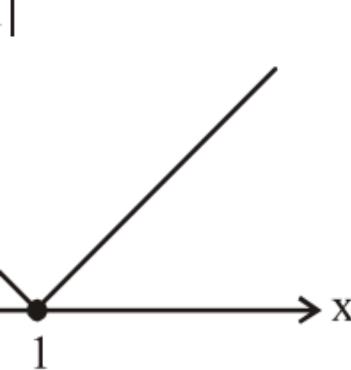
$$\sin \theta \sin \phi$$

$$\cos \phi \sin \phi$$

$$\begin{bmatrix} \cos \theta \sin \theta \sin^2 \phi \\ + \sin^2 \theta \sin^2 \phi \end{bmatrix}$$

$$\begin{bmatrix} \theta \sin \phi \\ \theta \sin \phi \end{bmatrix}$$

$$)$$



f. at $x = 1$

$x = 1$.

$\frac{2}{(x-2)}$, which is not defined at $x = 1/2, 2$.
 $(gof)(x)$ is discontinuous at $\{1/2, 1, 2\}$

$${}^{+r}C_n = {}^{n+r}C_{n+r-n})$$

$${}^3C_3 + \dots + {}^{n+m}C_m$$

$${}^{n+3}C_3 + \dots + {}^{n+m}C_m$$

$$+\dots+ {}^{n+m}C_m$$

are left with

$$\} \rightarrow 1/3$$

$$\frac{1}{3}$$

ghest order as 2.

$$x^2(x+1)dx$$

f

$\int f(x)dx = 0$, as $f(x)$ is an odd function]

a

b

c

$$e \quad 0 = 1 + a_1/2 + a_2/2^2 + a_3/2^3 + \dots \quad (1)$$

$$/2^4 - \dots + a_{12}/2^{12} \dots \quad (2)$$

$$a_{12}/2^{12})$$

$$a_{12}/2^{12} = -1/2$$

curves are respectively.

$$\sqrt{8m^2 + 2}$$

± 4

$$= \frac{7}{2}$$

Then $(x + y - z) = -xyz$.

$\tan B \tan C$

$B = 2\pi - 2C$

$\Rightarrow = -\tan 2C$

$\tan 2A \cdot \tan 2B \cdot \tan 2C$

$$\frac{2 \tan C}{-\tan^2 C}$$

$$\frac{\tan C}{-\tan^2 C}$$

$\tan C$, we get

7

as equal roots then $D = 0$.

$+ 18^\circ)$

$$-\frac{2\sqrt{5}}{5}\Big)$$

$$\frac{\sqrt{5}+1}{16} \left[1 - \frac{(\sqrt{5}-1)^2}{4} \right]$$

to

k)

$$\tan^{-1} x) = -x = -\frac{1}{5}$$

the equation $2\tan^2\theta - 4\tan\theta + 1 = 0$. Thus
 $\tan\theta_2 = 1/2$.

$$\tan\theta_2)/(1 - \tan\theta_1\tan\theta_2)]$$

$$\begin{vmatrix} b \\ a \\ c \end{vmatrix} = 0$$

$$(b - c) = 0$$

$$a = 0$$

$$bc - 2ca = 0$$

$$-(b^2 + c^2 - 2bc) + (c^2 + a^2 - 2ca) = 0$$

$$(b - c)^2 = 0$$

members can be zero if and only if $a = b = c$

(0°)

1

medium

$$= \lambda_1 \mu_1$$

rved.
entum

$$^4A^2]$$

$$\frac{1}{6}$$

$$_{\rm Hz}$$

$$\mathrm{falling\; object}$$

$$\frac{s}{\tau}$$

$$\frac{\Delta_2 Y_2}{F_1 l_1}$$

$$(3\times 10^8)^2 \times 10^{-11} \text{J}$$

$$\cdot \cos\left(\frac{\pi t}{2}+\phi\right)$$

$$\frac{\pi t}{2}+\phi\Biggr)$$

distance x from its equilibrium position.
at ρAg which applies to whole body. If a be

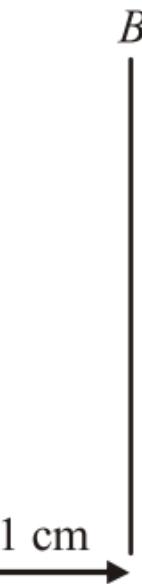
s equation of S.H.M.

determined by the formula

al meaning.

re $(2f, 2f)$

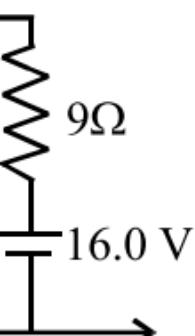
the metal plate A



mitted from metal plate A upto 10 seconds

$$5 \times 10^7$$

fully charged hence no current will flow



difference across resistances will be 8.0 V.

$$= \frac{8}{12}$$

eld,

?

$$\frac{1}{4} \epsilon_0 E^2$$

2

hen

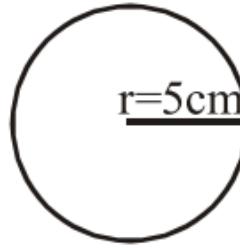
$$\frac{K_1 + K_2}{m}$$

$$= 1 \text{ if } v = u, \therefore u = 2$$

force acting on particle should always be
nt of the particle and directed towards the

ass.

at



c field

: 0.4A

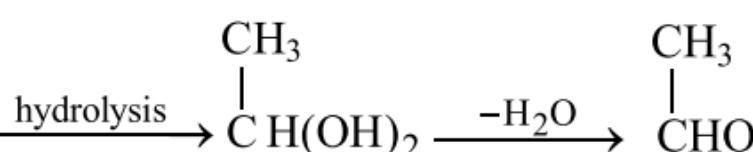
ally reflecting surface

velocity of light)

hence true

s

percentage of C, H and Cl in both will be



If a weak acid (H_2CO_3) with a strong base is completely ionised as Na^+ and CO_3^{2-} ions. The conjugate base of the weak acid H_2CO_3 undergoes hydrolysis according to the equilibrium of hydrolysis:



a strong base makes the solution basic, the pH will be greater than 7.

In the theory of gases, the average velocity of the molecules is given by the expression

$$v = \sqrt{\frac{8RT}{\pi M}}$$
 where T is the absolute temperature and M is the molecular weight.

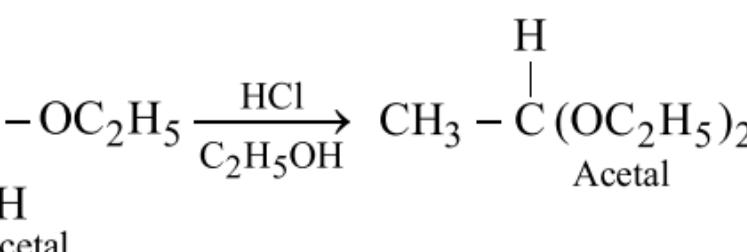
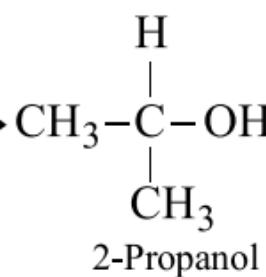
R is the gas constant. Thus the average velocity of the molecules is proportional to the square root of the absolute temperature. The ratio of the average velocity at 200°C to that at 100°C is

$$\sqrt{\frac{200}{100}} = 1.41$$

and the density of 0.046 g of alcohol

$\times 10^{21}$

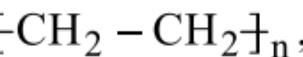
gives a blue solution. It can be NH_3 .



equal to 110°C. Although the salts will not boil in water, it should boil at or below this

are hexa-coordinated, in the case of (ii), one (iii) is coordinated to the central cobalt ion are coordinately linked. Thus, the ionisable cation is two and in (iii) it is only one.

lency of the complex cation.



or, it is a homopolymer.

body are met by glucose that is circulated and stored in the muscles.

is the stability of the carbanion. hence the

In the molecular species given, respectively the electronic configuration of the molecular number of electrons in antibonding orbitals is 18.

Behaviour is greater, when the pressure is higher than its deflection point or its critical temperature. 25°C and 4 atm pressure among the sets given

The energy change in the reaction of strong acid and strong base is always 13.7 kcal.

$$\frac{75}{100} + 87\left(\frac{25}{100}\right) = 85.5.$$

In the oxidation of nitrogen, the nitrogen present in the compounds is quantitatively converted into $\text{H}_4\text{N}^+ \text{SO}_4^-$ so obtained is decomposed with aqueous NH_3 which is absorbed in an excess of dilute H_2SO_4 and titrated with

tion mixture has the effect of lowering the reaction by changing the path or mechanism of reaction increases manifold. However, the enthalpy (ΔH) of the reaction are unaffected. This means it can react with both acids and alkalies. Lithium are highly electropositive and highly reactive. If these come in contact with water, the reaction that the hydrogen evolved catches fire. Thus, this is doubly exothermic, using water to react with these metals makes it explosively dangerous. Sodium and Potassium are reactive. Small fires can be quenched by covering with dry sand, since these measures remove oxygen and water vapour and thus become non-combustible.

$$= 0.107$$

$$\frac{1}{10} = 0.005$$

$$0.05 \times 392$$

$$= 1.96 \text{ g}$$

S is 50%.

located at the centre of the 6 faces and at the corners of the cube.

which is shared by 2 cells. Hence, the no. of atoms per face = $4/2 = 2$

and each face is surrounded by 8 other cells. Hence no. of atoms = $8/2 = 4$

$$= 4$$

completely,

reaction, $[\text{Ag}^+] = 0.1 \text{ M}$

$\approx 0.1)$

O

$$+\frac{2}{22.4} \times 2220 = 317.$$

MATICS

k)

$$\sin x - \cos x)$$

ng function.

$$\beta < \frac{\pi}{4}$$

$$x \in \left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$$

$$\sqrt{y^2 - y\sqrt{1+x^2}})$$

$$(\lambda x - 1)$$

)

$$x^2 - 2\lambda x + 1$$

$$+ \lambda^2 y^2 + 2\lambda y + 1$$

$$y^2 y + x + y) = 0$$

$$(x + y) + (x + y)] = 0$$

$$2] = 0$$

$$] = 0$$

$$\frac{\lambda}{2}$$

$$1) \left(1 - \frac{dy}{dx} \right) = 1$$

al equation and clearly degree of $\frac{dy}{dx}$ is 1.

al equation is 1.

ows between $x = (0, 2)$

$$x < 1$$

$$x \leq \sqrt{2}$$

$$+ \int_{\sqrt{3}}^2 3 \cdot dx$$

$$3(2 - \sqrt{3})$$

$$\sqrt{3} = 5 - \sqrt{2} - \sqrt{3}$$

$$-12 ; \gamma \delta = b$$

.....(1)

$(1+x)$ (2)

$$\frac{1}{4} = \frac{1}{x^2} \text{ or } x = 2$$

$$\alpha = 1 \text{ and } \beta = 2$$

$$= 1 \times 2^3 = 8$$

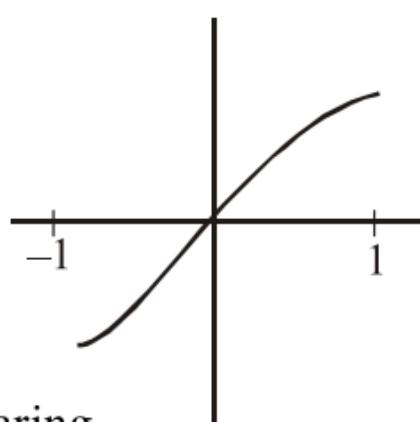
$\{1, 2, 3\},$

$\{(1, 2), (2, 3)\}$

relations on A.

$3\}$

$\notin R \cup S.$



$$\text{Py} = Q$$

$$\int 1 \cdot dx = e^x$$

C

$$\Rightarrow y = \frac{2e^{2x}}{3} + ce^{-x}$$

)

$$\left| \begin{array}{l} \\ \\ \end{array} \right. , C_1 \rightarrow C_1 + C_2 + C_3$$

0

$$\rightarrow R_3 - R_1$$

$$\begin{vmatrix} -x \\ 0 \\ 2x \end{vmatrix} = 0$$

+3a

the condition in the eqn 2.1

$C(0, 0)$. Therefore the equation of the circle

$$+ y^2 = 4a^2$$

igits of n is not divisible by 9'

2, 3, ... 9 is $p = 9/15$

[Binomial distribution]

es

$$(1 + \sqrt{2})a, (1 - \sqrt{2})a$$

s

$$+ 2ax - 5a^2 = 0$$

a

e of the roots.

$$Y^c) = (X \cap X^c) \cap Y^c$$

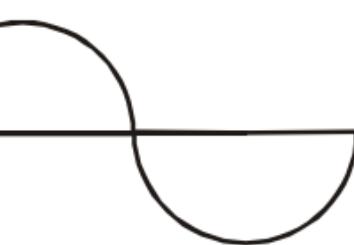
$$\log_e x \cdot \log_2 e \}$$

:

$$, x \cdot \log_2 e \}]$$

$$e^{-x} \cdot \frac{d}{dx} (\log_e x \cdot \log_2 e)$$

and multiples of x . Hence the function is continuous at all these



us

(0^+)

> 0

$(-h) < 0$

$= 0$

able at all multiples of π , i.e., $n\pi$ where $n = 0,$

$$\frac{d}{dx}$$

$x \cos x$

$$\int_0^{\pi/3} dx = \frac{\pi}{3}$$

gents is given by $SS_1 = T^2$

$$5) = (3x.1 + 2y.2 - 5)^2$$

$$55 = 0$$

can be found by using

$$\frac{2^2 - (9)(-4)}{+(-4)}$$

$x + 1$ are given as ω & ω^2 . i.e. say, $\alpha = \omega$

$$\omega^2)^7 = \omega^{14} = (\omega^3)^4 \omega^2 = \omega^2$$

$$1 = 0$$

$$\sin^{-1} x \quad (\because \cos^{-1} x = \frac{\pi}{2} - \sin^{-1} x)$$

$$\cos(2 \sin^{-1} x)$$

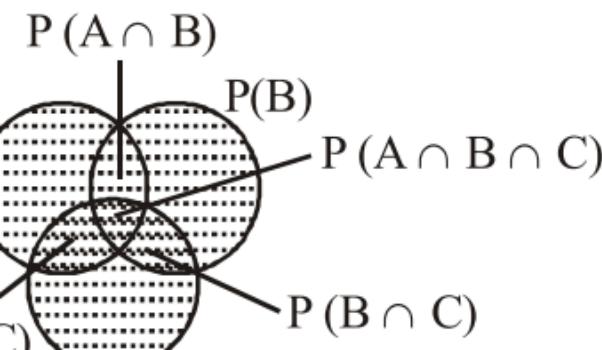
$$\text{or } x(1 - 2x) = 0 \text{ or } x = 0, \frac{1}{2}$$

$$0 \text{ or } y = 1$$

$$0) \& (1, 1)$$

$$\int_0^1 (\sqrt{x} - x^2) dx$$

$$= \frac{1}{3}$$



$$C) - P(A \cap B)$$

$$- P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$$

$$\frac{5}{8}$$

$$6 - r - 2r$$

$$6, \text{ or } r = 0$$

term.

$$_0 f(x) = f(0)$$

$$\lim_{x \rightarrow 0} \frac{\sin 3x}{x} = \lim_{x \rightarrow 0} \frac{3 \cdot \frac{\sin 3x}{3x}}{\frac{\sin x}{x}} = 3$$

$$\left[\because \lim_{x \rightarrow 0} \frac{\sin \theta}{\theta} = 1 \right]$$

$$+ c$$

$$= \frac{2}{3} + c$$

TEST-4

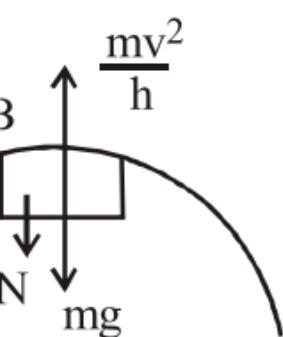
SICS

$$= \sqrt{\frac{2 \times 10 \times 3}{\frac{3}{2}}} = \sqrt{40}$$

$$\sqrt{\frac{40}{8}} = \sqrt{5} \text{ m.}$$

= velocity at B)

ck at B



ng

$$\Delta V = -V_0 \frac{\Delta p}{B}$$

$$= \rho_0 \left[1 + \frac{\Delta p}{B} \right]$$

depth and surface of ocean

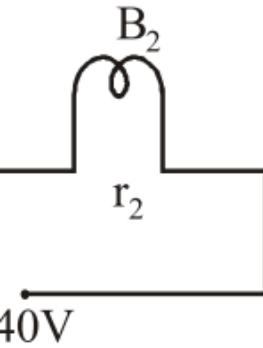
$$+ \partial z \hat{k} \Big)$$

$$x]_4^{10} + 3[y]_0^3$$

= -21kV
marked 25W -220V, will not fuse

p

e circuit

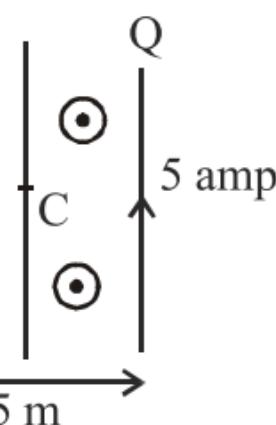


$$= \frac{(220)^2}{100}$$

$$\frac{440}{\left[\frac{1}{25} + \frac{1}{100} \right]}$$

wires in the same direction then magnetic field at P,

ward \odot



to wire Q

ward $\odot]$

$$\frac{\mu_0}{\pi} \text{ (upward)}$$

$$d_{\text{point}} = \frac{\mu_0}{2\pi}$$

and slab

100 N. So the block will slip over a slab.
between block and slab

.2 N

move the slab

$$V_p = V_Q$$

$$\text{photon} = \frac{IA\lambda}{hc}$$

$$\text{emitted} = \frac{1}{100} \times \frac{IA\lambda}{hc}$$

$$1.5 \times 10^{12} \text{ per sec}$$

line in Balmer series is given

$$n_1 = 3$$

or second line $n = 4$.

$$\lambda = 4860 \text{ \AA}$$

$$-\text{hole pair} = 7 \times 10^{15}/\text{m}^3$$

at doping donor Impurity

$$n_e = \frac{N_D}{2} = 2.5 \times 10^{21}$$

$$(\because n_e \gg n_h)$$

ent law

$T_2]$

esser wavelength (λ_m) and so curve for T_2

llation is maximum

ro)

s is $\sqrt{\frac{8kT}{\pi m}}$. It depends on temperature and speed of O_2 will be same in (A) and (C).

$$\frac{510(330+20)}{330+20-20 \cos 60^\circ}$$

one half circle is $\pi r^2/2$. The flux change in induced emf is then $e = \pi r^2 B/T = B \omega r^2/2$

$$e/R = B \omega r^2 / 2R$$

ltage is

urrent is

with normal incidence



gn convention,

$$f = -10 \text{ cm}$$

n

$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$$

-30cm.

in the mirror on the same side of the object.

$$= \frac{-v}{u} = \frac{h_1}{h_0}$$

m

$$E \cos 30^\circ)$$

$$qE$$

$$g \cos 30^\circ + qE \sin 30^\circ)$$

$$9.16 = 1.832 N$$

in the downward direction

$$30^\circ)$$

$$\frac{1.832}{2} \Big)$$

$$e, f = \frac{F}{m} = 2.3 \text{ m/sec}^2$$

$$\operatorname{cosec} 30^\circ = 2 \text{ m}$$

$$/2$$

$$\frac{6.4 \times 10^6 \text{ m}}{00 \text{ s}}$$

es, we get

$$\left. \frac{400)^2}{10^7 \text{ m}} \right\}^{1/3} - 6.4 \times 10^6$$

$$2 = \frac{12 - e}{1}$$

As $e \propto \omega$.

e of induced e.m.f. becomes

$$0^6 \times 24 \times 60 \times 60 \text{ joule}$$

$$\frac{\times 24 \times 60 \times 60}{\text{input energy}}$$

$$\frac{60 \times 60}{\times 10^{-11}} = 10.8 \times 10^{10} \text{ J}$$

$$\times 10^{-11} \text{ J}$$

$$\frac{\times 10^{10}}{\times 10^{-11}} = 3.375 \times 10^{21}$$

ay

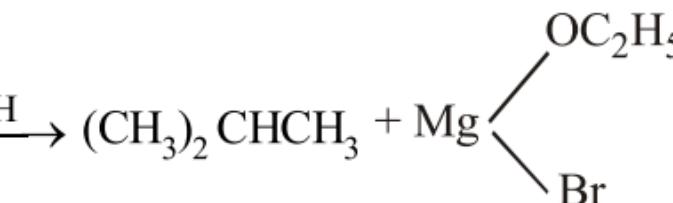
per day \times mass of U²³⁵

$$^{-27} = 1.324 \text{ mg}$$

ISTRY

In increased, energy in form of heat is supplied to the system. This increases the energy of the reacting molecules. This will increase the frequency of collisions and ultimately the rate of reaction will increase.

For example, in the case of the reaction between lanthanide ions and the complex formed by the coordination of a ligand L with a transition metal ion M, the lanthanide ions shield the outer shell electrons of the metal ion from the influence of the ligand. This results in a decrease in the effective nuclear charge experienced by the outer shell electrons of the metal ion, which in turn leads to a decrease in the ionic radius of the metal ion. As a result, the metal-ligand bond length decreases, which leads to an increase in the strength of the metal-ligand bond.



$T)^{\Delta n}$, we get

the reaction having highest value of Δn .

ctions are

1

cation

anion

order of size of cations

Cl^- .

character is

2

e.

no. of atoms Simplest ratio of atoms

$$/12 = 4.1 \quad 4.1/2.74 = 1.5 \\ \times 2 = 3$$

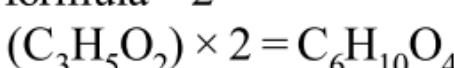
$$/1 = 6.84 \quad 6.84/2.74 = 2.5 \\ = 2.5 \times 2 = 5$$

$$/16 = 2.74 \quad 2.74/2.74 = 1 \\ 1 \times 2 = 2$$

$$36 + 5 + 32 = 73 \\ \text{density}$$

$$= 146/73 = 2$$

formula $\times 2$



K^{-1})
which is possible only if $T > 1000$ K.

ion state decrease by 2 while going down

in four different groups in chiral structure.
pollutant.

as A_4B_6 .
'B' forms *hcp* lattice and 'A' is present in

is occupied by

ce it contains only two types of H-atoms
no chlorinated compounds viz.

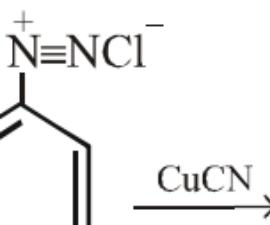
Cl^-
 s

$$= 1.62 \times 10^{-2}$$

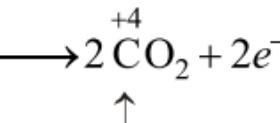
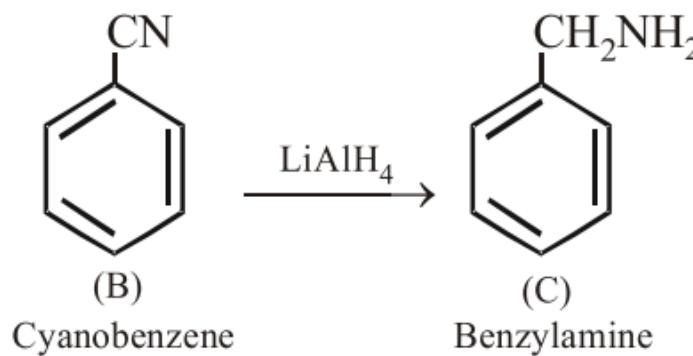
plex

bital
bital

$$-0.6 \Delta_0$$



(A)
benzene
azonium
chloride



$$\times 10^{-24} \text{ kg m sec}^{-1}$$

constant pressure

constant volume

)

$$-\Delta E = \Delta n_g RT$$

$$= 300 \text{ cal}$$

constant pressure and at constant volume
other by 300 cal.

$$\text{Total} = 5.$$

0g metal and 20g oxygen

metal \times 8 / mass of oxygen

or the complex compound

ur.

],

,

$\text{Pt}(\text{NH}_3)_2\text{Cl}_2$] does not exist due to both

means that 1L of this H_2O_2 solution will

from 68 g H_2O_2 at STP. 10 L of O_2 at STP

in 10 volume of H_2O_2 solution,

MATICS

,

es

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

$$4\sqrt{3}$$

$$3 = -1 \Rightarrow x = 2, 2$$

$$3 = 1 \Rightarrow x = 2 \pm \sqrt{2}$$

)

$$3t + 1)$$

num

$$\left(\frac{x}{2}\right)^{10-t} \left(\frac{-3}{x^2}\right)^t.$$

$$= 4 \Rightarrow t = 2$$

$$2 \left(\frac{1}{2}\right)^8 (3)^2 = \frac{405}{256}$$

1

then

$$/2$$

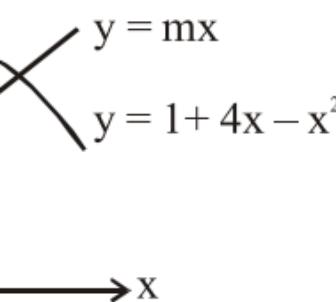
of $f(x)$ is real when

$$0$$

$$< 1$$

$$\frac{e-1}{e} \text{ and } x < 1.$$

$$= 0$$



$$2 \int_0^{3/2} mx \, dx$$

ms

s]

$(0-1) + \dots + n$ terms]

$+ 1 + 1 + \dots + n$ terms]

$$\left[\frac{n+1}{9} - 10 - n \right]$$

$$\frac{dx}{2 \tan \frac{x}{2} + \tan^2 \frac{x}{2}}$$

$$\frac{\sec^2 \frac{x}{2} dx}{-\tan^2 \frac{x}{2} + 2 \tan \frac{x}{2}}$$

$$dt \Rightarrow \sec^2 \frac{x}{2} dx = 2 dt .$$

$$= 2 \frac{-1}{(1+t)} + C$$

$$+ (C - 1) = \frac{\tan \frac{x}{2} - 1}{\tan \frac{x}{2} + 1} + b ,$$

ant

$$\frac{x}{2} + b = \tan \left(\frac{x}{2} - \frac{\pi}{4} \right) + b .$$

n as

$$\left[\frac{2^{x+1} - 2^x}{1 + 2^x \cdot 2^{x+1}} \right]$$

$$\cos \frac{6\pi}{7} \\ \left[-\sin \frac{3\pi}{7} \right] + \left[\sin \frac{7\pi}{7} - \sin \frac{5\pi}{7} \right]$$
$$\sin \frac{7\pi}{7} = \sin \pi = 0$$

s, we get

...(1)

get:

ation(1) , we get

x

in 'z' i.e.

Q

$\sec x$

s on the chord again.

► X

lly perpendicular.

$$\vec{a} = 0 \quad \dots(i)$$

$$\dots(ii)$$

$$\dots(iii)$$

, we get

$$2 + |\vec{c}|^2 + 2(\vec{a} \cdot \vec{b} + \vec{b} \cdot \vec{c} + \vec{c} \cdot \vec{a})$$

$$|\vec{b}| = 4, |\vec{c}| = 5$$

$$x \left| \begin{array}{l} \\ = 0 \end{array} \right.$$

$$= 0$$

$$\begin{aligned} & -a\} + b\{a - b + x\} = 0 \\ & \text{(finding the determinant.)} \\ & c + ca) = 0 \end{aligned}$$

$$^2 = 0$$

$$\frac{1}{2} \Sigma a^2]$$

$$\overline{\frac{3}{2} \Sigma a^2}.$$

$$+ \int_1^2 2x^2 dx, I_4 = \int_1^2 2x^3 dx$$

$$\nearrow 0 < x < 1, x^2 > x^3$$

$$> I_2 .$$

$$\int_1^2 x^3$$

$$[x - 3]$$

$$[\because -3 \leq f(x) - 3 < -2]$$

$$\leq f(x) - 3 < -1.4]$$

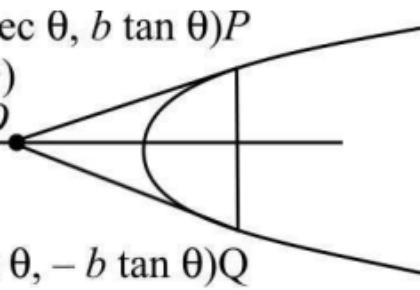
$$\{P(A), P(B)\} = \frac{2}{3}$$

$$\frac{1}{2}$$

$$P(A \cup B) \geq P(A) + P(B) - 1 = \frac{1}{6}$$

$$\frac{1}{6}$$

$(a \sec \theta, b \tan \theta)$ be end points of double
centre of the hyperbola.



$$\tan^2 \theta$$

$$^2 \sin^2 \theta = a^2$$

$$\left[\because e = \sqrt{1 - \frac{b^2}{a^2}} \right]$$

$$\sin^2 \theta < 1)$$

$$e^2 > \frac{4}{3} \Rightarrow e > \frac{2}{\sqrt{3}}.$$

ndicular from the origin on the given line.
rm is

$$\sqrt{3}x + y = 2p$$

s at $A\left(\frac{2p}{\sqrt{3}}, 0\right)$ and $B(0, 2p)$.

$$\frac{2p}{\sqrt{3}} \Big) 2p$$

$$10 = 0.$$

ten as

$$x + y)$$

$$\sin \frac{1}{2} x = 0 \text{ or } \sin \frac{1}{2} y = 0$$

$\left(-\frac{1}{2}, \frac{1}{2}\right)$ or $\left(\frac{1}{2}, -\frac{1}{2}\right)$ as the possible solution.

get $(0, \pm 1)$ and solving with $y = 0$, we get
Thus we have six pairs of solutions for x

$$\frac{\sin x - 1 + \frac{3x^2}{6}}{5x^4}$$

$$\frac{\sin x + 1}{5x^2}$$

0

$750 \text{ cm}^3/\text{sec.}$

$$= \frac{-1 + \sqrt{3}i}{2} = \omega$$

ω^2)

$$\therefore 1 + \omega + \omega^2 = 0$$

$$4 - (-2)^6 (\omega^3)^2$$

$$\omega^3 = 1$$

igits are 1, 4 and 9.

$\times 3 = 9$ ways.

is 1×9 . Similarly,

$\times 10 \times 9$ and

$\times 1 \times 100 \times 9$. We can deal with the digits

TEST-5

SICS

v_1

-----x

v_2

on of linear momentum along a direction of motion (i.e. along y-axis), we get

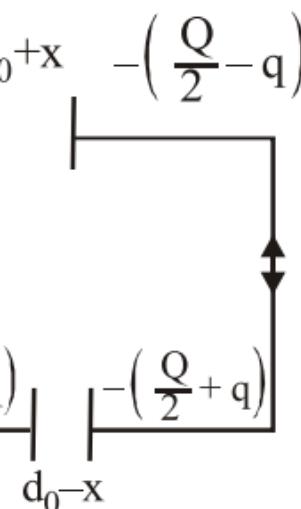
$$r e = \rho$$

is bent in a form of circular loop therefore

$$\text{but given axis} = \frac{3}{2} M R^2$$

e x from its initial position.

Using Kirchoff's voltage law



$$\frac{(d_0 - x)}{A} = 0$$

$$\left(\frac{dx}{dt} \right) = \frac{Q}{2d_0} u_0$$

sely with the distance for a long conductor.

e.

l :

$T^0]^y [M^0 L T^0]^z$

K

$$\left(\frac{\alpha + \beta}{\alpha \beta} \right)$$

$$160^\circ = \frac{\sqrt{3} u^2}{2g}$$

$$= \frac{u^2 \sin^2 30^\circ}{2g} = \frac{u^2}{8g}$$

$$4\sqrt{3}$$

maximum speed v_{max} are stopped by electric
distance $d = 1m$

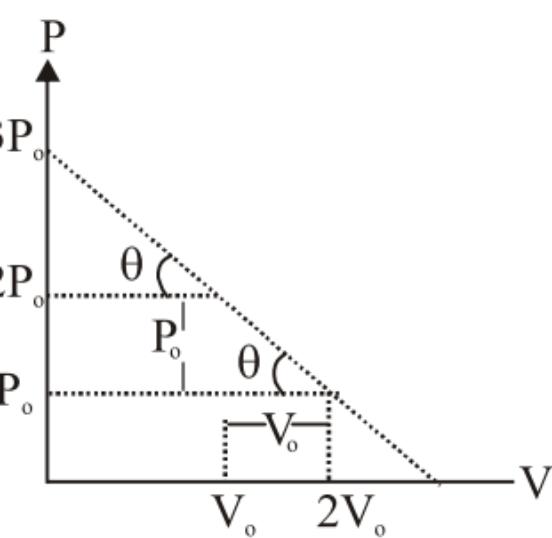
$$n = \frac{1240}{200} = 6.2 \text{ eV}$$

photoelectric effect

from $n_1 = \infty$ to $n_2 = 1$ and longest wavelength
in the given case.

$$\left. \frac{-25}{\times 36} \right) = \frac{11}{900} R$$

cycles is from zero to some maximum value.
In case of cooling, the temperature goes on decreasing linearly.



, $c = 3P_0]$

... (i)

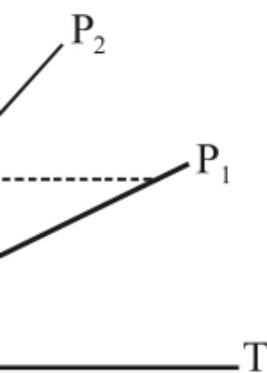
... (ii)

... (iii)

$$m \frac{dT}{dV} = 0$$

we get

[From (i)]



uses mean position.

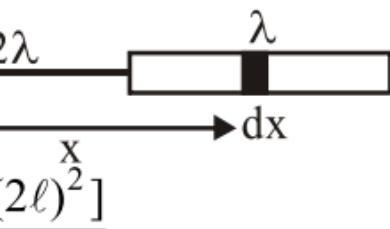
ms^{-1}

$$y = a \sin \omega t$$

$$\left(\frac{\pi}{4} \right) = \frac{a}{\sqrt{2}} \quad \dots(i)$$

$$\text{mean position, } y_1 = \frac{a}{\sqrt{2}},$$

[from (i)]



time t is given by

use in nature i.e.,

... (i)

... (ii)

to \vec{E}

$$\vec{k} \parallel \vec{E} \times \vec{B}$$

$$\frac{3mg}{m+m} = \frac{3}{4}g$$

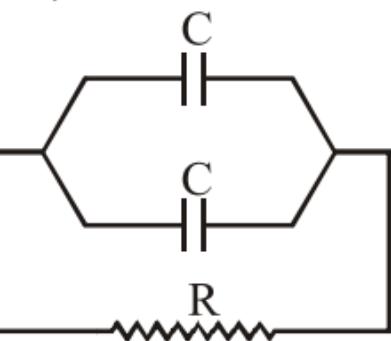
$$\frac{2mg}{m+m} = \frac{2g}{3}$$

or AB = 2 \times acceleration of mirror =

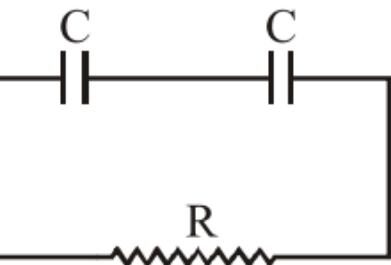
$$r_{CD} = 2 \left(\frac{2g}{3} \right) = \frac{4g}{3}$$

ages w.r.t. each other

ence, then



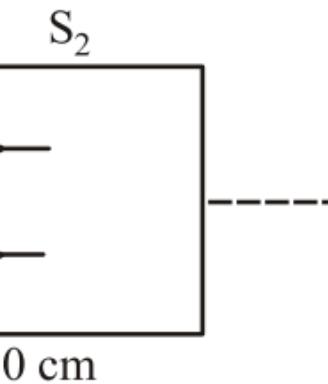
$$RC_e \ln 2$$



$$\pi G R \rho$$

o

$$= 2\sqrt{2gR}$$



executing SHM

... (i)

$$\sin\left(4t + \frac{\pi}{3}\right)$$

$$4t + \frac{\pi}{3}$$

... (ii)

in with standard equation of SHM $y = a \sin$

$$\frac{2\pi}{4} \Rightarrow T = \left(\frac{\pi}{2} \right)$$

. (ii), we get

$$\frac{\pi}{3}$$

,

$$)^2$$

$$K.E. = 0.3J$$

$$1000\Omega \text{ and } R_s = 100\Omega,$$

resistor

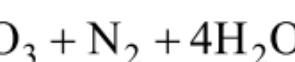
ence R_s is

ce R_L is

s

4 amp.

de is



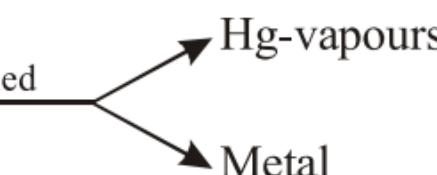
pyretic.

The reverse reaction depend upon whether it is exothermic or endothermic.

$$\Delta H = -\text{ve}, E_{a(b)} > E_{a(f)}$$

$$\Delta H = +\text{ve} \quad E_{a(b)} < E_{a(f)}$$

Reduction process and, van Arkel process are the methods applied depending upon the nature of the metal. In case of the impurities whereas amalgamation method is used for separation of noble metals like gold, silver, etc, amalgam formed is recovered from the amalgam by subjecting it to air. Mercury distils over leaving behind the metal.



agent and liberate O_2 when treated with



surface tension of solution, thus soap get stick to the surface, and these are removed by action of

and accepts OH^- ions to form $[\text{B}(\text{OH})_4]^-$

$$\text{g}), \quad K = \frac{1}{K_p}$$

formic acid and acetic acid by their action
acid gives a red ppt of cuprous oxide but
ppt.



(no H-bond)

(one H-bond)

one (G)

thymine (T)

base of ATGCTTGA is TACGAACT.

→ NaCN).

form oxide and nitride. On reaction with
and nitride gives hydroxide and ammonia.

on of freshly prepared precipitate into col-
e electrolyte.

$$= 1.04$$

C



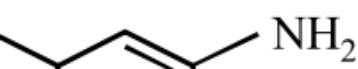
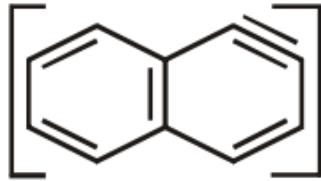
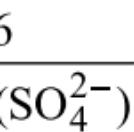
-1) = 1 Therefore $x = 3$.

Potential higher will be the oxidising power
reaction potential higher will be the reducing

t after 100 sec.

$$7 = \log \frac{0.29}{(a - x)}$$

= Valency of metal)



Cl^-
 -1

]; $\Delta H = -119.5 \text{ kJ}$

; $\Delta H = 3(-119.5)$

$$= -358.5 \text{ kJ}$$

es extra stability to the benzene molecule
hydrogenation to take place.

-208.1 kJ

MATICS

)

as per problem, second root is α^2 .

c equation.

$$\dots (1)$$

$$\dots (2)$$

$$\alpha^2 + \alpha = -p \text{ from } eq^n(1)]$$

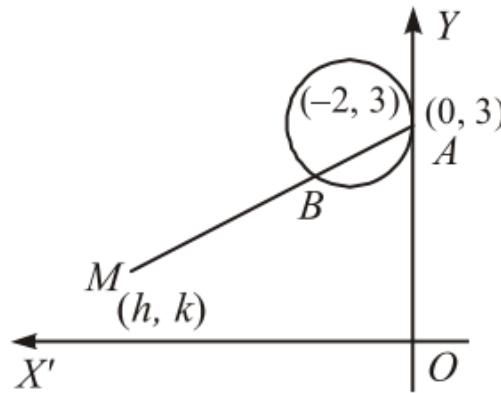
tion (1)

$$-p$$

$$\frac{-q}{-q} = -p$$

$$n + a = -p(p^2 - 2n + 1)$$

cle. i.e.,



which is a circle.

$$\frac{1}{x-1} \Bigg) \text{ if } x \neq 1 \\ \text{if } x = 1$$

$$0 \sin \frac{1}{h}$$

$$1 \\ \left. \frac{x-1}{(-1)^2} \cos \left(\frac{1}{x-1} \right) \right]_{x=0}$$

$$= 200$$

$$C^c) = n[A \cap (B \cup C)^c]$$

$$\left]$$

$$)-n(A\cap B\cap C)]$$

$$00 - 700 = 3300.$$

$$Qe^x + Rx \quad \dots (i)$$

$$(\log 2) = 31$$

$$\dots (ii)$$

$$+ R$$

$$\dots (iii)$$

$$\dots (iv)$$

$$x]dx = \frac{39}{2}$$

$$\frac{0}{-}$$

... (v)

$$\frac{x^n}{m}, \left(\frac{\infty}{\infty} \text{ Form} \right)$$

[Again using L-Hospital's rule]

$$m \Biggr)$$

[Again using L-Hospital's rule]

$$\frac{\infty}{\infty} \text{ Form} \Biggr)$$

$$-ax + b$$

in x) is $\sqrt{2}$

$$\geq \sqrt{2}$$

$$3 - 4 \sin^2 B$$

$$\frac{a^2 + c^2 - b^2)^2}{4(ac)^2}$$

$$\frac{a^2 + c^2)^2}{(ac)^2}$$

$$\left(\frac{x^2}{c^2}\right)^2.$$

$$(\sin^2 x) \quad \dots(i)$$

et

$$\left\{ \frac{y}{1+x} \right\} + \frac{\sin 2x}{\sqrt{1-\sin^4 x}}$$

$$= -1.$$

at (0, 1) is

hyperbola $xy = c^2$ is $(ct, c/t)$
 $x^2 = a^2$ $\dots(i)$

(ii)

as

$$\int v \, dx \Big] \, dx$$

Hence we choose $(\log x)^2$ as Ist function

$$\left. - \cdot \frac{x^4}{4} \, dx \right\}$$

$$x \, dx$$

$$\left. - \int \frac{1}{x} \cdot \frac{x^4}{4} \, dx \right\}$$

$$\int x^3 \, dx$$

$$+ C$$

$$C$$

$$\dots\dots (i)$$

$$\dots\dots (ii)$$

$$\sin^{-1}(\tan 2\theta)$$

$$\dots\dots (iii)$$

$$\sin^{-1}(\sin 2\theta)$$

ent will be 1.

$$\frac{1}{3}(1-x)$$

$$= \pm 1$$

$$-\sqrt{-x}) dx - \frac{1}{\sqrt{2}} \int_{-2}^0 \sqrt{-x} dx \Bigg]$$

$$\left. \frac{1}{\sqrt{2}} \times \frac{-2}{3} (-x)^{3/2} \right]_{-2}^0 \Bigg\}$$

$$\frac{4}{3}.$$

$(p \wedge \sim q) \rightarrow r$ is

$$\text{of} \left(\frac{3}{2}x^2 - \frac{1}{3x} \right)^9 \text{ is}$$

dent of x in the expansion of $(1 + x + 2x^3)$

... (ii)

ns x^0, x^{-1} and x^{-3} in

$= 6.$

value of r and hence no such term exists.

the coefficient

$$C_7(-1)^7 \left(\frac{3}{2}\right)^{9-7} \left(\frac{1}{3}\right)^7$$

$$= \frac{7}{18} - \frac{2}{27} = \frac{17}{54}.$$

$$\Rightarrow \frac{dy}{dx} - \frac{f'(x)}{f(x)}y = -\frac{y^2}{f(x)}$$

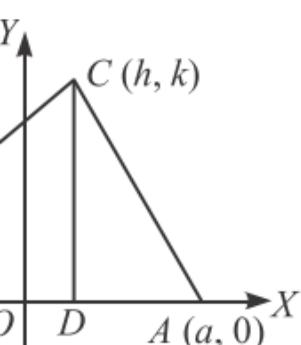
$$\frac{dz}{dx} + \frac{f'(x)}{f(x)}z = \frac{1}{f(x)}$$

(x)

$$\cdot \frac{1}{f(x)}(f(x))dx + c$$

$$-B) = \tan \theta$$

(i)



and $\tan B$ in (i), we get

$$y \cot \theta = a^2.$$

ng through intersecting the planes

$\delta = 0$ is,

: 0

0(i)

om origin is 1.

$$= 1$$

1

= 0

$$+ y - 2z + 3 = 0$$

$$-2y - 2z - 3 = 0$$

$$-2y - 2z - 3 = 0 \text{ and } 2x + y - 2z + 3 = 0.$$

$$\Rightarrow \frac{1}{2} = \frac{181 - x^2}{2.(90)}$$

$$\vec{c} = (2, -2, 4)$$

$\hat{z}; \hat{b}$

$$4\hat{k}$$

$$- 2(-2\hat{k} + 3\hat{j} + 5\hat{k})$$

$$+ 3(2\hat{i} - 2\hat{j} + 4\hat{k})$$

$$+ 3c).\hat{i} = 11.$$

le has greater angle opposite to it.

to $\sqrt{a^2 + b^2 + ab} = c$ (say) is the greatest

$$\therefore c^2 = a^2 + b^2 + ab]$$

$$+ h^2 + i^2 = 5$$

's)

$$\begin{aligned} & | -| z_2 || \quad \dots(1) \\ & = 5 \\ & 4i || \end{aligned}$$

the least value when $|z_2|$ has greatest value

2.

We can assign 2, 3 or 7 to any of variable.

at one variable in 5 ways or can assign

^{15}C , ways

$$= 5 \times 5 \times 5 \times 15 = 1875$$

ed by taking multiplication of only two

(b) given numbers, there are the numbers 3, in number such that when any one of these remaining 67 numbers or any two of these resulting products is divisible by 3. Then the the products of two of the given numbers

$$_1 + {}^{33}C_2.$$

$$\frac{\partial}{\partial} = 0.55$$