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IN

DEX

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INSTRU

1. This test will be a 3 hours Test.
2. This test consists of Physics, Cher
   equal weightage of 100 marks.
3. Each question is of 4 marks.
4. There are three sections in the ques
   to 25), Chemistry (Q.no.26 to 50) a
   section is divided into two parts,
   questions & Part II consists of 5 N
5. There will be only one correct choi
   each question 4 marks will be awa
   deducted for incorrect choice for I
   awarded for not attempted questio
   awarded for correct answer and zer
6. Any textual, printed or written mate
   allowed for the students appearing
7. All calculations / written work sho

PHYSICS

PART-I (Multiple Choice Questions)

1. Two stars each of mass M and radius R are approaching each other for a head-on collision. They start approaching each other when their separation is r >> R. If their speeds at this separation are negligible, the speed v with which they collide would be

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

EST 1

CTIONS

mistry and Mathematics questions with

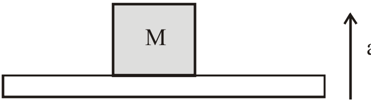
stion paper consisting of Physics (Q.no.1
and Mathematics (Q. no.51 to 75). Each
Part I consists of 20 multiple choice
umerical value type Questions.
ce in the given four choices in Part I. For
arded for correct choice, 1 mark will be
Part I Questions and zero mark will be
n. For Part II Questions 4 marks will be
o for unattempted and incorrect answer.
erial, mobile phones, calculator etc. is not
for the test.
uld be done in the rough sheet provided.

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

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

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

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 normal reaction between the block and platform is



(a) $-\frac{MgaT^2}{2}$

(b) $\frac{1}{2}M\,(g+a)\,aT^2$

(c) $\frac{1}{2}Ma^2T$

(d) Zero

3. A large number of water drops each of radius r combine to have a drop of radius R. If the surface tension is T and the mechanical equivalent of heat is J, then the rise in temperature will be

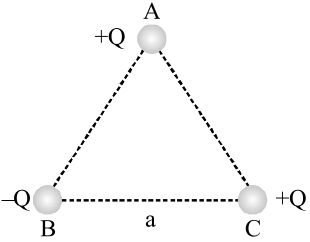
(a) $\frac{2T}{rJ}$

(b) $\frac{3T}{RJ}$

(c) $\frac{3T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

(d) $\frac{2T}{J}\left(\frac{1}{r}-\frac{1}{R}\right)$

4. Three charges are placed at the vertices of an equilateral triangle of side '*a*' as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is



(a) $Q^2/(4\pi\varepsilon_0 a^2)$
(b) $-Q^2/(4\pi\varepsilon_0 a^2)$
(c) Zero
(d) $Q^2/(2\pi\varepsilon_0 a^2)$

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 $\left(\frac{R}{2}, y, \frac{R}{2}\right)$ 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 resultant magnetic induction at a point midway between them is

$(\mu_0 = 4\pi \times 10^{-7}\,\text{Hm}^{-1})$

(a) $\sqrt{2} \times 10^{-7}$ tesla

(b) $\sqrt{5} \times 10^{-7}$ tesla

(c) $\sqrt{2} \times 10^{-3}$ tesla

(d) $\sqrt{5} \times 10^{-3}$ tesla

7. Two boys are standing at the ends A and B of a ground where $AB = a$. The boy at B starts running in a direction perpendicular to AB with velocity v_1. The boy at A starts running simultaneously with velocity v and catches the other boy in a time t, where t is

(a) $a/\sqrt{v^2 + v_1^2}$

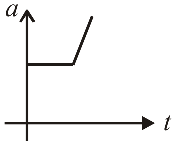
(b) $a/(v + v_1)$

(c) $a/(v - v_1)$

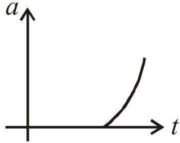
(d) $\sqrt{a^2/(v^2 - v_1^2)}$

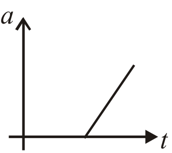
8. A block is placed on a rough horizontal plane. A time dependent horizontal force $F = kt$ acts on the block. Here, k is a positive constant. The acceleration-time graph of the block is

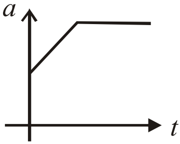
(a)



(b)



(c) 

(d) 

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 wil 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 disance 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

11. A sinusoidal voltage of amplitude 25 volt and frequency 50Hz is applied to a half wave rectifier using P-n junction diode. No filter is used and the load resistor is 1000Ω. The forward resistance R_f of ideal diode is 10Ω. The percentage rectifier efficiency is

(a) 40% (b) 20%

(c) 30% (d) 15%

12. When photon of energy 4.25 eV strike the surface of a metal A, the ejected photoelectrons have maximum kinetic energy T_A eV and de-Brolie wavelength λ_A. The maximum kinetic energy of photoelectrons liberated from another metal B by photon of energy 4.70 eV is $T_B = (T_A - 1.50)$ eV. If the de-Broglie wavelength of these photoelectrons is $\lambda_B = 2\lambda_A$, then

(a) the work function of A is 3.40 eV

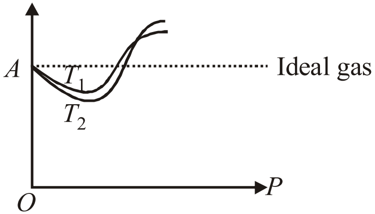
(b) the work function of B is 6.75 eV

(c) $T_A = 2.00$ eV

(d) $T_B = 2.75$ eV

13. Given is the graph between $\frac{PV}{T}$ and P for 1 g of oxygen gas at two different temperatures T_1 and T_2, as shown in figure. Given, density of oxygen = 1.427 kg m^{-3}. The value of PV/T at the point A and the relation between T_1 and T_2 are respectively

$\frac{PV}{T}$ J k^{-1}

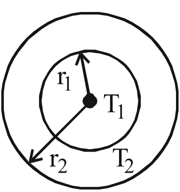


(a) $0.259\ J\ K^{-1}$ and $T_1 < T_2$
(b) $8.314\ J\ mol^{-1}\ K^{-1}$ and $T_1 > T_2$
(c) $0.259\ J\ K^{-1}$ and $T_1 > T_2$
(d) $4.28\ g\ J\ K^{-1}$ and $T_1 < T_2$

14. An observer moves towards a stationary source of sound with a speed 1/5th 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, 0.8λ (b) 1.2f, 1.2λ
(c) 1.2f, λ (d) f, 1.2λ

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) $In\left(\frac{r_2}{r_1}\right)$

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

(c) $(r_2 - r_1)$

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

16. A gas is compressed isothermally to half its initial volume. The same gas is compressed separately through an adiabatic process until its volume is again reduced to half. Then :

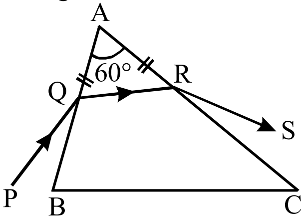
(a) Compressing the gas isothermally will require more work to be done.

(b) Compressing the gas through adiabatic process will require more work to be done.

(c) Compressing the gas isothermally or adiabatically will require the same amount of work.

(d) Which of the case (whether compression through isothermal or through adiabatic process) requires more work will depend upon the atomicity of the gas.

17. A ray PQ incident on the refracting face BA is refracted in the prism BAC as shown in the figure and emerges from the other



refracting face AC as RS such that AQ = AR. If the angle of prism A = 60° and the refractive index of the material of prism is $\sqrt{3}$, then the angle of deviation of the ray is

(a) 60°

(b) 45°

(c) 30°

(d) None of these

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 a 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

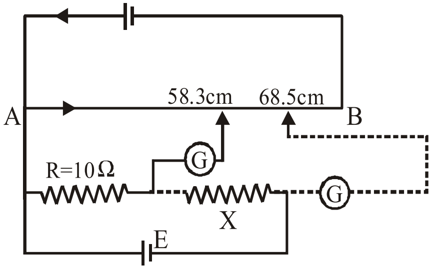
20. In a diffraction pattern due to a single slit of width 'a', the first minimum is observed at an angle 30° when light of wavelength 5000 Å is incident on the slit. The first secondary maximum is observed at an angle of :

(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 = 10Ω is at 58.3 cm, while that with unknown resistance X is 68.5 cm. Find X (in Ω).



22. An automobile moves on a road with a speed of 54 km h^{-1}. The radius of its wheels is 0.45 m and the moment of inertia of the wheel about its axis of rotation is 3 kg m^2. If the vehicle is brought to rest in 15s, the magnitude of average torque (in kgm^2s^{-2}) transmitted by its brakes to the wheel is :

23. A coil of effective area 4 m^2 is placed at right angles to the magnetic induction B. The e.m.f. of 0.32 V is induced in the coil. When the field is reduced to 20% of its initial value in 0.5 sec. Find B (in wb/m^2).

24. A disc of radius $R = 10$ cm oscillates as a physical pendulum about an axis perpendicular to the plane of the disc at a distance r from its centre. If $r = \frac{R}{4}$, the approximate period of oscillation (in second) is (Take $g = 10\ m\ s^{-2}$)

25. Taking the wavelength of first Balmer line in hydrogen spectrum (n = 3 to n = 2) as 660 nm, the wavelength (in nm) of the 2^{nd} Balmer line (n = 4 to n = 2) will be;

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) $K_2Cr_2O_7$

(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 –

$$CH_3 - COONH_4 \xrightarrow{\Delta} X \xrightarrow{P_2O_5} Y \xrightarrow{H_2O/H^{\oplus}} Z$$

(a) $CH_3 - CH_2 - CO - NH_2$

(b) $CH_3 - CN$

(c) $(CH_3CO)_2O$

(d) $CH_3 - COOH$

30. Correct order of first IP among following elements Be, B, C, N, O is

(a) $B < Be < C < O < N$

(b) $B < Be < C < N < O$

(c) $Be < B < C < N < O$

(d) $Be < B < C < O < N$

31. Select the rate law that corresponds to data shown for the following reaction

$A + B \longrightarrow$ products.

Exp.	**[A]**	**[B]**	**Initial rate**
1	0.012	0.035	0.1
2	0.024	0.070	0.8
3	0.024	0.035	0.1
4	0.012	0.070	0.8

(a) rate $= k\,[B]^3$

(b) rate $= k\,[B]^4$

(c) rate $= k\,[A]\,[B]^3$

(d) rate $= k\,[A]^2\,[B]^2$

32. The pH of 0.1 M solution of the following species increases in the order :

(a) $NaCl < NH_4Cl < NaCN < HCl$

(b) $HCl < NH_4Cl < NaCl < NaCN$

(c) $NaCN < NH_4Cl < NaCl < HCl$

(d) $HCl < NaCl < NaCN < NH_4Cl$

33. Aldehydes and ketones are distinguished by which of the following test ?

(a) Lucas test

(b) Tollen's test

(c) $KMnO_4$ solution (Baeyer's test)

(d) None of these

34. Which is not a true statement?

(a) α-Carbon of α-amino acid is asymmetric

(b) All proteins are found in L-form

(c) Human body can synthesize all proteins they need

(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 $[CuCO_3.Cu(OH)_2]$, 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 charactristics.

(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) $NaWO_3$

38. When phenol is treated with excess bromine water. It gives

(a) m-Bromophenol
(b) o-and p-Bromophenols
(c) 2,4-Dibromophenol
(d) 2,4, 6-Tribromophenol.

39. Given below, catalyst and corresponding process/reaction are matched. The one with mismatch is

(a) $[RhCl(PPh_3)_2]$: Hydrogenation
(b) $TiCl_4 + Al(C_2H_5)_3$: Polymerization
(c) V_2O_5 : Haber-Bosch process
(d) Nickel : Hydrogenation

40. The molecule which has zero dipole moment is :

(a) CH_3Cl (b) NF_3
(c) BF_3 (d) ClO_2^-

41. One mole of NaCl (s) on melting absorbed 30.5 kJ one of heat and its entropy is increased by 28.8 $JK^{-1}mol^{-1}$. The melting point of NaCl is

(a) 1059 K (b) 30.5 K
(c) 28.8 K (d) 28800 K

42. Which alkene on ozonolysis gives CH_3CH_2CHO and $CH_3\underset{\underset{O}{\|}}{C}CH_3$?

(a) $CH_3CH_2CH=C(CH_3)_2$
(b) $CH_3CH_2CH=CHCH_2CH_3$
(c) $CH_3CH_2CH=CHCH_3$
(d) $CH_3-\underset{\underset{CH_3}{|}}{C}=CHCH_3$

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) $[Co(NH_3)_6]^{3+}$
(b) $[Mn(CN)_6]^{4-}$
(c) $[Fe(CN)_6]^{4-}$
(d) $[Ni(NH_3)_6]^{2+}$

(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 C_7H_7Cl has in all ..... isomers :

48. Calculate the volume strength of 1.5 N H_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})

MATHEMATICS

PART-I (Multiple Choice Questions)

51. If the coefficient of 4th term in the expansion of $\left(x+\dfrac{\alpha}{2x}\right)^n$ is 20, then the respective values of α and n are

(a) 2, 7 (b) 5, 8
(c) 3, 6 (d) 2, 6

52. If the roots of the quadratic equation $x^2+px+q=0$ are tan 30° and tan 15°, respectively, then the value of $2+q-p$ is

(a) 2 (b) 3
(c) 0 (d) 1

53. If a^2, b^2, c^2 are in A.P. then $\dfrac{1}{b+c}, \dfrac{1}{c+a}, \dfrac{1}{a+b}$ are in-

(a) A.P.
(b) G.P.
(c) H.P.
(d) None of these

54. Let C be the circle with centre (0, 0) and radius 3 units. The equation of the locus of the mid points of the chords of the circle C that subtend an angle of $\dfrac{2\pi}{3}$ at its center is

(a) $x^2+y^2=\dfrac{3}{2}$

(b) $x^2+y^2=1$

(c) $x^2+y^2=\dfrac{27}{4}$

(d) $x^2+y^2=\dfrac{9}{4}$

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

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

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

(a) 2 (b) 1
(c) 0 (d) –1

56. If { } denotes the fractional part of x, the range of the function $f(x)=\sqrt{\{x\}^2-2\{x\}}$ is

(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. $\displaystyle\int\frac{dx}{\cos x+\sqrt{3}\sin x}$ equals

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

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

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

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

59. If $\dfrac{\tan 3\theta - 1}{\tan 3\theta + 1} = \sqrt{3}$, then the general value of θ is

(a) $\dfrac{n\pi}{3} - \dfrac{\pi}{12}$ (b) $n\pi + \dfrac{7\pi}{12}$

(c) $\dfrac{n\pi}{3} + \dfrac{7\pi}{36}$ (d) $n\pi + \dfrac{\pi}{12}$

60. Three normals are drawn to the parabola $y^2 = x$ through point $(a, 0)$. Then

(a) $a = 1/2$
(b) $a = 1/4$
(c) $a > 1/2$
(d) None of these

61. If four vertices of a regular octagon are chosen at random, then the probability that the quadrilateral formed by them is a rectangle is

(a) $\dfrac{1}{8}$ (b) $\dfrac{2}{21}$

(c) $\dfrac{1}{32}$ (d) $\dfrac{1}{35}$

62. The function

$f(x) = x^3 - 3x^2 - 24x + 5$ is an increasing function in the interval given below

(a) $(-\infty, -2) \cup (4, \infty)$

(b) $(-2, \infty)$

(c) $(-2, 4)$

(d) $(-\infty, 4)$

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 $\text{cosec}^{-1} 2.6$ 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

67. Let $f(x) = \begin{cases} x^p \sin\frac{1}{x}, & x \neq 0 \\ 0 & , x = 0 \end{cases}$ then

f(x) is continuous but not differentiable at $x = 0$ if

(a) $0 < p \leq 1$

(b) $1 \leq p < \infty$

(c) $-\infty < p < 0$

(d) $p = 0$

68. The length and foot of the perpendicular from the point (7, 14, 5) to the plane $2x + 4y - z = 2$, are

(a) $\sqrt{21}, (1, 2, 8)$

(b) $3\sqrt{21}, (3, 2, 8)$

(c) $21\sqrt{3}, (1, 2, 8)$

(d) $3\sqrt{21}, (1, 2, 8)$

69. If $\Delta(x) = \begin{vmatrix} e^x & \sin x \\ \cos x & \ln(1+x^2) \end{vmatrix}$, then

the value of $\lim_{x \to 0} \frac{\Delta(x)}{x}$ is

(a) 0 (b) 2

(c) –1 (d) –2

70. The number of positive integral solutions of the equation

$\tan^{-1} x + \cot^{-1} y = \tan^{-1} 3$, is

(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	30–35	35–40	40–45
frequency	5	6	15	10	5	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

RESPONS

PHYSICS		CHEMIST	
1.	ⓐⓑⓒⓓ	26.	ⓐⓑ
2.	ⓐⓑⓒⓓ	27.	ⓐⓑ
3.	ⓐⓑⓒⓓ	28.	ⓐⓑ
4.	ⓐⓑⓒⓓ	29.	ⓐⓑ
5.	ⓐⓑⓒⓓ	30.	ⓐⓑ
6.	ⓐⓑⓒⓓ	31.	ⓐⓑ
7.	ⓐⓑⓒⓓ	32.	ⓐⓑ
8.	ⓐⓑⓒⓓ	33.	ⓐⓑ
9.	ⓐⓑⓒⓓ	34.	ⓐⓑ
10.	ⓐⓑⓒⓓ	35.	ⓐⓑ
11.	ⓐⓑⓒⓓ	36.	ⓐⓑ
12.	ⓐⓑⓒⓓ	37.	ⓐⓑ
13.	ⓐⓑⓒⓓ	38.	ⓐⓑ
14.	ⓐⓑⓒⓓ	39.	ⓐⓑ
15.	ⓐⓑⓒⓓ	40.	ⓐⓑ
16.	ⓐⓑⓒⓓ	41.	ⓐⓑ
17.	ⓐⓑⓒⓓ	42.	ⓐⓑ
18.	ⓐⓑⓒⓓ	43.	ⓐⓑ
19.	ⓐⓑⓒⓓ	44.	ⓐⓑ
20.	ⓐⓑⓒⓓ	45.	ⓐⓑ
21.		46.	
22.		47.	
23.		48.	
24.		49.	

SE SHEET

TRY	MATHEMATICS	
ⓒⓓ	**51.**	ⓐⓑⓒⓓ
ⓒⓓ	**52.**	ⓐⓑⓒⓓ
ⓒⓓ	**53.**	ⓐⓑⓒⓓ
ⓒⓓ	**54.**	ⓐⓑⓒⓓ
ⓒⓓ	**55.**	ⓐⓑⓒⓓ
ⓒⓓ	**56.**	ⓐⓑⓒⓓ
ⓒⓓ	**57.**	ⓐⓑⓒⓓ
ⓒⓓ	**58.**	ⓐⓑⓒⓓ
ⓒⓓ	**59.**	ⓐⓑⓒⓓ
ⓒⓓ	**60.**	ⓐⓑⓒⓓ
ⓒⓓ	**61.**	ⓐⓑⓒⓓ
ⓒⓓ	**62.**	ⓐⓑⓒⓓ
ⓒⓓ	**63.**	ⓐⓑⓒⓓ
ⓒⓓ	**64.**	ⓐⓑⓒⓓ
ⓒⓓ	**65.**	ⓐⓑⓒⓓ
ⓒⓓ	**66.**	ⓐⓑⓒⓓ
ⓒⓓ	**67.**	ⓐⓑⓒⓓ
ⓒⓓ	**68.**	ⓐⓑⓒⓓ
ⓒⓓ	**69.**	ⓐⓑⓒⓓ
ⓒⓓ	**70.**	ⓐⓑⓒⓓ
	71.	
	72.	
	73.	
	74.	

MOCK T

INSTRU

1. This test will be a 3 hours Test.
2. This test consists of Physics, Cher
   equal weightage of 100 marks.
3. Each question is of 4 marks.
4. There are three sections in the ques
   to 25), Chemistry (Q.no.26 to 50) a
   section is divided into two parts,
   questions & Part II consists of 5 N
5. There will be only one correct choi
   each question 4 marks will be awa
   deducted for incorrect choice for I
   awarded for not attempted questio
   awarded for correct answer and zer
6. Any textual, printed or written mate
   allowed for the students appearing
7. All calculations / written work sho

PHYSICS

PART-I (Multiple Choice Questions)

1. A bus is moving with a velocity of 10m/s on a straight road. A scooterist wishes to overtake the bus in 100 seconds. If the bus is at a distance of 1 km from the scooterist, at what velocity should the scooterist chase the bus?

(a) 50 m/sec (b) 40 m/sec

(c) 30 m/sec (d) 20 m/sec

2. The length of an elastic string is x when the tension is 5N. Its length is y when the tension is 7N. What will

EST 2

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
umerical 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.
uld be done in the rough sheet provided.

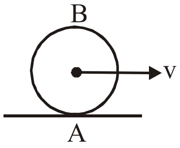
be its length, when the tension is 9N?

(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, ρ = 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) $M^{-1}L^2T^3$

4. A wheel is rolling on a plane road. The linear velocity of centre of mass is v. Then velocities of the points A and B on circumference of wheel relative to road will be



(a) $v_A = v, v_B = 0$
(b) $v_A = v_B = 0$
(c) $v_A = 0, v_B = v$
(d) $v_A = 0, v_B = 2v$

5. A metallic wire of density d is lying horizontal on the surface of water. The maximum length of wire so that it may not sink will be

(a) $\sqrt{\frac{2Tg}{\pi d}}$ (b) $\sqrt{\frac{2\pi T}{dg}}$

(c) $\sqrt{\frac{2T}{\pi dg}}$ (d) any length

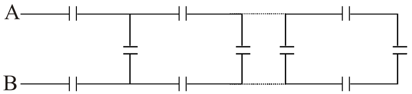
6. Two points of a rod move with velocities 3v and v perpendicular to the rod and in the same direction, separated by a distance r. Then the angular velocity of the rod is
(a) 3v/r (b) 4v/r
(c) 5v/r (d) 2v/r

7. For hydrogen gas $C_p - C_v = a$ and for oxygen gas $C_p - C_v = b$. So, the relation between a and b is given by
(a) $a = 16\,b$ (b) $16a = b$
(c) $a = 4b$ (d) $a = b$

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

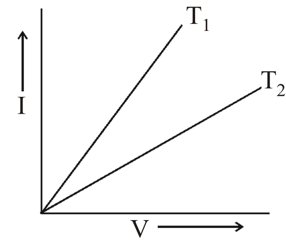
(a) $T_1 = T_2 = T_3$
(b) $T_1 < T_2 < T_3$
(c) $T_1 > T_2 > T_3$
(d) $T_1 < T_3 < T_2$

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



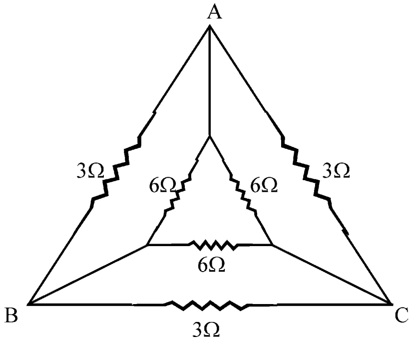
(a) ∞
(b) zero
(c) $C[(\sqrt{3} - 1) / 2]$
(d) $C[(\sqrt{3} + 1) / 2]$

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



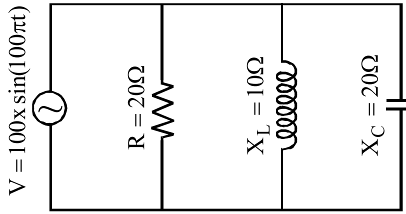
(a) $T_1 > T_2$ (b) $T_1 < T_2$
(c) $T_1 = T_2$ (d) $T_1 = 2T_2$

11. In the circuit shown the effective resistance between B and C is



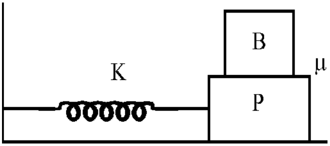
(a) 3 Ω (b) 4 Ω
(c) 4/3 Ω (d) 3/4 Ω

12. In the given circuit, the current drawn from the source is



(a) 20 A (b) 10 A
(c) 5 A (d) $5\sqrt{2}$ A

13. A flat plate P of mass 'M' executes SHM in a horizontal plane by sliding over a frictionless surface with a frequency V. A block 'B' of mass 'm' rests on the plate as shown in figure. Coefficient of 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) $\frac{\mu g}{4\pi^2 V}$

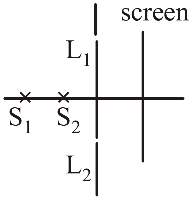
(c) $\frac{\mu}{4\pi^2 V^2 g}$ (d) $\frac{\mu g}{2\pi^2 V^2}$

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

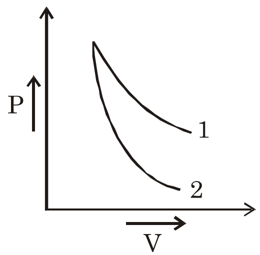


(a) will not be there
(b) will not be there if the intensity of light reaching the screen from S_1 and S_2 are equal.
(c) will be there under all circumstances
(d) we will have only the central fringe

16. What is the ratio of the circumference of the first Bohr orbit for the electron in the hydrogen atom to the de Brogile wavelength of electrons having the same velocity as the electron in the first Bohr orbit of the hydrogen atom?
(a) 1 : 1 (b) 1 : 2
(c) 1 : 4 (d) 2 : 1

17. The radioactivity of a sample is R_1 at a time T_1 and R_2 at a time T_2. If the half life of the specimen is T, the number of atoms that have disintegrated in the time $(T_2 – T_1)$ is proportional to
(a) $(R_1T_1 - R_2T_2)$
(b) $(R_1 - R_2)$
(c) $(R_1 - R_2)/T$
(d) $(R_1 - R_2) \times T$

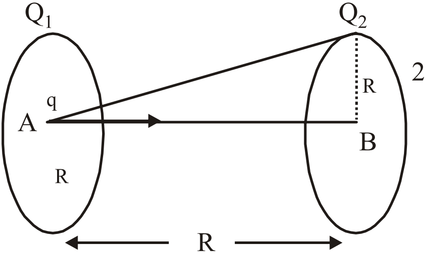
18. P–V plots for two gases during adiabatic processes are shown in the figure. Plots 1 and 2 should correspond respectively to



(a) He and Ar (b) He and O_2

(c) O_2 and N_2 (d) O_2 and He

19. Two identical thin rings, each of radius R metres, are coaxially placed at a distance R metres apart. If Q_1 coulomb and Q_2 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) $q(Q_1-Q_2)$
$(\sqrt{2}-1)/\sqrt{2}\, 4\pi\varepsilon_0 R$

(c) $q\sqrt{2}\,(Q_1+Q_2)/4\pi\varepsilon_0 R$

(d) $q(Q_1+Q_2)$
$(\sqrt{2}+1)/\sqrt{2}\, 4\pi\varepsilon_0 R$

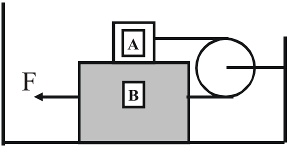
20. The ratio of the coefficient of volume expansion of a glass container to that of a viscous liquid kept inside the container is 1 : 4. What fraction of the inner volume of the container should the liquid occupy so that the volume of the remaining vacant space will be same at all temperatures ?

(a) $2:5$ (b) $1:4$

(c) $1:64$ (d) $1:8$

PART-II (Numerical Answer Questions)

21. The masses of the blocks A and B are 0.5 kg and 1 kg respectively. These are arranged as shown in the figure and are connected by a massless string. The coefficient of friction between all contact surfaces is 0.4. The force (in N) necessary to move the block B with constant velocity will be ($g = 10 m/s^2$)

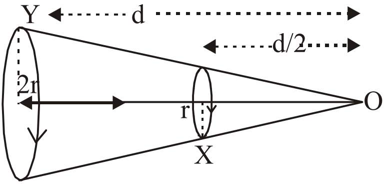


22. A body is thrown vertically upwards from the surface of earth in such a way that it reaches upto a height equal to $10R_e$. The velocity (in km/s) imparted to the body will be

23. A non-conducting partition divides a container into two equal compartments. One is filled with helium gas at 200 K and the other is filled with oxygen gas at 400 K. The number of molecules in each gas is the same. If the partition is removed to allow the gases to mix, the final temperature (in K) will be

24. A transformer is used to light a 140 W, 24 V bulb from a 240 V a.c. mains. The current in the main cable is 0.7 A. The efficiency (in %) of the transformer is

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 & $1.5 \times 10^5\ Nm^{-2}$ is $100.5\ ms^{-1}$. If the temperature is raised to 100K & pressure to $6.0 \times 10^5\ Nm^{-2}$, the root mean square speed becomes.
(a) $100.5\ ms^{-1}$ (b) $201.0\ ms^{-1}$
(c) $402\ ms^{-1}$ (d) $1608\ ms^{-1}$

28. Reduction with aluminium isopropoxide in excess of isopropyl alcohol is called Meerwein Ponndorff-Verley reduction (MPV). What will be the final product when cyclohex-2-enone is selectively reduced in MPV reaction ?

(a) Cyclohexanol
(b) Cyclohex-2-enol
(c) Cyclohexanone
(d) Benzene

29. N_2 and O_2 are converted to mono cations N_2^+ and O_2^+ respectively, which of the following is wrong?

(a) In N_2^+, the N – N bond weakens
(b) In O_2^+, the O – O bond order increases
(c) In O_2^+, paramagnetism decreases
(d) N_2^+ becomes diamagnetic

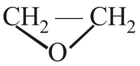
30. The reaction in which hydrogen peroxide acts as a reducing agent is

(a) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(b) $2KI + H_2O_2 \rightarrow 2KOH + I_2$

(c) $2FeSO_4 + H_2SO_4 + H_2O_2 \rightarrow Fe_2(SO_4)_3 + 2H_2O$

(d) $Ag_2O + H_2O_2 \longrightarrow 2Ag + H_2O + O_2$

31. Reaction of  with RMgX leads to formation of

(a) RCHOHR

(b) $RCHOHCH_3$

(c) RCH_2CH_2OH

(d) R_2CHCH_2OH

32. Which reaction will not yield an amide?

(a) $C_2H_5-\overset{\overset{O}{||}}{C}-Cl+NH_3$

(b) $C_2H_5-\overset{\overset{O}{||}}{C}-O-\overset{\overset{O}{||}}{C}-Cl$

$+CH_3NH_2$

(c) $CH_3-\overset{\overset{O}{||}}{C}-Cl+(CH_3)_3N$

(d) $CH_3-\overset{\overset{O}{||}}{C}-O-\overset{\overset{O}{||}}{C}-CH_3$

$+CH_3NH-CH_2-CH_3$

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

35. If s_0, s_1, s_2 and s_3 are the solubilities of AgCl in water, 0.01 M $CaCl_2$, 0.01 M NaCl and 0.05 M $AgNO_3$ solutions, respectively, then

(a) $s_0 > s_1 > s_2 > s_3$

(b) $s_0 > s_2 > s_1 > s_3$

(c) $s_0 > s_2 > s_3 > s_1$

(d) $s_0 > s_1 = s_2 > s_3$

36. An organic compound is treated with $NaNO_2$ and dil. HCl at 0°C. The resulting solution is added to an alkaline solution of β-naphthol where by a brilliant red dye is produced. It shows the presence of

(a) $-NO_2$ group

(b) aromatic $-NH_2$ group

(c) $-CONH_2$ group

(d) aliphatic $-NH_2$ group

37. Point out the incorrect statment among the following :

(a) The oxidation state of oxygen is +2 in OF_2.

(b) Acidic character follows the order $H_2O < H_2S < H_2Se < H_2Te$.

(c) The tendency to form multiple bonds increases in moving down the group from sulphur to tellurium (towards C and N)

(d) Sulphur has a strong tendency to catenate while oxygen shows this tendency to a limited extent.

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

41. When pink $[Co(H_2O)_6]^{2\oplus}$ is dehydrated the colour changes to blue. The correct explanation for the change is :

(a) The octahedral complex becomes square planar.

(b) A tetrahedral complex is formed.

(c) Distorted octahedral structure is obtained.

(d) Dehydration results in the formation of polymeric species.

42. Amongst the following the compound that is both paramagnetic and coloured is

(a) $K_2Cr_2O_7$

(b) $(NH_4)_2[TiCl_6]$

(c) $CoSO_4$

(d) $K_3[Cu(CN)_4]$

43. A reaction rate constant is given by $K = 1.2 \times 10^{10} e^{-2500/RT}$. It means

(a) log K vs T will give a straight line

(b) log K vs 1/T gives a straight line with a slope –2500/2.303 R

(c) half life of reaction will be more at higher temperature

(d) log K vs 1/T gives a straight line with a slope 2500/R

44. The correct statement among the following is :

(a) The alkali metals when strongly heated in oxygen form superoxides.

(b) Caesium is used in photoelectric cells.

(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,

$$Zn\left|\underset{(0.01M)}{ZnSO_4}\right|\left|\underset{(1.0M)}{CuSO_4}\right|Cu\text{ , at 298 K}$$

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 600mm 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

$$CO_2 + 2H_2O \rightleftharpoons H_3O^+ + HCO_3^-;$$

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?

49. The wave number of first line of Balmer series of hydrogen is 15200 cm^{-1}. Wht will be the wave number of first Balmer line of Li^{2+} ion?

50. A cylinder of gas supplied by Bharat Petroleum is assumed to contain 14 kg of butane. If a normal family requires 20,000 kJ of energy per day for cooking, butane gas in the cylinder last for .... Days.

(ΔH_c of C_4H_{10} = –2658 JK per mole)

MATHEMATICS

PART-I (Multiple Choice Questions)

51. If a, b, c, d and p are distinct non zero real numbers such that $(a^2 + b^2 + c^2)\, p^2 - 2(ab + bc + cd)p + (b^2 + c^2 + d^2) \leq 0$ then a,b,c,d are in

(a) A.P.

(b) G.P.

(c) H.P.

(d) satisfy $ab = cd$

52. Which of the following is correct?

(a) If $a^2 + 4b^2 = 12ab$, then

$$\log(a+2b) = \frac{1}{2}(\log a + \log b)$$

(b) If $\frac{\log x}{b-c} = \frac{\log y}{c-a} = \frac{\log z}{a-b}$,

then $x^a.y^b.z^c = abc$

(c)

$$\frac{1}{\log_{xy} xyz} + \frac{1}{\log_{yz} xyz} + \frac{1}{\log_{zx} xyz} = 2$$

(d) All are correct

53. If $0 < \alpha, \beta, \gamma < \pi/2$ such that $\alpha+\beta+\gamma=\dfrac{\pi}{2}$ and $\cot\alpha$, $\cot\beta$, $\cot\gamma$ are in arithmetic progression, then the value of $\cot\alpha \cot\gamma$ is

(a) 1 (b) 3

(c) $\cot^2\beta$ (d) $\cot\alpha+\cot\gamma$

54. If $\omega=\cos\dfrac{\pi}{n}+i\sin\dfrac{\pi}{n}$, then value of $1+\omega+\omega^2+...+\omega^{n-1}$ is

(a) $1+i$

(b) $1+i\tan(\pi/n)$

(c) $1+i\cot(\pi/2n)$

(d) None of these

55. The circles $x^2+y^2-2x-15=0$ and $x^2+y^2+4y+3=0$ have

(a) no common tangent

(b) one common tangent

(c) three common tangents

(d) four common tangents

56. Which of the following is correct?

(a) If A and B are square matrices of order 3 such that $|A|=-1$, $|B|=3$, then the determinant of 3 AB is equal to 27.

(b) If A is an invertible matrix, then $\det(A^{-1})$ is equal to $\det(A)$

(c) If A and B are matrices of the same order, then $(A+B)^2=A^2+2AB+B^2$ is possible if $AB=I$

(d) None of these

57. If the solution of the linear equations $x-2y+z=0$; $2x-y+3z=0$ and $\lambda x+y-z=0$ is trivial then the value of λ is given by

(a) $\lambda = -\frac{4}{5}$ (b) $\lambda \neq -\frac{4}{5}$

(c) $\lambda = 2$ (d) $\lambda \neq 2$

58. Let $f(x) = |x - 1|$. Then

(a) $f(x^2) = (f(x))^2$

(b) $f(x+y) = f(x) + f(y)$

(c) $f(|x|) = |f(x)|$

(d) None of these

59. If

$$\sin^{-1}\frac{2a}{1+a^2} + \sin^{-1}\frac{2b}{1+b^2} = 2\tan^{-1}x,$$

then x is equal to

(a) $\frac{a-b}{1+ab}$ (b) $\frac{b}{1+ab}$

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

60. If AB = 0, then for the matrices

$$A = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$$

and $B = \begin{bmatrix} \cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$,

$\theta - \phi$ is

(a) an odd number of $\frac{\pi}{2}$

(b) an odd multiple of π

(c) an even multiple of $\frac{\pi}{2}$

(d) 0

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

(a) R (b) $R - \{0\}$

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

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 $f(x) = \dfrac{x - \{x+1\}}{x - \{x+2\}}$; where $\{x\}$ is the fractional part of x, then $\lim\limits_{x \to 1/3} f(x)$

(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

66. The value of

$$\int_{-\pi/4}^{\pi/4} (x|x| + \sin^3 x + x\tan^2 x + 1)\,dx \text{ is}$$

(a) 0 (b) 1
(c) $\pi/4$ (d) $\pi/2$

67. Let $(1-x-2x^2)^6 = 1 + a_1 x + a_2 x^2 + \ldots + a_{12} x^{12}$. Then

$$\frac{a_2}{2^2} + \frac{a_4}{2^4} + \frac{a_6}{2^6} + \ldots\ldots + \frac{a_{12}}{2^{12}} \text{ is}$$

equal to

(a) -1 (b) $-1/2$
(c) 0 (d) $1/2$

68. The equation of a common tangent to $y^2 = 4x$ and the curve $x^2 + 4y^2 = 8$ can be

(a) $x - 2y + 2 = 0$

(b) $x + 2y + 4 = 0$

(c) $x - 2y = 4$

(d) $x + 2y = 4$

69. The function $f(x) = (x-3)^2$ satisfies all the conditions of mean value theorem in $\{3, 4\}$. A point on $y = (x-3)^2$, where the tangent is parallel to the chord joining (3, 0) and (4,1) is

(a) $\left(\frac{7}{2}, \frac{1}{2}\right)$ (b) $\left(\frac{7}{2}, \frac{1}{4}\right)$

(c) (1,4) (d) (4, 1)

70. If $x + y - z + xyz = 0$, then

$$\frac{2x}{1-x^2} + \frac{2y}{1-y^2} - \frac{2z}{1-z^2} \text{ is equal}$$

to

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

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

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

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

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 $\cos 36^0 \cos 42^0 \cos 78^0$ is

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

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 ΔABC, if $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix} = 0$, then

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

RESPONS

PHYSICS		CHEMIST	
1.	ⓐⓑⓒⓓ	26.	ⓐⓑ
2.	ⓐⓑⓒⓓ	27.	ⓐⓑ
3.	ⓐⓑⓒⓓ	28.	ⓐⓑ
4.	ⓐⓑⓒⓓ	29.	ⓐⓑ
5.	ⓐⓑⓒⓓ	30.	ⓐⓑ
6.	ⓐⓑⓒⓓ	31.	ⓐⓑ
7.	ⓐⓑⓒⓓ	32.	ⓐⓑ
8.	ⓐⓑⓒⓓ	33.	ⓐⓑ
9.	ⓐⓑⓒⓓ	34.	ⓐⓑ
10.	ⓐⓑⓒⓓ	35.	ⓐⓑ
11.	ⓐⓑⓒⓓ	36.	ⓐⓑ
12.	ⓐⓑⓒⓓ	37.	ⓐⓑ
13.	ⓐⓑⓒⓓ	38.	ⓐⓑ
14.	ⓐⓑⓒⓓ	39.	ⓐⓑ
15.	ⓐⓑⓒⓓ	40.	ⓐⓑ
16.	ⓐⓑⓒⓓ	41.	ⓐⓑ
17.	ⓐⓑⓒⓓ	42.	ⓐⓑ
18.	ⓐⓑⓒⓓ	43.	ⓐⓑ
19.	ⓐⓑⓒⓓ	44.	ⓐⓑ
20.	ⓐⓑⓒⓓ	45.	ⓐⓑ
21.		46.	
22.		47.	
23.		48.	
24.		49.	

SE SHEET

TRY		MATHEMATICS
ⓒ ⓓ	**51.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**52.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**53.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**54.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**55.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**56.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**57.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**58.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**59.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**60.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**61.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**62.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**63.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**64.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**65.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**66.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**67.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**68.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**69.**	ⓐ ⓑ ⓒ ⓓ
ⓒ ⓓ	**70.**	ⓐ ⓑ ⓒ ⓓ
	71.	
	72.	
	73.	
	74.	

MOCK T

INSTRU

1. This test will be a 3 hours Test.
2. This test consists of Physics, Che
   equal weightage of 100 marks.
3. Each question is of 4 marks.
4. There are three sections in the ques
   to 25), Chemistry (Q.no.26 to 50) a
   section is divided into two parts,
   questions & Part II consists of 5 N
5. There will be only one correct choi
   each question 4 marks will be awa
   deducted for incorrect choice for
   awarded for not attempted questio
   awarded for correct answer and zer
6. Any textual, printed or written mate
   allowed for the students appearing
7. All calculations / written work sho

PHYSICS

PART-I (Multiple Choice Questions)

1. Astronauts look down on earth surface from a space ship parked at an altitude of 500 km. They can resolve objects of the earth of the size (It can be assumed that the pupils diameter is 5mm and wavelength of light is 500 nm)

(a) 0.5m (b) 5m

(c) 50m (d) 500m

2. The wavelength of sodium light in air is 5890Å. The velocity of light in air is 3×10^{-8} ms^{-1}. The wavelength of light in a glass of refractive index 1.6, would be close to

EST 3

CTIONS

mistry and Mathematics questions with

stion paper consisting of Physics (Q.no.1
and Mathematics (Q. no.51 to 75). Each
Part I consists of 20 multiple choice
umerical 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.
uld be done in the rough sheet provided.

(a) 5890 Å (b) 3680 Å
(c) 9424 Å (d) 15078 Å

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

(a) $MLT^{-1}A^{-1}$
(b) $MLT^{-2}A^{-2}$
(c) $M^{-1}L^{-3}T^{+4}A^{2}$
(d) $M^{2}L^{-2}T^{-2}A^{2}$

5. A black body at a temperature of 227°C radiates heat at the rate of 20 cal m^{-2} s^{-1}. When its temperature rises to 727°C the heat radiated will be

(a) 40 units (b) 160 units
(c) 320 units (d) 640 units

6. Two waves of wavelengths 99 cm and 100 cm both travelling with velocity 396 m/s are made to interfere. The number of beats produced by them per second are

(a) 1 (b) 2
(c) 4 (d) 8

7. A sphere of mass 'm' and radius 'r' is falling in the column of a viscous fluid. Terminal velocity attained by falling object is proportional to

(a) r^2 (b) $1/r$
(c) r (d) $-1/r^2$

8. There are two wires of the same length. The diameter of second wire is twice that of the first. On applying the same load to both the wires, the extension produced in them will be in ratio of

(a) 1 : 4 (b) 1 : 2
(c) 2 : 1 (d) 4 : 1

9. When a proton, anti-proton annihilate the energy released is

(a) 1.5×10^{-10} J
(b) 28.8×10^{-10} J
(c) 6×10^{-10} J
(d) 9×10^{-10} J

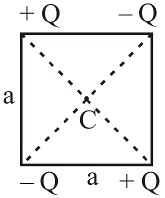
10. $y = 2\,(\text{cm}) \sin\left[\frac{\pi t}{2} + \phi\right]$

What is the maximum acceleration of the particle doing the SHM

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

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

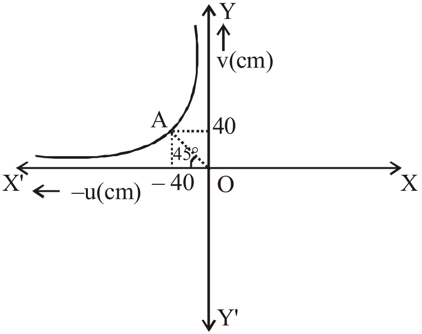
(a) $\rho = \dfrac{X\pi D}{4L}$

(b) $\rho = \dfrac{X\pi D^2}{4L}$

(c) $\rho = \dfrac{X^2\pi D^2}{4L}$

(d) $\rho = \dfrac{X\pi D^2}{4L^2}$

14. Consider the following u-v diagram regarding the experiment to determine the focal length of a convex lens.



At the point A, the values of u and v are equal. The focal length of the lens is

(a) 40 cm (b) 20 cm

(c) 10 cm (d) 15 cm

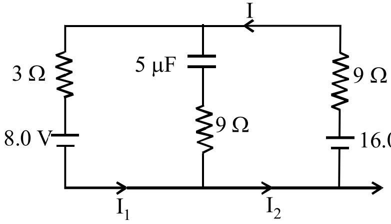
15. Two metallic plates A and B, each of area $5 \times 10^{-4} m^2$, are placed parallel to each other at a separation of 1 cm. Plate B carries a positive charge of 33.7×10^{-12}C. A mono-chromatic beam of light, with photons of energy 5 eV each, starts falling on plate A at t = 0 so that 10^{16} photons fall on it per square meter per second. Assume that one photoelectron is emitted for every 10^6 incident photons. Also assume 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 Ω, 9 Ω and 9 Ω and a capacitor of 5.0 μF.



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 $\varepsilon_0 = 8.8 \times 10^{-12}$ $C^2/N\text{-}m^2$, then average energy density of electric field will be:

(a) 35.2×10^{-10} J/m^3

(b) 35.2×10^{-11} J/m^3

(c) 35.2×10^{-12} J/m^3

(d) 35.2×10^{-13} J/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

(a) $\left(\frac{K_1+K_2}{m}\right)^{\frac{1}{2}}$

(b) $\left[\frac{K_1K_2}{m(K_1+K_2)}\right]^{\frac{1}{2}}$

(c) $\left[\frac{K_1K_2}{(K_1-K_2)m}\right]^{\frac{1}{2}}$

(d) $\left[\frac{K_1^2+K_2^2}{(K_1+K_2)m}\right]^{\frac{1}{2}}$

19. A sphere is placed in front of a convex lens of focal length f. The radius of the sphere is much smaller compared to f. The image of the sphere would look spherical if the object distance is

(a) f (b) $\frac{3f}{2}$

(c) 2f (d) $\frac{f}{2}$

20. Which of the following expressions corresponds to simple harmonic motion along a straight line, where x is the displacement and a, b, c are positive constants?

(a) $a+bx-cx^2$

(b) bx^2

(c) $a-bx+cx^2$

(d) $-bx$

PART-II (Numerical Answer Questions)

21. The source of sound generating a frequency of 3 kHz reaches an observer with a speed of 0.5 times in air. The frequency (in kHz) heard by the observer is

22. The temperature of reservoir of Carnot's engine operating with an efficency 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 0.5×10^{-5} 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/cm^2 is incident on a totally reflecting plane mirror of area 1.5 cm^2, then the force (in newton) acting on the mirror will be

CHEMISTRY

PART-I (Multiple Choice Questions)

26. Ethylene dicholoride and ethylidine chloride are isomeric compounds. The false statement about these isomers is that they :
- (a) react with alcoholic potash and give the same product
- (b) are position isomers
- (c) contain the same percentage of chlorine
- (d) are both hydrolysed to the same product

27. An aqueous solution of sodium carbonate has a pH greater than 7 because :
- (a) it contains more carbonate ions than H_2O molecules
- (b) contains more sodium ions than carbonate ions
- (c) Na^+ ions react with water
- (d) carbonate ions react with H_2O

28. By what ratio the average velocity of the molecule in gas changes when the temperature is raised from 50 to 200ºC ?

(a) $\frac{1.21}{1}$ (b) $\frac{1.46}{1}$

(c) $\frac{2}{1}$ (d) $\frac{4}{1}$

29. How many H-atoms are present in 0.046 g of ethanol ?

(a) 6×10^{20} (b) 1.2×10^{21}

(c) 3×10^{21} (d) 3.6×10^{21}

30. A metal M reacts with N_2 to give a compound 'A' (M_3N). 'A' on heating at high temperature gives back 'M' and 'A' on reacting with H_2O gives a gas 'B'. 'B' turns $CuSO_4$ solution blue on passing through it. M and B can be :

(a) Al & NH_3 (b) Li & NH_3

(c) Na & NH_3 (d) Mg & NH_3

31. When ethanal reacts with CH_3MgBr and C_2H_5OH/dry HCl, the product formed are :

(a) ethyl alcohol and 2-propanol

(b) ethane and hemi acetal

(c) 2-propanol and acetal

(d) propane and methyl acetate

32. If the solutions of NaCl and $NaNO_3$ are mixed in one beaker and the temperature adjusted to 383° K, the contents of the beaker will most likely:

(a) freeze

(b) boil

(c) exhibit precipitation of $NaNO_3$

(d) exhibit a marked color change

33. Given the molecular formula of the hexa-coordinated complexes (i) $CoCl_3.6NH_3$, (ii) $CoCl_3.5NH_3$, (iii) $CoCl_3.4NH_3$

If the number of co-ordinated NH_3 molecules in i, ii and iii respectively

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 ºC & 4 atm
(b) 100 ºC & 2 atm
(c) –100 ºC & 4 atm
(d) 0 ºC & 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

40. The relative abundance of two isotopes of atomic weight 85 and 87 is 75% and 25% respectively. The average atomic weight of element is

(a) 75.5 (b) 85.5
(c) 40.0 (d) 86.0

41. In Kjeldahl's method, nitrogen present in the organic compound is quantitatively converted into

(a) ammonium nitrite
(b) ammonium sulphate
(c) ammonium phosphate
(d) ammonium nitrate

42. An organic amino compound reacts with aqueous nitrous acid at low temperature to produce an oily nitrosoamine. The compound is:

(a) $CH_3\,NH_2$
(b) $CH_3CH_2NH_2$
(c) $CH_3CH_2NH.CH_2CH_3$
(d) $(CH_3\,CH_2)_3N$

43. Which reaction characteristics are changed by the addition of a catalyst to a reaction at constant temperature ?

(i) Activation energy
(ii) Equilibrium constant
(iii) Reaction enthalpy

(a) (i) only
(b) (iii) only
(c) (i) and (ii) only
(d) all of these

44. Which is not true for beryllium ?

(a) Beryllium is amphoteric
(b) It forms unusual carbide, Be_2C
(c) $Be(OH)_2$ is basic
(d) Beryllium halides are electron deficient

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 $\frac{N}{10}$ $KMnO_4$ 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 mixure 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
$[\Delta H_{comb.}(CH_4) = 890 \text{ kJ mol}^{-1},$
$\Delta H_{comb.}(C_3H_8) = 2220 \text{kJ mol}^{-1}]$ is

MATHEMATICS

PART-I (Multiple Choice Questions)

51. The function $f(x) = \tan^{-1}(\sin x + \cos x)$ is an increasing function in

(a) $\left(0, \frac{\pi}{2}\right)$ (b) $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

(c) $\left(\frac{\pi}{4}, \frac{\pi}{2}\right)$ (d) $\left(-\frac{\pi}{2}, \frac{\pi}{4}\right)$

52. The degree of differential equation satisfying the relation

$$\sqrt{1+x^2} + \sqrt{1+y^2} = \lambda(x\sqrt{1+y^2} - y\sqrt{1+x^2})$$ is

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

53. $\int_0^2 [x^2]\,dx$, where $[x]$ is the greatest integer $\leq x$ is

(a) $5+\sqrt{2}+\sqrt{3}$

(b) $-5+\sqrt{2}-\sqrt{3}$

(c) $5-\sqrt{2}-\sqrt{3}$

(d) $-4+\sqrt{3}-\sqrt{2}$

54. α, β be the roots of $x^2 - 3x + a = 0$ and γ, δ be the roots of $x^2 - 12x + b = 0$ and numbers $\alpha, \beta, \gamma, \delta$ (in order) form an increasing G.P. then

(a) $a = 3, b = 12$
(b) $a = 12, b = 3$
(c) $a = 2, b = 32$
(d) $a = 4, b = 16$

55. Assume R and S are (non-empty) relations in a set A. Which of the following relation given below is false

(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 $\left[2\pi k + \frac{\pi}{2}, 2\pi k - \frac{\pi}{2}\right]$ the graph of $\sin x$ 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) $e^{-x} + \frac{2}{3}e^{2x} + c$

59. If $\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} = 0$ then x is

(a) 0, 2a
(b) a, 2a
(c) 0, 3a
(d) None of these

60. The equation of a circle with origin as centre and passing through the vertices of an equilateral triangle whose median is of length 3a is

(a) $x^2 + y^2 = 9a^2$
(b) $x^2 + y^2 = 16a^2$
(c) $x^2 + y^2 = 4a^2$
(d) $x^2 + y^2 = a^2$

61. If a positive integer n is divisible by 9, then the sum of the digits of n is divisible by 9. So which statement is it contrapositive.

(a) (sum of digits of n is divisible by 9) $\Rightarrow$ (n is divisible by 9)
(b) (sum of digits of n is not divisible by 9) $\Rightarrow$ (n is not divisible by 9)
(c) (sum of digits of n is divisible by 9) $\Rightarrow$ (n is divisible by 9)
(d) none of these

62. Fifteen coupons are numbered 1, 2 ..... 15,respectively. Seven coupons are selected at random one at a time

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 $a \le 0$ then roots of

$x^2 - 2a|x - a| - 3a^2 = 0$ 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) ϕ

(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

66. $f(x)=\sin|x|.f(x)$ is not differentiable at

(a) $x=0$ only

(b) all x

(c) multiples of π

(d) multiples of $\frac{\pi}{2}$

67. $\int_0^{\pi/3} \frac{\cos x+\sin x}{\sqrt{1+\sin 2x}} dx$ is

(a) $\frac{4\pi}{3}$ (b) $\frac{2\pi}{3}$

(c) π (d) $\frac{\pi}{3}$

68. The angle between the pair of tangents drawn to the ellipse $3x^2+2y^2=5$ from the point (1,2) is

(a) $\tan^{-1}\left(\frac{12}{5}\right)$

(b) $\tan^{-1}\left(6\sqrt{5}\right)$

(c) $\tan^{-1}\left(\frac{12}{\sqrt{5}}\right)$

(d) $\tan^{-1}\left(12\sqrt{5}\right)$

69. Let α and β be the roots of the equation $x^2+x+1=0$ the equation whose roots are α^{19}, β^7 is

(a) $x^2-x-1=0$

(b) $x^2-x+1=0$

(c) $x^2+x-1=0$

(d) $x^2+x+1=0$

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

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

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

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

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

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

$= k,$ 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

RESPONS

PHYSICS

1. ⓐⓑⓒⓓ
2. ⓐⓑⓒⓓ
3. ⓐⓑⓒⓓ
4. ⓐⓑⓒⓓ
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CHEMIS

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SE SHEET

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ⓒ ⓓ		**53.**	ⓐ ⓑ ⓒ ⓓ
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		72.	
		73.	
		74.	

MOCK T

INSTRU

1. This test will be a 3 hours Test.
2. This test consists of Physics, Cher
   equal weightage of 100 marks.
3. Each question is of 4 marks.
4. There are three sections in the ques
   to 25), Chemistry (Q.no.26 to 50) a
   section is divided into two parts,
   questions & Part II consists of 5 N
5. There will be only one correct choi
   each question 4 marks will be awa
   deducted for incorrect choice for I
   awarded for not attempted questio
   awarded for correct answer and zer
6. Any textual, printed or written mate
   allowed for the students appearing
7. All calculations / written work sho

PHYSICS

PART-I (Multiple Choice Questions)

1. A solid cylinder rolls down an inclined plane of height 3 m and reaches the bottom of plane with angular velocity of $2\sqrt{2}$ rad.s^{-1}. The radius of cylinder must be (Take g = 10 ms^{-2})

(a) 5 cm (b) 0.5 cm

(c) $\sqrt{10}cm$ (d) $\sqrt{5}m$

2. In the figure shown, a particle of mass m is released from the position A on a smooth track. When the particle reaches at B, then normal reaction on it by the track is

EST 4

CTIONS

mistry and Mathematics questions with

stion paper consisting of Physics (Q.no.1
and Mathematics (Q. no.51 to 75). Each
Part I consists of 20 multiple choice
umerical 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.
uld 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) $\rho = \rho_0\left[1 - \frac{\rho_0 gy}{B}\right]$

(b) $\rho = \rho_0\left[1 + \frac{\rho_0 g y}{B}\right]$

(c) $\rho = \rho_0\left[1 + \frac{B}{\rho_0 h g y}\right]$

(d) $\rho = \rho_0\left[1 - \frac{B}{\rho_0 h g y}\right]$

4. The electric field in a certain region is given by $\vec{E} = (5\hat{i} - 3\hat{j})kV/m$. The potential difference $V_B - V_A$ between points A and B, having coordinates (4, 0, 3)m and (10, 3, 0)m respectively, is equal to

(a) 21 kV (b) –21 kV

(c) 39 kV (d) –39 kV

5. Two electric bulbs marked 25W – 220 V and 100W – 220V are connected in series to a 440 V supply. Which of the bulbs will fuse?

(a) Both (b) 100 W

(c) 25 W (d) Neither

6. Two long parallel wires P and Q are held perpendicular to the plane of the paper at a separation of 5 m. If P and Q carry currents of 2.5 A and 5 A respectively in the same direction, then the magnetic field at a point midway between P and Q is

(a) $\frac{\mu_0}{\pi}$ (b) $\sqrt{3}\frac{\mu_0}{\pi}$

(c) $\frac{\mu_0}{2\pi}$ (d) $\frac{3\mu_0}{2\pi}$

7. Two seconds after projection a projectile is travelling in a direction inclined at 30° to the horizontal. After one more second, it is travelling horizontally. The magnitude and direction of its initial velocity are-

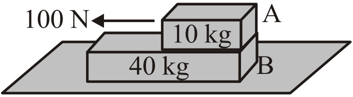
(a) $2\sqrt{20}$ m/s 60°

(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 resultaing 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) $\dfrac{f-a}{2(1+b)}$ (b) $\dfrac{a-1}{1+b}$

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

10. Ultraviolet light of wavelength 300 nm and intensity 1.0 watt/m^2 falls on the surface of a photosensitive material. If 1% of the incident photons produce photoelectrons, then find the number of photoelectrons emitted from an area of 1.0 cm^2 of the surface.

(a) 9.61×10^{14} per sec
(b) 4.12×10^{13} per sec
(c) 1.51×10^{12} per sec
(d) 2.13×10^{11} per sec

11. If the wavelength of the first line of the Balmer series of hydrogen is 6561 Å, find the wavelength of the second line of the series.

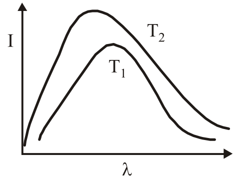
(a) 13122 Å (b) 3280 Å
(c) 4860 Å (d) 2187 Å

12. The concentration of hole - electron pairs in pure silicon at T = 300 K is 7×10^{15} per cubic meter. Antimony is doped into silicon in a proportion of 1 atom in 10^7 Si atoms. Assuming that half of the impurity atoms contribute electron in the conduction band, calculate the factor by which the number of charge carriers increases due to doping. The number of silicon atoms per cubic meter is 5×10^{28}

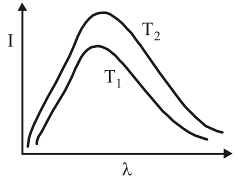
(a) 2.8×10^5 (b) 3.1×10^2
(c) 4.2×10^5 (d) 1.8×10^5

13. Shown below are the black body radiation curves at temperatures T_1 and T_2 ($T_2 > T_1$). Which one of the following plots is correct?

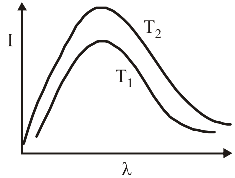
(a)



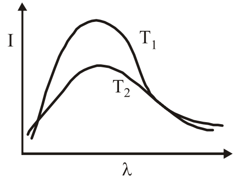
(b)



(c)



(d)



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

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

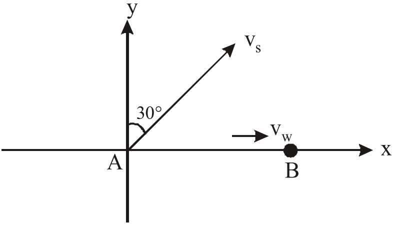
The resonant angular frequency is

(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 equal quantities of O_2 and N_2. If the average speed of the O_2 molecules in vessel A is V_1, that of the N_2 molecules in vessel B is V_2, the average speed of the O_2 molecules in vessel C is

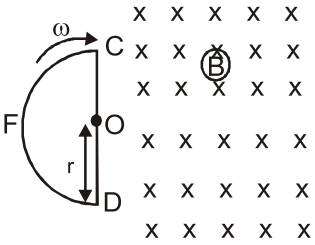
(a) $(V_1 + V_2)/2$
(b) V_1
(c) $(V_1 V_2)^{1/2}$
(d) $\sqrt{3kT/M}$

16. In the figure shown a source of sound of frequency 510 Hz moves with constant velocity $v_s = 20$ m/s in the direction shown. The wind is blowing at a constant velocity $v_w = 20$ m/s towards an observer who is at rest at point B. Corresponding to the sound emitted by the source at initial position A, the frequency detected by the observer is equal to (speed of sound relative to air = 330 m/s)



(a) 510 Hz (b) 500 Hz
(c) 525 Hz (d) 550 Hz

17. In fig, CODF is a semicircular loop of a conducting wire of resistance R and radius r. It is placed in a uniform magnetic field B, which is directed into the page (perpendicular to the plane of the loop).



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) $Br^2 \omega/R$

(c) $Br^2 \omega/2R$ (d) $B\pi r^2 \omega/R$

18. If E = 100 sin (100t) volt and I = 100 sin $\left(100t+\frac{\pi}{3}\right)mA$ are the 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 = speed of light)

(a) zero (b) E/Atc

(c) 2E/Atc (d) E/c

20. A 2.0 cm tall object is placed 15 cm in front of a concave mirror of focal length 10 cm. What is the size and nature of the image

(a) 4 cm, real
(b) 4 cm, virtual
(c) 1.0 cm, real
(d) None of these

PART-II (Numerical Answer Questions)

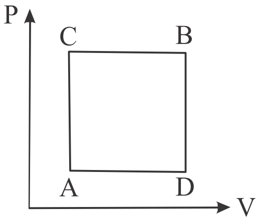
21. An inclined plane making an angle of 30º with the horizontal is placed in a uniform electric field of intensity 100 V/m. A particle of mass 1 kg and charge 0.01 C is allowed to slide down from rest on the plane from a height of 1 m. If the coefficient of friction is 0.2, then find the time taken (in second) by the particle to reach the bottom.

22. A satellite is to be placed in equatorial geostationary orbit around earth for communication. The height (in metre) of such a satellite is

[$M_E = 6 \times 10^{24}$ kg, $R_E = 6400$ km, $T =$ 24 h, $G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}]

23. A simple electric motor has an armature resistance of 1 Ω and runs from a dc source of 12 volt. When running unloaded it draws a current of 2 amp. When a certain load is connected, its speed becomes one-half of its unloaded value. What is the new value of current drawn (in ampere)?

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

27. Which of the following factors may be regarded as the main cause of lanthanoid contraction?

(a) Greater shielding of $5d$ electrons by $4f$ electrons.

(b) Poorer shielding of $5d$ electrons by $4f$ electrons.

(c) Effective shielding of one of $4f$ electrons by another in the subshell.

(d) Poor shielding of one of $4f$ electron by another in the subshell.

28. Isobutyl magnesium bromide with dry ether and ethyl alcohol gives :

(a) $\underset{\displaystyle CH_3}{CH_3\overset{|}{C}HCH_2OH}$ & CH_3CH_2MgBr

(b) $\underset{\displaystyle CH_3}{CH_3\overset{|}{C}HCH_3}$ & $MgBr(OC_2H_5)$

(c) $\underset{\displaystyle CH_3}{CH_3\overset{|}{C}HCH=CH_2}$ & $Mg(OH)Br$

(d) $\underset{\displaystyle CH_3}{CH_3\overset{|}{C}HCH_3}$ & CH_3CH_2OMgBr

29. The K_p/K_c ratio will be highest in case of

(a) $CO(g) + \frac{1}{2} O_2(g) \rightleftharpoons CO_2(g)$

(b) $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$

(c) $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$

(d) $7H_2(g) + 2NO_2(g) \rightleftharpoons 2NH_3(g) + 4H_2O(g)$

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) $C_3H_5O_2$ (b) $C_4H_{10}O_2$

(c) $C_6H_{10}O_4$ (d) $C_3H_{10}O_2$

32. Consider the following transformations :

$$CH_3COOH \xrightarrow{CaCO_3} A \xrightarrow{heat} B \xrightarrow[NaOH]{I_2} C$$

The molecular formula of C is

(a) $CH_3-\overset{\overset{\displaystyle OH}{|}}{\underset{\underset{\displaystyle I}{|}}{C}}-CH_3$

(b) $ICH_2—COCH_3$
(c) CHI_3
(d) CH_3I

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

$C(graphite) + CO_2\ (g) \rightarrow 2CO(g)$

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 of B, then the ratio of number of molecules of A and B are

(a) 1 : 2 (b) 2 : 1

(c) 1 : 4 (d) 4 : 1

35. The stability of +1 oxidation state among Al, Ga, In and Tl increases in the sequence :

(a) Ga < In < Al < Tl

(b) Al < Ga < In < Tl

(c) Tl < In < Ga < Al

(d) In < Tl < Ga < Al

36. Among the following four structures I to IV,

$$C_2H_5-\underset{}{\overset{\overset{\displaystyle CH_3}{|}}{C}}H-C_3H_7,$$

(I)

$$CH_3-\overset{\overset{\displaystyle O}{||}}{C}-\overset{\overset{\displaystyle CH_3}{|}}{C}H-C_2H_5,$$

(II)

$$H-\underset{\underset{\displaystyle H}{|}}{\overset{\overset{\displaystyle H}{|}}{C^+}},$$

(III)

$$C_2H_5-\overset{\overset{\displaystyle CH_3}{|}}{C}H-C_2H_5$$

(IV)

it is true that

(a) only I and II are chiral compounds

(b) only III is a chiral compound

(c) only II and IV are chiral compounds

(d) all four are chiral compounds

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}

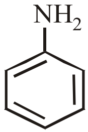
(c) 1.62×10^{-2} (d) 1.62×10^{-6}

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) $-0.6\,\Delta_0$

42. In the reaction sequence



$\xrightarrow[0°C]{NaNO_2, HCl} A$

$\xrightarrow{CuCN} B \xrightarrow{LiAlH_4} C$, the product 'C' is:

(a) benzonitrile
(b) benzaldehyde
(c) benzoic acid
(d) benzylamine

43. Nylon threads are made of

(a) polyester polymer
(b) polyamide polymer
(c) polyethylene polymer
(d) polyvinyl polymer

44. In the reaction of oxalate with permanganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is:

(a) 1 (b) 10
(c) 2 (d) 5

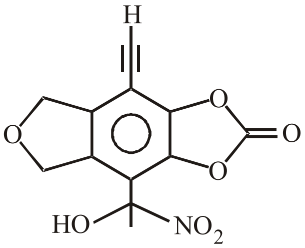
45. Momentum of radiations of wavelength 0.33 nm is :

(a) 2.01×10^{-21} kg m sec^{-1}
(b) 2.01×10^{-24} g m sec^{-1}
(c) 2.01×10^{-21} g m sec^{-1}
(d) 2.01×10^{-24} kg m sec^{-1}

PART-II (Numerical Answer Questions)

46. Calculate the difference in the heat of formation (in calories) of carbon monoxide at constant pressure and at constant volume at 27 °C.

47. Calculate number of molecules of Grignard reagent consumed by 1 molecule of following compound.



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 $[Cu^{II}(NH_3)_4][Pt^{II}Cl_4]$

50. Calculate the strength in % of labelled 10 volume H_2O_2 solution.

MATHEMATICS

PART-I (Multiple Choice Questions)

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

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

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

all permissible real x, is

(a) -10 (b) -6

(c) -7 (d) -8

53. In the expansion of $\left(\frac{x}{2}-\frac{3}{x^2}\right)^{10}$, the coefficient of x^4 is

(a) $\frac{405}{256}$ (b) $\frac{504}{259}$

(c) $\frac{450}{263}$

(d) None of these

54. If the plane $3x + y + 2z + 6 = 0$ is parallel to the line $\frac{3x-1}{2b} = 3 - y = \frac{z-1}{a}$, then the value of $3a + 3b$ is

(a) $\frac{1}{2}$ (b) $\frac{3}{2}$

(c) 3 (d) 4

55. The domain of definition of the function

$f(x) = \sqrt{1+\log_e(1-x)}$ is

(a) $-\infty < x \le 0$

(b) $-\infty < x \le \frac{e-1}{e}$

(c) $-\infty < x \le 1$

(d) $x \ge 1-e$

56. The function $f(x) = [x]^2 - [x^2]$ (where $[y]$ is the greatest integer less than or equal to y), is discontinuous at

(a) All integers

(b) All integers except 0 and 1

(c) All integers except 0

(d) All integers except 1

57. The line $y = mx$ bisects the area enclosed by lines $x = 0$, $y = 0$ and $x = 3/2$ and the curve $y = 1 + 4x - x^2$. Then the value of m is

(a) $\frac{13}{6}$ (b) $\frac{13}{2}$

(c) $\frac{13}{5}$ (d) $\frac{13}{7}$

58. The sum of the series $3 + 33 + 333 + ...+ n$ 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 $\frac{dy}{dx}$ at $x = 0$ is

(a) $\frac{3}{5}\log 2$ (b) $\frac{2}{5}\log 2$

(c) $-\frac{3}{2}\log 2$

(d) None of these

61. The value of

$$\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+\cos\frac{6\pi}{7} \text{ is}$$

(a) 0 (b) 1

(c) $\frac{1}{2}$ (d) $-\frac{1}{2}$

62. An integrating factor of the differential equation

$\frac{dy}{dx} = y\tan x - y^2 \sec x$ is equal to:

(a) $\tan x$ (b) $\sec x$

(c) $\operatorname{cosec} x$ (d) $\cot x$

63. If $y = 2x$ is a chord of the circle $x^2 + y^2 = 10x$, then the equation of the circle whose diameter is this chord, is -

(a) $x^2 + y^2 + 2x + 4y = 0$

(b) $x^2 + y^2 + 2x - 4y = 0$

(c) $x^2 + y^2 - 2x - 4y = 0$

(d) None of these

64. Magnitudes of vectors $\vec{a}, \vec{b}, \vec{c}$ are 3, 4, 5 respectively. If $\vec{a}$ and $\vec{b}+\vec{c}$, $\vec{b}$ and $\vec{c}+\vec{a}$, $\vec{c}$ and $\vec{a}+\vec{b}$ are mutually perpendicular, then magnitude of $\vec{a}+\vec{b}+\vec{c}$ is

(a) $4\sqrt{2}$ (b) $3\sqrt{2}$

(c) $5\sqrt{2}$ (d) $3\sqrt{3}$

65. If $a + b + c = 0$, then the solution of the equation

$$\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0 \text{ is}$$

(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 $f : R \to R$ and $g : R \to R$ 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

69. If PQ is a double ordinate of hyperbola $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ such that OPQ is an equilateral triangle, O being the centre of the hyperbola. Then the eccentricity e of the hyperbola satisfies

(a) $1<e<2/\sqrt{3}$ (b) $e=2/\sqrt{3}$

(c) $e=\sqrt{3}/2$ (d) $e>2/\sqrt{3}$

70. The equation of the lines on which the perpendiculars from the origin make 30° angle with x-axis and which form a triangle of area $\frac{50}{\sqrt{3}}$ with axes, are

(a) $x+\sqrt{3}y\pm 10=0$

(b) $\sqrt{3}x+y\pm 10=0$

(c) $x\pm\sqrt{3}y-10=0$

(d) None 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

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

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

RESPONS

PHYSICS		CHEMIST	
1.	(a) (b) (c) (d)	26.	(a) (b)
2.	(a) (b) (c) (d)	27.	(a) (b)
3.	(a) (b) (c) (d)	28.	(a) (b)
4.	(a) (b) (c) (d)	29.	(a) (b)
5.	(a) (b) (c) (d)	30.	(a) (b)
6.	(a) (b) (c) (d)	31.	(a) (b)
7.	(a) (b) (c) (d)	32.	(a) (b)
8.	(a) (b) (c) (d)	33.	(a) (b)
9.	(a) (b) (c) (d)	34.	(a) (b)
10.	(a) (b) (c) (d)	35.	(a) (b)
11.	(a) (b) (c) (d)	36.	(a) (b)
12.	(a) (b) (c) (d)	37.	(a) (b)
13.	(a) (b) (c) (d)	38.	(a) (b)
14.	(a) (b) (c) (d)	39.	(a) (b)
15.	(a) (b) (c) (d)	40.	(a) (b)
16.	(a) (b) (c) (d)	41.	(a) (b)
17.	(a) (b) (c) (d)	42.	(a) (b)
18.	(a) (b) (c) (d)	43.	(a) (b)
19.	(a) (b) (c) (d)	44.	(a) (b)
20.	(a) (b) (c) (d)	45.	(a) (b)
21.		46.	
22.		47.	
23.		48.	
24.		49.	

SE SHEET

TRY		MATHEMATICS
c d	51.	a b c d
c d	52.	a b c d
c d	53.	a b c d
c d	54.	a b c d
c d	55.	a b c d
c d	56.	a b c d
c d	57.	a b c d
c d	58.	a b c d
c d	59.	a b c d
c d	60.	a b c d
c d	61.	a b c d
c d	62.	a b c d
c d	63.	a b c d
c d	64.	a b c d
c d	65.	a b c d
c d	66.	a b c d
c d	67.	a b c d
c d	68.	a b c d
c d	69.	a b c d
c d	70.	a b c d
	71.	
	72.	
	73.	
	74.	

MOCK T

INSTRU

1. This test will be a 3 hours Test.
2. This test consists of Physics, Cher
   equal weightage of 100 marks.
3. Each question is of 4 marks.
4. There are three sections in the ques
   to 25), Chemistry (Q.no.26 to 50) a
   section is divided into two parts,
   questions & Part II consists of 5 N
5. There will be only one correct choic
   each question 4 marks will be awa
   deducted for incorrect choice for I
   awarded for not attempted questio
   awarded for correct answer and zer
6. Any textual, printed or written mate
   allowed for the students appearing
7. All calculations / written work sho

PHYSICS

PART-I (Multiple Choice Questions)

1. A sphericla ball A of mass 4 kg, moving along a straight line strikes another spherical ball B of mass 1kg at rest. After the collision, A and B move with velocities $\upsilon_1\ ms^{-1}$ and $\upsilon_2\ ms^{-1}$ respectively making angles of 30° and 60° with respect to the original direction of motion of A.

The ratio $\frac{\upsilon_1}{\upsilon 2}$ will be

EST 5

CTIONS

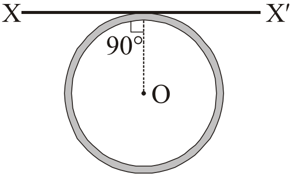
mistry and Mathematics questions with

stion paper consisting of Physics (Q.no.1
and Mathematics (Q. no.51 to 75). Each
Part I consists of 20 multiple choice
umerical 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.
uld be done in the rough sheet provided.

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

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

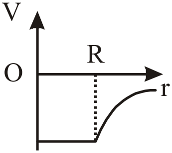
2. A thin wire of length L and uniform linear mass density ρ is bent into a circular loop with centre at O as shown. The moment of inertia of the loop about the axis XX′ is

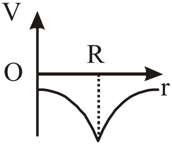


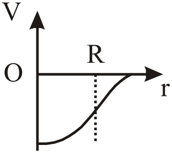
(a) $\frac{\rho L^3}{8\pi^2}$ (b) $\frac{\rho L^3}{16\pi^2}$

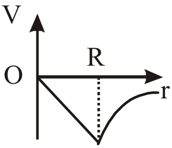
(c) $\frac{5\rho L^3}{16\pi^2}$ (d) $\frac{3\rho L^3}{8\pi^2}$

3. The diagram showing the variation of gravitational potential of earth with distance from the centre of earth is

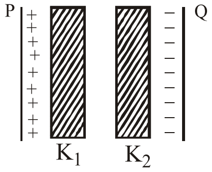
(a)


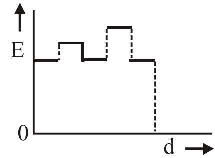
(b)


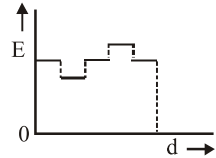
(c)


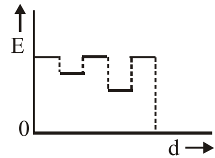
(d)


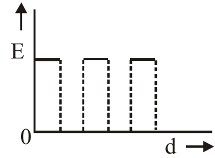
4. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in the figure. The variation of electric field 'E' between the plates with distance 'd' as measured from plate P is correctly shown by :



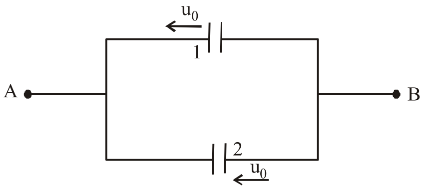
(a) 

(b) 

(c) 

(d) 

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 system by connecting a battery across A and B and battery is removed. Now first plate of first capacitor and second plate of second capacitor starts moving with constant velocity u_0 towards left. Find the magnitude of current flowing in the loop during the process.

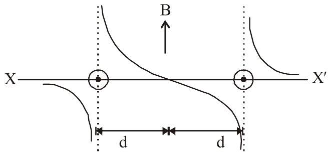


(a) $\frac{Q}{2d_0}u_0$ (b) $\frac{Q}{d_0}u_0$

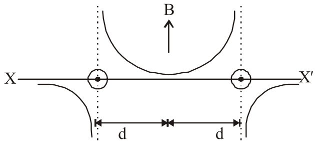
(c) $\frac{2Q}{d_0}u_0$ (d) $\frac{Q}{3d_0}u_0$

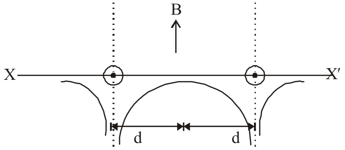
6. Two long parallel wires are at a distance 2d apart. They carry steady equal currents flowing out of the plane of the paper as shown. The variation of the magnetic field B along the line XX' is given by

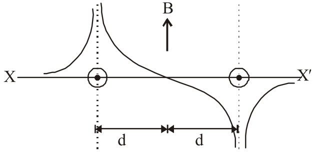
(a)



(b)



(c) 

(d) 

7. If dimensions of critical velocity υ_c of a liquid flowing through a tube are expressed as $[\eta^x \rho^y r^x]$, 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) $\frac{\alpha\beta t}{\alpha+\beta}$

9. The speed of a projectile at its maximum height is $\frac{\sqrt{3}}{2}$ times its initial speed. If the range of the projectile is 'P' times the maximum height attained by it. P is-

(a) $\frac{4}{3}$ (b) $2\sqrt{3}$

(c) $4\sqrt{3}$ (d) $\frac{3}{4}$

10. All electrons ejected from a surface by incident light of wavelength 200nm can be stopped before travelling 1m in the direction of uniform electric field of 4N/C. The work function of the surface is

(a) 4 eV (b) 6.2 eV

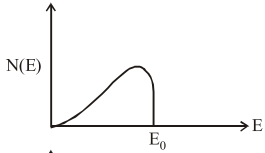
(c) 2 eV (d) 2.2 eV

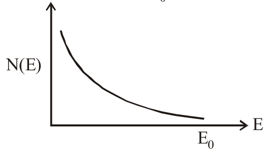
11. Find the ratio of longest wavelength and the shortest wavelength observed in the five spectral series of emission spectrum of hydrogen.

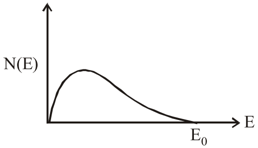
(a) $\frac{4}{3}$ (b) $\frac{525}{376}$

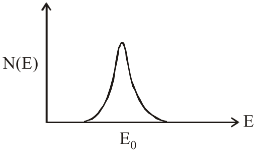
(c) 25 (d) $\frac{900}{11}$

12. The energy spectrum of β-particles [Number N(E) as a function of β-energy E] emitted from a radioactive source is

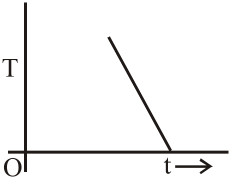
(a) 

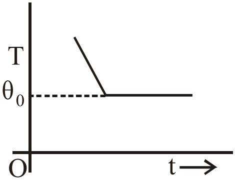
(b) 

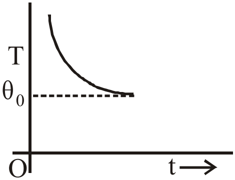
(c) 

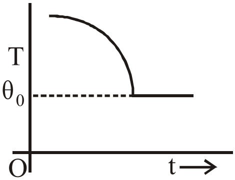
(d) 

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

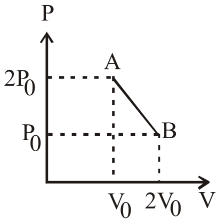
(a) 

(b) 

(c) 

(d) 

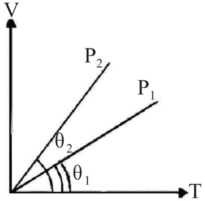
14. 'n' moles of an ideal gas undergoes a process A $\rightarrow$ B as shown in the figure. The maximum temperature of the gas during the process will be :



(a) $\frac{9P_0V_0}{2nR}$ (b) $\frac{9P_0V_0}{nR}$

(c) $\frac{9P_0V_0}{4nR}$ (d) $\frac{3P_0V_0}{2nR}$

15. In the given (V – T) diagram, what is the relation between pressure P_1 and P_2 ?



(a) $P_2 > P_1$

(b) $P_2 < P_1$

(c) Cannot be predicted

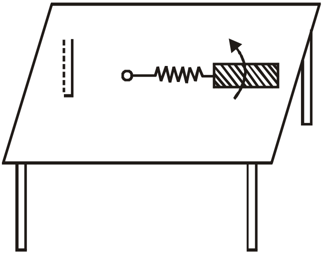
(d) $P_2 = P_1$

16. A particle executes simple harmonic motion with a time period of 16s. At time t = 2s, the particle crosses the mean position while at t = 4s, its velocity is 4 m/s^{-1}. The amplitude of motion in metre is

(a) $\sqrt{2}\pi$ (b) $16\sqrt{2}\pi$

(c) $24\sqrt{2}\pi$ (d) $\frac{32\sqrt{2}}{\pi}$

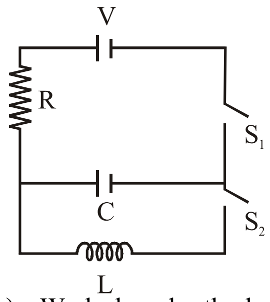
17. A metallic rod of length 'ℓ' is tied to a string of length 2ℓ and made to rotate with angular speed ω on a horizontal table with one end of the string fixed. If there is a vertical magnetic field 'B' in the region, the e.m.f. induced across the ends of the rod is



(a) $\dfrac{2B\omega\ell^2}{2}$ (b) $\dfrac{3B\omega\ell^2}{2}$

(c) $\dfrac{4B\omega\ell^2}{2}$ (d) $\dfrac{5B\omega\ell^2}{2}$

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

(b) At $t = \tau$, $q = CV/2$
(c) At $t = 2\tau$, $q = CV(1 - e^{-2})$

(d) At $t = \frac{\tau}{2}$, $q = CV(1 - e^{-1})$

19. An electromagnetic wave in vacuum has the electric and magnetic field $\vec{E}$ and $\vec{B}$, which are always perpendicular to each other. The direction of polarization is given by $\vec{X}$ and that of wave propagation by $\vec{k}$. Then

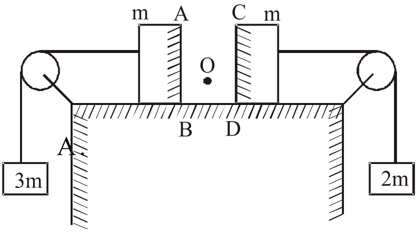
(a) $\vec{X} \parallel \vec{B}$ and $\vec{k} \parallel \vec{B} \times \vec{E}$

(b) $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$

(c) $\vec{X} \parallel \vec{B}$ and $\vec{k} \parallel \vec{E} \times \vec{B}$

(d) $\vec{X} \parallel \vec{E}$ and $\vec{k} \parallel \vec{B} \times \vec{E}$

20. Two blocks each of mass m lie on a smooth table. They are attached to two other masses as shown in the figure. The pulleys and strings are light. An object O is kept at rest on the table. The sides AB and CD of the two blocks are made reflecting. The acceleration of two images formed in these two reflecting surfaces w.r.t. each other is 17g/A then find the value of



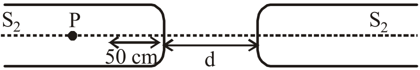
(a) 2
(b) 6
(c) 4
(d) 5

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



24. The displacement of a particle executing SHM is given by $y = 5\sin\left(4t + \frac{\pi}{3}\right)$. If T is the time period and mass of the particle is 2g, the kinetic energy (in joule) of the particle when $t = \frac{T}{4}$ is given by

25. A zener diode of voltage V_Z (= 6V) is used to maintain a constant voltage across a load resistance R_L (= 1000 Ω) by using a series resistance R_s (= 100Ω). If the e.m.f. of source is E (= 9 V), what is the power (in watt) being dissipated in Zener diode ?

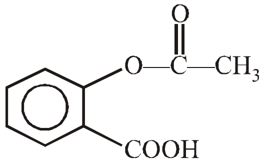
CHEMISTRY

PART-I (Multiple Choice Questions)

26. The compound that does not produce nitrogen gas by the thermal decomposition is :

(a) $Ba(N_3)_2$ (b) $(NH_4)_2Cr_2O_7$
(c) NH_4NO_2 (d) $(NH_4)_2SO_4$

27. The following compound is used as



(a) an anti-inflammatory compound
(b) analgesic
(c) hypnotic
(d) antiseptic

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 $[B(OH)_4]^-$

33. Consider the reaction

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The equilibrium constant of the above reaction is K_P. If pure ammonia is left to dissociate, the partial pressure of ammonia at equilibrium is given by (Assume that $P_{NH_3} << P_{total}$ at equilibrium)

(a) $\dfrac{3^{3/2} K_P^{1/2} P^2}{16}$

(b) $\dfrac{K_P^{1/2} P^2}{16}$

(c) $\dfrac{K_P^{1/2} P^2}{4}$

(d) $\dfrac{3^{3/2} K_P^{1/2} P^2}{4}$

34. The property which distinguishes formic acid from acetic acid is

(a) only ammonium salt of formic acid on heating gives amide.

(b) when heated with alcohol/ H_2SO_4 only acetic acid forms ester.

(c) only acetic acid forms salts with alkali.

(d) only formic acid reduces Fehling's solution.

35. The standard emf of a cell, involving one electron change is found to be 0.591 V at 25°C. The equilibrium constant of the reaction is ($F = 96500\ C\ mol^{-1}$)

(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) $NH_2 - Hg - Hg - Cl$
(d) Hg_2NH_2Cl

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

40. What happens when magnesium is burnt in air and the products X and Y are treated with water?

$$\begin{array}{ccccc} \mathrm{Mg} & \xrightarrow{\text{Air}} & \mathrm{X} & + & \mathrm{Y} \\ & & \Big\downarrow{\scriptstyle H_2O} & & \Big\downarrow{\scriptstyle H_2O} \\ & & \mathrm{P} & & \mathrm{P+Q} \end{array}$$

	X	**Y**	**P**	**Q**
(a)	MgO	$Mg(OH)_2$	$Mg(OH)_2$	N_2
(b)	MgO	Mg_3N_2	$Mg(OH)_2$	NH_3
(c)	MgO	Mg_3N_2	$Mg(OH)_2$	N_2
(d)	MgO	$MgCO_3$	$Mg(OH)_2$	CO_2

41. When a small quantity of $FeCl_3$ solution is added to the fresh precipitate of $Fe(OH)_3$, a colloidal sol is obtained.

The process through which this sol is formed is known as

(a) exchange of solvent
(b) chemical double decomposition
(c) peptization
(d) electrophoresis

42. The molal elevation constant of water = 0.52 °C kg mol^{-1}. The boiling point of 1.0 molal aqueous KCl solution (assuming complete dissociation of KCl), therefore should be

(a) 100.52 °C (b) 101.04 °C
(c) 99.48 °C (d) 98.96 °C

43. The oxidation state of Cr in $[Cr(NH_3)_4Cl_2]^+$ is

(a) 0 (b) +1
(c) +2 (d) +3

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

$F_2(g) + 2e^- \rightarrow 2F^-(aq);$ $E^\circ = +2.85$ V

$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq);$ $E^\circ = +1.36$ V

$Br_2(l) + 2e^- \rightarrow 2Br^-(aq);$ $E^\circ = +1.06$ V

$I_2(s) + 2e^- \rightarrow 2I^-(aq);$ $E^\circ = +0.53$ 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

 $\longrightarrow CH_3 - CH = CH_2$

This follows first order kinetics. The rate constant is $2.714 \times 10^{-3}\ s^{-1}$. 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

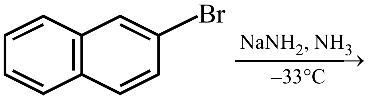
(c) 0.145 M (d) 0.0018 M

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.

48. How many isomeric naphthylamines are expected in the following reaction ?



49. At infinite dilution, the molar conductance of Ba^{2+} and Cl^- are 127 and 76 S cm^2 mol^{-1}. What is the molar conductivity of $BaCl_2$ at indefinite dilution?

50. The enthalpy of hydrogenation of cyclohexene is – 119.5 kJ mol^{-1}. If resonance energy of benzene is – 150.4 kJ mol^{-1}, calculate its enthalpy of hydrogenation in kJ.

MATHEMATICS

PART-I (Multiple Choice Questions)

51. If one root is square of the other root of the equation $x^2 + px + q = 0$, then the relation between p and q is

(a) $p^3 - (3p - 1)q + q^2 = 0$

(b) $p^3 - q(3p + 1) + q^2 = 0$

(c) $p^3 + q(3p - 1) + q^2 = 0$

(d) $p^3 + q(3p + 1) + q^2 = 0$

52. A chord AB drawn from the point $A(0, 3)$ on circle $x^2 + 4x + (y - 3)^2 = 0$ meets to M in such a way that $AM = 2AB$, then the locus of point M will be

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

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

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

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

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

are given by

(a) $P = 2, Q = -3, R = 4$
(b) $P = -5, Q = 2, R = 3$
(c) $P = 5, Q = -2, R = 3$
(d) $P = 5, Q = -6, R = 3$

56. The value of $\lim\limits_{x \to 0^+} x^m (\log x)^n$, m, $n \in N$ is

(a) 0

(b) $\dfrac{m}{n}$

(c) mn

(d) None of these

57. The value of a in order that $f(x) = \sin x - \cos x - ax + b$ decreases for all real values is given by

(a) $a \geq \sqrt{2}$ (b) $a < \sqrt{2}$

(c) $a \geq 1$ (d) $a < 1$

58. If in ΔABC, $2b^2 = a^2 + c^2$, then $\dfrac{\sin 3B}{\sin B} =$

(a) $\dfrac{c^2 - a^2}{2ca}$

(b) $\dfrac{c^2 - a^2}{ca}$

(c) $\left(\dfrac{c^2 - a^2}{ca}\right)^2$

(d) $\left(\dfrac{c^2 - a^2}{2ca}\right)^2$

59. The equation of the normal to the curve

$y=(1+x)^y+\sin^{-1}(\sin^2 x)$ 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 $t_1t_2t_3t_4$ is equal to

(a) -1 (b) 1

(c) c^4 (d) $-c^4$

61. $\int\left(32x^3(\log x)^2 dx\right)$ 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

63. The area of the plane region bounded by the curves $x+2y^2=0$ and $x+3y^2=1$ is equal to

(a) 1/3 (b) 2/3

(c) 4/3 (d) 5/3

64. The inverse of the statement $(p \wedge \sim q) \rightarrow r$ is

(a) $\sim (p \vee \sim q) \rightarrow \sim r$

(b) $(\sim p \wedge q) \rightarrow \sim r$

(c) $(\sim p \vee q) \rightarrow \sim r$

(d) None of these

65. The coefficient of the term independent of x in the expansion of $(1+x+2x^3)\left(\frac{3}{2}x^2-\frac{1}{3x}\right)^9$ is

(a) $\frac{1}{3}$ (b) $\frac{19}{54}$

(c) $\frac{17}{54}$ (d) $\frac{1}{4}$

66. The solution to the differential equation $\frac{dy}{dx}=\frac{yf'(x)-y^2}{f(x)}$ where $f(x)$ is a given function is

(a) $f(x)=y(x+c)$

(b) $f(x)=cxy$

(c) $f(x)=c(x+y)$

(d) $yf(x)=cx$

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

70. If $\vec{a} = (1, -1, 2)$, $\vec{b} = (-2, 3, 5)$, $\vec{c} = (2, -2, 4)$ and $\hat{i}$ is the unit vector in the x-direction, then $(\vec{a} - 2\vec{b} + 3\vec{c})\hat{i} =$

(a) 11 (b) 15
(c) 18 (d) 36

PART-II (Numerical Answer Questions)

71. Find the greatest angle of a triangle whose sides are

$a, b, \sqrt{a^2 + b^2 + ab}\cdot$

72. How many 3 × 3 matrices M with entries from $\{0, 1, 2\}$ are there, for 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

RESPONS

PHYSICS		CHEMIST	
1.	ⓐⓑⓒⓓ	26.	ⓐⓑ
2.	ⓐⓑⓒⓓ	27.	ⓐⓑ
3.	ⓐⓑⓒⓓ	28.	ⓐⓑ
4.	ⓐⓑⓒⓓ	29.	ⓐⓑ
5.	ⓐⓑⓒⓓ	30.	ⓐⓑ
6.	ⓐⓑⓒⓓ	31.	ⓐⓑ
7.	ⓐⓑⓒⓓ	32.	ⓐⓑ
8.	ⓐⓑⓒⓓ	33.	ⓐⓑ
9.	ⓐⓑⓒⓓ	34.	ⓐⓑ
10.	ⓐⓑⓒⓓ	35.	ⓐⓑ
11.	ⓐⓑⓒⓓ	36.	ⓐⓑ
12.	ⓐⓑⓒⓓ	37.	ⓐⓑ
13.	ⓐⓑⓒⓓ	38.	ⓐⓑ
14.	ⓐⓑⓒⓓ	39.	ⓐⓑ
15.	ⓐⓑⓒⓓ	40.	ⓐⓑ
16.	ⓐⓑⓒⓓ	41.	ⓐⓑ
17.	ⓐⓑⓒⓓ	42.	ⓐⓑ
18.	ⓐⓑⓒⓓ	43.	ⓐⓑ
19.	ⓐⓑⓒⓓ	44.	ⓐⓑ
20.	ⓐⓑⓒⓓ	45.	ⓐⓑ
21.		46.	
22.		47.	
23.		48.	
24.		49.	

SE SHEET

TRY

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MATHEMATICS

51.	ⓐ ⓑ ⓒ ⓓ
52.	ⓐ ⓑ ⓒ ⓓ
53.	ⓐ ⓑ ⓒ ⓓ
54.	ⓐ ⓑ ⓒ ⓓ
55.	ⓐ ⓑ ⓒ ⓓ
56.	ⓐ ⓑ ⓒ ⓓ
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68.	ⓐ ⓑ ⓒ ⓓ
69.	ⓐ ⓑ ⓒ ⓓ
70.	ⓐ ⓑ ⓒ ⓓ
71.	
72.	
73.	
74.	

MOCK

PHY

1. **(b)** Since the speeds of the stars ar
hence the initial kinetic energy
total energy of the system is

$$E_i = KE + PE = 0 + \left(-\frac{GMM}{r}\right.$$

where M represents the mass
tween them.
When two stars collide their ce
of a star *i.e.* $2R$.
Let v be the speed with which t
system at the instant of their c

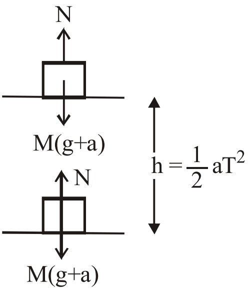
$$E_f = 2\times\left(\frac{1}{2}Mv^2\right) + \left(-\frac{GMM}{2R}\right.$$

According to law of conservati
$E_f = E_i$

$$Mv^2 - \frac{GM^2}{2R} = -\frac{GM^2}{r} \text{ or } v^2 =$$

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

2. **(b)**



Work done by normal reaction

TEST-1

SICS

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

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

of each star and r is initial separation be-

ntres will be at a distance twice the radius

wo stars collide. Then total energy of the
ollision is given by

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

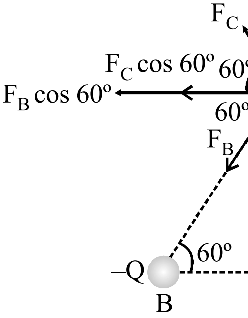
on of mechanical energy,

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

3. **(c)** Rise in temperature , $\Delta\theta = \frac{3T}{JSd}$

$$\therefore \Delta\theta = \frac{3T}{J}\left(\frac{1}{r} - \frac{1}{R}\right)$$ (For

4. **(c)** $\left|\overrightarrow{F_B}\right| = \left|\overrightarrow{F_C}\right| = k \cdot \frac{Q^2}{a^2}$

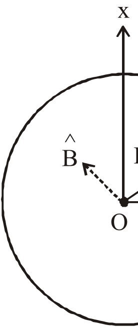


Hence force experienced by the
is zero.

5. **(a)** The magnitude of magnetic fie

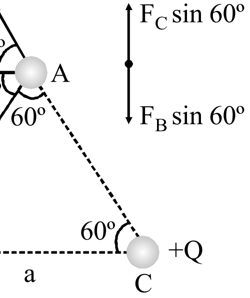
$$B = \frac{\mu_0 Jr}{2} = \frac{\mu_0 i}{2\pi R^2} \times \frac{R}{\sqrt{2}} = \frac{\mu}{2\sqrt{}}$$

(independent



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

water S = 1 and d = 1)

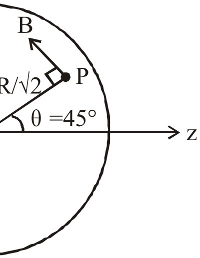


charge at A in the direction normal to BC

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

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

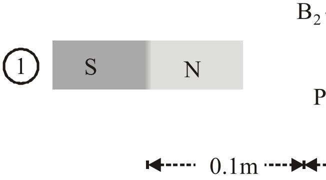
on y-coordinate)



$$\hat{B} = \frac{\hat{i} - \hat{k}}{\sqrt{2}}$$ (shown by dotted l

$$\therefore \quad \vec{B} = B\hat{B} = \frac{\mu_0 i}{4\pi R}(\hat{i} - \hat{k})$$

6. **(d)**

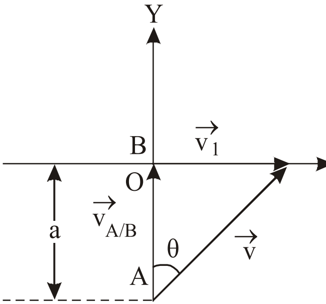


From figure $B_{net} = \sqrt{B_a^2 + B_e^2}$

$$= \sqrt{\left(\frac{\mu_0}{4\pi}.\frac{2M}{d^3}\right)^2 + \left(\frac{\mu_0}{4\pi}.\frac{M}{d^3}\right)^2}$$

$$= \sqrt{5}.\frac{\mu_0}{4\pi}.\frac{M}{d^3} = \sqrt{5} \times 10^{-7} \times \frac{}{(0}$$

7. **(d)**



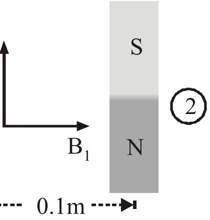
Velocity of A relative to B is gi

$$\vec{v}_{A/B} = \vec{v}_A - \vec{v}_B = \vec{v} - \vec{v}_1$$

By taking x-components of equat

$$0 = v \sin\theta - v_1 \Rightarrow \sin\theta = \frac{v_1}{v}$$

ines)



$\frac{10}{.1)^3} = \sqrt{5} \times 10^{-3}$ tesla

X

ven by

.... (1)

ion (1), we get

.... (2)

Time taken by boy at A to catc

$$t = \frac{\text{Relative displacement alo}}{\text{Relative velocity along}}$$

$$= \frac{a}{v\cos\theta} = \frac{a}{v.\sqrt{1-\sin^2\theta}} = $$

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

8. **(c)**

9. **(b)** Joule is a unit of ernergy.

SI	**New**
$n_1 = 5$	$n_2 =$
$M_1 = 1$ kg	$M^2 =$
$L_1 = 1$ m	$L^2 =$
$T_1 = 1$ s	$T^2 =$

Dimensional formula of energy

$a = 1, b = 2, c = -2$

As $n_2 = n_1 \left(\frac{M^1}{M^2}\right)^a \left(\frac{L^1}{L^2}\right)^b \left(\frac{T_1}{T_2}\right.$

$$= 5\left(\frac{1kg}{\alpha kg}\right)^1 \left(\frac{1m}{\beta m}\right)^2 \left(\frac{1s}{\gamma s}\right)^{-2} =$$

10. **(d)**

11. **(a)** $I_m = \frac{V_m}{R_f + R_L} = \frac{25}{(10+1000)} =$

$$I_{dc} = \frac{I_m}{\pi} = \frac{24.75}{3.14} = 7.87\text{ mA}$$

$$I_{rms} = \frac{I_m}{2} = \frac{24.75}{2} = 12.37\text{ mA}$$

$P_{dc} = I_{dc}^2 \times R_L = (7.87 \times 10^{-3})^2$

h the boy at B is given by

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

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

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

system

?

$= \alpha$ kg

β m

γ s

is comparing with, [$M^aL^bT^c$], 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

$\times 10^3 = 61.9$ mW

Rectifier efficiency

$$\eta = \frac{P_{dc}}{P_{ac}} \times 100 = \frac{61.9}{154.54} \times 100$$

12. **(c)** $K_{max} = E - W_0$

$\therefore \quad T_A = 4.25 - (W_0)_A$

$T_B = (T_A - 1.5) = 4.70 - (W$

Equation (i) and (ii) gives (W_0)

De Broglie wave length $\lambda = \frac{}{\sqrt{2}}$

$$\Rightarrow \frac{\lambda_B}{\lambda_A} = \sqrt{\frac{K_A}{K_B}} \Rightarrow 2 = \sqrt{\frac{T_A}{T_B - 1}}$$

From equation (i) and (ii)

$W_A = 2.25\, eV$ and $W_B = 4.20\, eV$

13. **(c)** $PV = \mu RT = \frac{m}{M} RT,$

where m = mass of the gas

and $\frac{m}{M} = \mu$ = number of moles

$\frac{PV}{T} = \mu R =$ a constant for all

That is why, ideally it is a straig

$$\therefore \quad \frac{PV}{T} = \frac{1\text{g}}{32\text{g mol}^{-1}} \times 8.31\ \text{J}$$

Also, $T_1 > T_2$

14. **(c)** $f_{apparent} = \left(\frac{u + u/5}{u}\right) f = \frac{6}{5} f =$

Wavelength remains constant

15. **(d)** Consider a shell of thickness (

inner and outer surfaces of this

$\frac{dQ}{dt}$ = rate of flow of heat thro

$= 40.05\%$

$V_0)_B$

$_B - (W_0)_A = 1.95\ eV$

$\dfrac{h}{2mK} \Rightarrow \lambda \propto \dfrac{1}{\sqrt{K}}$

$.5 \Rightarrow T_A = 2eV$

.

.

values of *P*.

ght line.

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

1.2f

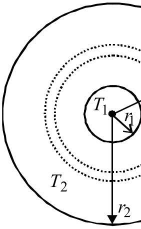
(unchanged) in this case.

dr) and of radii (*r*) and the temperature of

shell be *T*, (*T* – *dT*)

ugh it

$= -4\pi K r^2 \dfrac{dT}{dr} \quad (\because\ A = 4\pi r^2$



To measure the radial rate of l
since the area of the surface thr

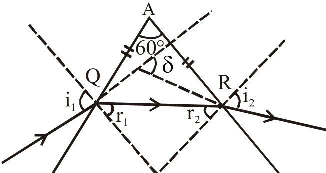
Then, $\left(\dfrac{dQ}{dt}\right)\displaystyle\int_{r_1}^{r_2} \frac{1}{r^2}\,dr = -4\pi K \int_{T_1}^{T_2}$

$$\frac{dQ}{dt}\left[\frac{1}{r_1} - \frac{1}{r_2}\right] = -4\pi K\,[$$

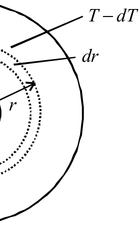
or $\quad \dfrac{dQ}{dt} = \dfrac{-4\pi K r_1 r_2 (T_2 - T}{(r_2 - r_1)}$

16. **(b)** W_{ext} = negative of area with vol
W(adiabatic) > W(isothermal)

17. **(a)**



)



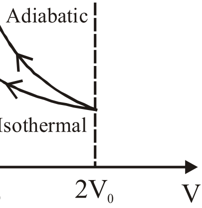
heat flow, integration technique is used,
ough which heat will flow is not constant.

dT

$[T_2 - T_1]$

$\left.T_1\right)$ $\therefore \quad \frac{dQ}{dt} \propto \frac{r_1 r_2}{(r_2 - r_1)}$

ume-axis



Given AQ = AR and $\angle A = 60°$

$\therefore \quad \angle AQR = \angle ARQ = 60°$

$\therefore \quad r_1 = r_2 = 30°$

Applying Snell's law on face A

$1. \sin i_1 = \mu \sin r_1$

$\Rightarrow \sin i_1 = \sqrt{3} \sin 30° = \sqrt{3} \times \frac{1}{2}$

$\therefore \quad i_1 = 60°$

Similarly, $i_2 = 60°$

In a prism, deviation

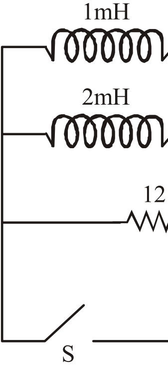
$\delta = i_1 + i_2 - A = 60° + 60° - 60° =$

18. **(a)** Both magnetic and electric fiel
wave.

19. **(a)** At t = 0, current will flow only

$\therefore I_{\min} = \frac{5}{12}$

At $t \to \infty$ both L_1 and $_2$ behav



$\therefore R_{\text{eff}} = \frac{3}{2}, \; I_{\max} = \frac{10}{3}$

$\frac{I_{\max}}{I_{\min}} = 8$

20. **(d)** For the first minima,

$\theta = \frac{\eta\lambda}{a} \quad \Rightarrow \quad \sin 30° = \frac{\lambda}{a} = \frac{1}{2}$

First secondary maxima will be

B.

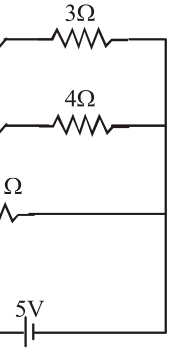
$= \frac{\sqrt{3}}{2}$

$= 60°$

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

in 12Ω resistance

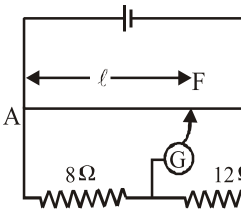
ve as conductign wires



at

21. **(11.75)** Let E_1 and E_2 be potential

$$\frac{E_2}{E_1} = \frac{IX}{IR} = \frac{X}{R} \quad \text{or} \quad X = \frac{E_2}{E_1} R$$



But $\frac{E_2}{E_1} = \frac{\ell_2}{\ell_1}$

so $X = \frac{\ell_2}{\ell_1} R = \frac{68.5}{58.3} \times 10$

22. **(6.66) Given :** Speed $V = 54\ \text{kmh}^{-1}$

Moment of inertia, $I = 3\ \text{kgm}^2$

Time $t = 15\text{s}$

$$\omega_i = \frac{V}{r} = \frac{15}{0.45} = \frac{100}{3} \quad \omega_f = 0$$

$$\omega_f = \omega_i + \alpha t$$

$$0 = \frac{100}{3} + (-\alpha)(15) \qquad \Rightarrow$$

Average torque transmitted by b

$$\tau = (I)(\alpha) = 3 \times \frac{100}{45} = 6.66\ \text{kgn}$$

23. **(0.05)** Given : $A = 4\ \text{m}^2$, $e = 0.32$

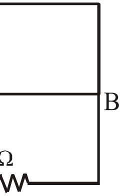
B_1 is the initial magnetic induc

$B_2 = 0.2\ B_1$

$$e = \frac{d\phi}{dt} = \frac{A(B_1 - B_2)}{\Delta t} \quad \text{or} \quad 0.32$$

0.16

drops across R and X so



$= 11.75\Omega$

$= 15\ ms^{-1}$

$\alpha = \dfrac{100}{45}$

rakes to the wheel

$^2s^{-2}$

V, $dt = 0.5 sec.$

tion and when it is reduced to 20%

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

24. **(0.94)** Time period of a physica

$$T = 2\pi\sqrt{\frac{I}{mgh}}$$

where *I* is the moment of inertia
of the pendulum about an axis
through the pivot, *m* is the ma
from the pivot to the centre of
In this case, a solid disc of *R* os
axis perpendicular to the plane

$$\therefore\ I = \frac{mR^2}{2} + mr^2 = \frac{mR^2}{2} + m\left(\frac{R}{4}\right.$$

$$= \frac{9mR^2}{16} \qquad \left(\because r = \frac{R}{4}\right)$$

Here, $R = 10$ cm $= 0.1$ m, $h = \frac{R}{4}$

$$\therefore\quad T = 2\pi\sqrt{\frac{\frac{9mR^2}{16}}{\frac{mgR}{4}}} = 2\pi\sqrt{\frac{9R}{4g}}$$

$$= 2\pi\sqrt{\frac{9\times0.1}{4\times10}} = 2\pi\times\frac{3}{2}\times\frac{1}{10} = 0.9$$

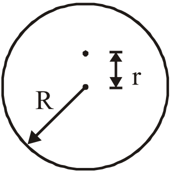
25. **(488.9)** $\frac{1}{\lambda_1} = R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) =$

$$\frac{1}{\lambda_2} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right) = \frac{3R}{16}$$

$$\therefore \frac{\lambda_2}{\lambda_1} = \frac{80}{108}$$

$$\lambda_2 = \frac{80}{108}\lambda_1 = \frac{80}{108}\times 660 = 48$$

l pendulum is



a

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.

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

4 s

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

8.9nm.

ISTRY

27. (b) CuF_2 is both paramagnetic and

28. (c) s-character $\propto$ bond angle

For 25% s character (as in sp^3

33.3% s character (as in sp^2 hy

50% s character (as in sp hybri

Similarly, when the bond angl

will decrease accordingly.

Decrease in angle = 120° – 109.

Decrease in s-character = 33.3 –

Actual decrease in bond angle =

Expected decrease in s-charact

$$= \frac{8.3}{10.5} \times 4.5 = 3.56\%$$

Thus, the s-character should

$= 25 - 3.56 = 21.44\%$

29. (d) $CH_3-COONH_4 \xrightarrow{\Delta} CH_3$

$\xrightarrow{\Delta/P_2O_5} \underset{(Y)}{CH_3-CN} \xrightarrow{H_3}$

30. (a) Be – $1s^2 2s^2$; B – $1s^2 2s^2 2p^1$; C –

increases along the period. But

atoms with fully or partly fille

high ionisation energy.

31. (a) From data 1 and 3, it is clear th

remains unaffected. Hence ra

keeping [A] constant, [B] is d

$\propto [B]^3$.

32. (b) (i) HCl is a strong acid. Hen

(ii) NaCl is a salt of strong ac

and hence its pH is 7.

(iii) $NH_4Cl + H_2O \rightleftharpoons NH$

$\therefore$ The solution is acidic

(iv) $NaCN + H_2O \rightleftharpoons NaO$

$\therefore$ The solution is basic a

$\therefore$ Correct order for incre

$HCl < NH_4Cl < NaCl < Na$

d coloured.

hybrid orbital), bond angle is 109.5°, for
ybrid orbital), bond angle is 120° and for
d orbital), bond angle is 180°.
e decreases below 109.5°, the *s*-character

$.5° = 10.5°$
$- 25 = 8.3$
$= 109.5° - 105° = 4.5°$
ter

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

$\underset{(X)}{-\ CONH_2}$

$\xrightarrow{O^{\oplus}} \underset{(Z)}{CH_3 - COOH}$

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

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

ce its pH is lowest among the others.
cid and strong base so it is not hydrolysed

$_4OH + HCl$
and pH is less than that of 0.1 M HCl.
$OH + HCN$
nd pH is more than that of 0.1 M HCl.
ease in pH is
CN.

34. (b) All proteins are not found in L
D or L

35. (a) $2CuSO_4 + 2Na_2CO_3 + H_2O$ —

36. (c) For metal, as temperature incre
ductivity decreases.

37. (d) In a unit cell, W atoms at the c

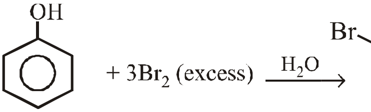
O-atoms at the centre of edges

Na-atoms at the centre of the c

$W : O : Na = 1 : 3 : 1$

Hence, formula $= NaWO_3$

38. (d) With Br_2 water, phenol gives 2



39. (c) V_2O_5 is used as catalyst in con

40. (c) The dipole moment of symmetr

Triangular plar

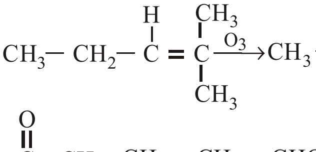
41. (a) $NaCl(s) \rightarrow NaCl(l)$

Given that : $\Delta H = 30.5\ kJ\ mol^{-1}$

$\Delta S = 28.8\ JK^{-1}mol^{-1} = 28.8 \times 10$

By using $\Delta S = \frac{\Delta H}{T} = \frac{30.5}{28.8 \times 10}$

42. (a)



-form but they may be present in form of

$\longrightarrow CuCO_3.Cu(OH)_2 + 2Na_2SO_4 + CO_2$

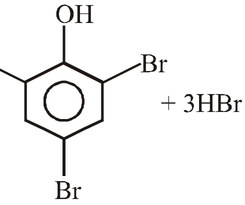
eases, resistance increases and hence con-

orner $= \frac{1}{8} \times 8 = 1$

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

cube = 1

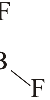
, 4, 6- tribromophenol.



2, 4, 6-Tribromophenol

ntact process of manufacturing H_2SO_4

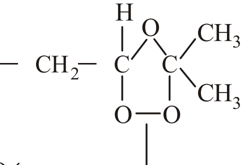
rical molecule is zero.



nar (symmetrical molecule)

$^{-3}$ kJ K^{-1} mol^{-1}

$\overline{^{-3}} = 1059\,K.$



44. **(b)** Radioactive decay follows firs

Decay constant $(\lambda) = \frac{0.693}{t_{1/2}} =$

Given, $R_0 = 100$ $\therefore$

and $t = \frac{2.303}{\lambda}\log\frac{[R]_0}{[R]} = \frac{2.3}{\left(\frac{0.6}{57}\right.}$

$= \frac{2.303 \times 5730}{0.693} \times 0.0969 = 184$

45. **(d)** Hybridisation

$\underset{d^2sp^3}{[Fe(CN)_6]^{4-}}, \underset{d^2sp^3}{[Mn(CN)_6]^{4-}},$

$\underset{d^2sp^3}{[Co(NH_3]^{3+}}, \underset{sp^3d^2}{[Ni(NH_3)_6]^{2+}}$

Hence $[Ni(NH_3)_6]^{2+}$ is outer

46. (409.5) According to combined gas e

$\frac{PV}{T} = \frac{P_1V_1}{T_1}$

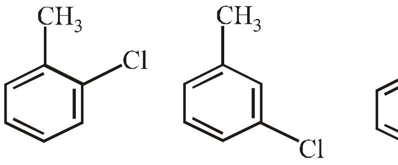
$P = 1$ atm, $P_1 = \frac{3}{4}$ atm (on redu

$V = v, V_1 = 2v, T = 273K, T_1 =$

$\frac{1 \times v}{273} = \frac{3 \times 2v}{4 \times T_1}$

$T_1 = \frac{3 \times 2 \times 273}{4} = 409.5\,K$

47. **(4)** C_7H_7Cl has 4 isomers



t order kinetics. therefore,

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

$$R = 80$$

$$\frac{03}{\left(\frac{93}{30}\right)} \log \frac{100}{80}$$

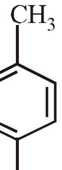
45 years

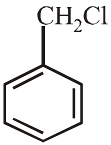
r orbital complex.

equation,

ucing by 25%)

?





48. **(8.4)** Normality of $H_2O_2 = \frac{\text{vol.}}{}$

Volume of (1N) H_2O_2 solution

$\therefore$ Volume strength of 1.5 N

$= 1.5 \times 5.6 = 8.4$ volumes.

49. **(26)** ABAB.... is hexagonal close pa
% and, empty space = 26%.

50. **(3)** $M_2O_x \xrightarrow{\text{Reduction}} M$

Eq. of M_2O_x = eq. of Metal

$$\frac{\text{Wt. of } M_2O_x}{\text{Eq. wt. of } M_2O_x} = \frac{\text{Wt. of}}{\text{Eq. wt. o}}$$

$$\frac{4}{\frac{2 \times 56 + x \times 16}{2x}} = \frac{2.8}{\frac{56}{x}}$$

On solving we get,

$$\Rightarrow \frac{4}{56 + 8x} = \frac{2.8}{56} \Rightarrow \frac{1}{14 + 2x}$$

Hence, the oxide is M_2O_3.

MATHE

51. **(d)** $T_4 = {}^nC_3\, x^{n-3} \left(\frac{\alpha}{2x}\right)^3 \Rightarrow {}^n$

If $n = 6$, then ${}^6C_3 \left(\frac{\alpha}{2}\right)^3 = 20$

52. **(b)** Given equation is $x^2 + px + q$

Sum of roots = $\tan 30° + \tan 15$

Product of roots = $\tan 30° . \tan$

$$\tan 45° = \frac{\tan 30° + \tan 15°}{1 - \tan 30° . \tan 15°} =$$

$$\Rightarrow -p = 1 - q \Rightarrow q - p = 1$$

strength

5.6

= 5.6 volumes.

H_2O_2

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

Metal

f Metal

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

MATICS

$C_3\ x^{n-6}\left(\frac{\alpha}{2}\right)^3 = 20$

$\Rightarrow \alpha = 2$

$= 0$

$° = -p$

$15° = q$

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

or $(a+c)(a+b), (b+c)(a+b$

A.P. $\Rightarrow \frac{1}{b+c}, \frac{1}{c+a}, \frac{1}{a+b}$ a

[dividing by $(a+b)(b+c)(c+$

54. **(d)** Let $M(h, k)$ be the mid-point

of chord AB where

$\angle ACB = \frac{2\pi}{3}$

$\therefore \angle ACM = \frac{\pi}{3}$

Also $CM = 3\cos\frac{\pi}{3} = \frac{3}{2}$

$\Rightarrow \sqrt{h^2+k^2} = \frac{3}{2} \Rightarrow h^2+k^2 =$

$\therefore$ Locus of (h, k) is $x^2+y^2 =$

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

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

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

$+ \tan^{-1}(c) +$

$= \tan^{-1}(a) + \tan^{-1}(c)$

$\therefore \frac{dy}{dx} = 0$

56. **(d)** $\{x^2\} - 2\{x\} \geq 0$

$\Rightarrow \{x\}(\{x\} - 2\} \geq 0$

$\Rightarrow \{x\} \leq 0$ or $\{x\} \geq 2$

Second case is not possible.

Hence $\{x\} = 0$, as $\{x\} \leq [0, 1)$

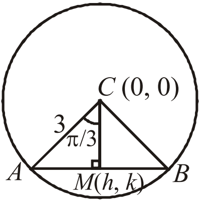
Hence range of $f(x)$ contains o

57. **(d)** Here $p = 7$ and $\alpha = 30°$

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

are in A.P.

$-a)]$



$= \frac{9}{4}$

$= \frac{9}{4}$

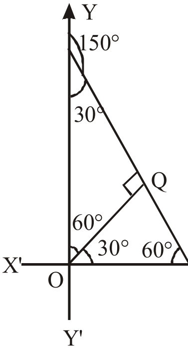
$^{-1}\left(\frac{3+2\log_e x}{1-6\log_e x}\right)$

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

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

only one element 0.

.



or $\sqrt{3}\,x + y = 14$

58. **(c)** $I = \int \frac{dx}{\cos x + \sqrt{3}\sin x}$

$$I = \int \frac{dx}{2\left[\frac{1}{2}\cos x + \frac{\sqrt{3}}{2}\sin x\right]}$$

$$= \frac{1}{2}\int \frac{dx}{\left[\sin\frac{\pi}{6}\cos x + \cos\frac{\pi}{6}\sin x\right.}$$

$$\Rightarrow \; I = \frac{1}{2}\int \operatorname{cosec}\left(x + \frac{\pi}{6}\right)dx$$

$$\because \int \operatorname{cosec} x \, dx = \log|(\tan x/2$$

$$\therefore \; I = \frac{1}{2}\log\tan\left(\frac{x}{2} + \frac{\pi}{12}\right) + C$$

59. **(c)** Given $\frac{\tan 3\theta - 1}{\tan 3\theta + 1} = \sqrt{3}$

$$\Rightarrow \sqrt{3}\,(\tan 3\theta + 1) = \tan 3\theta - 1$$

$$\Rightarrow \sqrt{3}\tan 3\theta + \sqrt{3} = \tan 3\theta - 1$$

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

$2)\,| + C$

C

$$\Rightarrow \tan 3\theta(\sqrt{3}-1) = -(1+\sqrt{3})$$

$$\Rightarrow \tan 3\theta = \frac{-(\sqrt{3}+1)}{(\sqrt{3}-1)} = \frac{-(1+}{-(1-}$$

$$\Rightarrow \tan 3\theta = \tan 105° = \tan\frac{7\pi}{12}$$

[**Note :** $\tan\theta = \tan\alpha \Rightarrow \theta = n\pi$

$$\therefore\ 3\theta = n\pi + \frac{7\pi}{12} \Rightarrow \theta = \frac{n\pi}{3} +$$

60. **(c)** Equation of normal in slope fo
$y = mx - 2Am - Am^3$

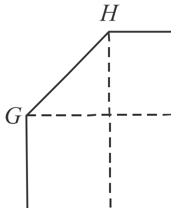
$$= mx - 2\left(\frac{1}{4}\right)m - \left(\frac{1}{4}\right)m^3$$

$\Rightarrow 4mx - 4y - m^3 - 2m = 0$
$\because$ $(a, 0)$ lies on the normal. Th
$\Rightarrow m(m^2 + 2 - 4a) = 0$
$\Rightarrow m = 0$ or $m^2 + 2 - 4a = 0$
If $m = 0$, then from (i),
$y = 0$ i.e., x-axis is one normal.
If $m^2 + 2 - 4a = 0 \Rightarrow m^2 = 4a -$

$$\Rightarrow 4a - 2 > 0 \Rightarrow a > \frac{1}{2}.$$

61. **(d)** By the diagram only 2 rectangl
$\therefore$ number of favourable cases
Total number of cases $= {}^8$

$$\therefore \text{ required probability} = \frac{2}{{}^8C_4}$$



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

$\tau + \alpha$]

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

rm on $y^2 = 4Ax$ is

...(i)

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

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

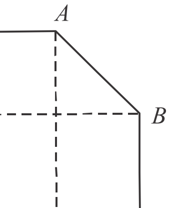
2 $\quad [\because m^2 > 0]$

es are formed $ADEH$, $GFCB$.

$= 2$

C_4

$= \frac{1}{35}$



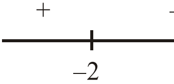
62. **(a)** $f(x) = x^3 - 3x^2 - 24x + 5$

For increasing, $f'(x) > 0, 3x^2$

$\Rightarrow x^2 - 2x - 8 > 0 \Rightarrow x^2 - 4x +$

$\Rightarrow (x+2)(x-4) > 0$.

Now, by the sign scheme for 3.



$\Rightarrow x \in (-\infty, -2) \cup (4, \infty)$

63. **(c)** Given that $y = y(x)$ and $x\cos$
For $x = 0$ in (i) we get $y = \pi$
Differentiating (i) with respect

$-x\sin y . y' + \cos y + y'\cos x -$

$\Rightarrow y' = \dfrac{y\sin x - \cos y}{\cos x - x\sin y}$

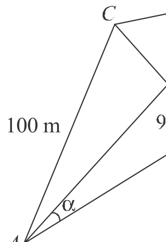
$\Rightarrow y'(0) = 1$ (Using $y(0) = \pi$)
Differentiating (ii) with respec

$\left(y'\sin x + y\cos x + \sin y.\right.$

$y'' = \dfrac{-(-\sin x - \sin y - x\cos y}{(\cos x - x\,\mathrm{s}}$

$\Rightarrow y''(0) = \dfrac{\pi(1) - 0}{1} = \pi.$

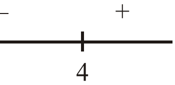
64. **(b)** *DP* is a clock tower standing a



$-6x-24>0$

$2x-8>0$

$x^2-6x-24,$



$y+y\cos x=\pi$ ...(i)

t to x, we get,

$y\sin x=0$

....(ii)

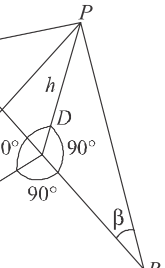
ct to x, we get,

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

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

$\text{in } y)^2$

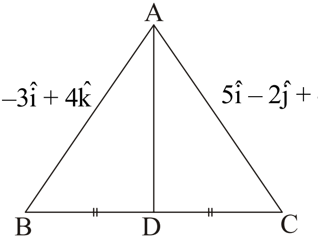
t the middle point D of BC.



$\therefore \cot\beta = \sqrt{(\operatorname{cosec}^2\beta - 1)} = \sqrt{(}$

In the triangles PAD and PBD,
$AD = h\cot\alpha = 3.2\,h$ and $BD =$
In the right angled ΔABD, AB^2
$\Rightarrow 100^2 = [(3.2)^2 + (2.4)^2]\,h^2 =$

65. **(b)**



$$\overrightarrow{AD} = \frac{(-3+5)\hat{i} + (0-2)\hat{j} + (}{2}$$

$$= \frac{2\hat{i} - 2\hat{j} + 8\hat{k}}{2} = \hat{i} - \hat{j} + 4$$

$\therefore$ length of median

$$= |\overrightarrow{AD}| = \sqrt{(1)^2 + (-1)^2 + (4)^2}$$

66. **(a)** $\sim[p \vee (\sim p \vee q)] \equiv \sim p \wedge \sim (\sim$

$\equiv \sim p \wedge (\sim(\sim p) \wedge \sim q)$

$\equiv \sim p \wedge (p \wedge \sim q)$.

67. **(a)** $f(x) = x^p \sin\frac{1}{x}, x \neq 0$ and $f(x$

Since at $x = 0$, $f(x)$ is a continu

$$\therefore \lim_{x\to 0} f(x) = f(0) = 0$$

$$\Rightarrow \lim_{x\to 0} x^p \sin\frac{1}{x} = 0 \Rightarrow p > 0$$

$f(x)$ is differentiable at $x = 0$, if

$$x^p \sin\frac{1}{x} - 0$$

$(5.76)} = 2.4$

,

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

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

$16\, h^2 \Rightarrow h = 25$ m.

$4\hat{k}$

$4 + 4)\hat{k}$

$\hat{k}$

$= \sqrt{18}$

$p \vee q)$

$) = 0, x = 0$

ous function

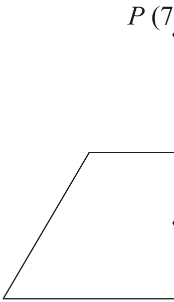
$\lim_{x \to 0} \frac{f(x) - f(0)}{x - 0}$ exists

$\Rightarrow \lim_{x\to 0} x^{p-1} \sin\frac{1}{x}$ exists

$\Rightarrow p-1>0$ or $p>1$

$\therefore$ for $0<p\le 1$, f(x) is a contin

68. (d) Let M be the foot of perpendicu
PM is normal to the plane. So
through $P(7, 14, 5)$ and has d.r



Therefore, its equation is $\frac{x-}{2}$

$\Rightarrow x = 2r+7,\ \ y = 4r+14,\ \ z$

Co-ordinates of M be $(2r+7,$

Since M lies on the plane $2x+$

$2(2r+7)+4(4r+14)-(-r+$

Co-ordinates of foot of perpen
PM = Length of perpendicular

$= \sqrt{(1-7)^2+(2-14)^2+(8}$

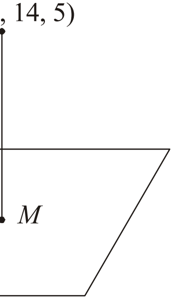
69. (c) $\Delta(x) = \begin{vmatrix} e^x & \sin x \\ \cos x & \ln(1+x^2) \end{vmatrix}$

$= e^x \ln$

So, $\lim_{x\to 0} \frac{\Delta(x)}{x} = \lim_{x\to 0} \frac{e^x \ln(1+}{}$

uous function at x = 0 but not differentiable.

ular from (7, 14, 5) to the given plane, then
, its d.r.'s are 2, 4, – 1. Since *PM* passes
.'s 2, 4, – 1.



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

$$= -r+5$$

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

$-4y - z = 2,$ therefore

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

dicular are $M(1, 2, 8)$.
from P

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

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

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

70. **(a)** $\tan^{-1} x + \tan^{-1} \frac{1}{y} = \tan^{-1} 3$

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

$$\Rightarrow y = \frac{1+3x}{3-x} > 0 \qquad [\because \text{ x ar}$$

$\Rightarrow x - 3 < 0 \Rightarrow x < 3$ or $x = 1$

$\therefore y = 2, 7$

solution set is $(x, y) \in \{(1, 2),$

71. **(64)** A selection of 3 balls so as to in
in the following 3 mutually ex
(i) 1 black ball and 2 others = 3
(ii) 2 black balls and one other
(iii) 3 black balls and no other
$\therefore$ Total number of ways = 45 +

72. (19.5)

Class	Frequency	C
5 – 10	5	
10 – 15	6	
15 – 20	15	
20 – 25	10	
25 – 30	5	
30 – 35	4	
35 – 40	2	
40 – 45	2	

Here N = 49. $\qquad \therefore \frac{N}{2} = \frac{49}{2}$

The cumulative frequency just
class is 15–20. Thus 15– 20 is t
= 11, $h = 5$

$$\therefore \quad \text{median} = \ell + \frac{N/2 - F}{f} \times$$

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

nd y are positive]

, 2

$(2, 7)\}$

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

$C_1 \times {}^6C_2 = 3 \times 15 = 45$

$= {}^3C_2 \times {}^6C_1 = 3 \times 6 = 18$

$= {}^3C_3 \times {}^6C_0 = 1$

$+ 18 + 1 = 64.$

umulative Frequency
5
11
26
36
41
45
47
49
N = 49

9
$= 24.5$

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

h

73. (3.75) α, β are roots of the equation 2

Therefore sum of roots $(\alpha + \beta$

And product of roots $(\alpha.\beta) =$

$$\text{Now, } \begin{vmatrix} 0 & \beta & \beta \\ \alpha & 0 & \alpha \\ \beta & \alpha & 0 \end{vmatrix}$$

$= 0\,|0 - \alpha^2| - \beta\,|0 - \alpha\beta| + \beta\,|\alpha$

$= \alpha\beta^2 + \beta\alpha^2 = \alpha\beta(\alpha+\beta)$

$= \frac{5}{2}\left(\frac{-3}{2}\right) = \frac{-15}{4} = -3.75$

74. (21.5) Let $I = \int_{-3}^{2} \{|x+1| + |x+2| + |x$

Breaking points are

$x + 1 = 0 \Rightarrow x = -1$

$x + 2 = 0 \Rightarrow x = -2$

$x - 1 = 0 \Rightarrow x = 1$

$\therefore\ I = \int_{-3}^{-2} f(x)\,dx + \int_{-2}^{-1} f(x)\,dx$ -

where $f(x) = |x+1| + |x+2| +$

Now, $I_1 = \int_{-3}^{-2} [-(x+1) - (x+2$

$= -\left[\frac{x^2}{2} + x + \frac{x^2}{2} + 2x + \frac{x^2}{2} +\right.$

$I_2 = \int_{-2}^{-1} [-(x+1) + (x+2) - (x$

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

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

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

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

$$-1|\} \, dx$$

$$+\int_{-1}^{1} f(x)\,dx + \int_{1}^{2} f(x)\,dx$$

$$|x-1|$$

$$) - (x-1)\big]\,dx$$

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

$$-1)\big]\,dx$$

$$\Big|^{-1}$$

$$= \frac{-x^2}{2} + 2x\Big|_{-2}^{-1} = \left(\frac{-1}{2} - 2\right)$$

$$= -\frac{5}{2} + 6 = \frac{7}{2}$$

$$I_3 = \int_{-1}^{1} [(x+1) + (x+2) - (x -$$

$$= \int_{-1}^{1} (x+4)\,dx \;= \frac{x^2}{2} + 4x\Big|^{1}$$

$$I_4 = \int_{1}^{2} [(x+1) + (x+2) + (x-1$$

$$= \int_{1}^{2} (3x+2)\,dx = \frac{3x^2}{2} + 2x\Big|$$

$$\therefore \; I = I_1 + I_2 + I_3 + I_4$$

$$= \frac{7}{2} + \frac{7}{2} + 8 + \frac{13}{2} = \frac{43}{2}$$

$$= \frac{27+16}{2} = \frac{43}{2} = 21.5$$

75. (4.5) Given curves are, $y = 2x - x^2$
and $y = -x$
Putting the value of y in (i),

$$-x = 2x - x^2$$

$$\Rightarrow x(x-3) = 0 \Rightarrow x = 0, 3$$

$\therefore$ area under the curve

$$= \int_0^3 [(2x - x^2) - (-x)]\,dx$$

$$= \int_0^3 (3x - x^2)\,dx = \left[\frac{3x^2}{2} - \frac{x^3}{3}\right]_0^3$$

$-(-2-4)$

$1)\big]\,dx$

$= 8$

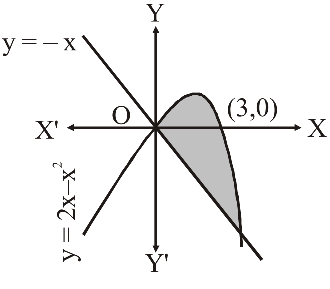
-1

$1)\,dx\big]$

${}^{2}_{1} = \frac{13}{2}$

.....(i)

.....(ii)



1. (d) Let the scooterist velocity be v
$1000 + (10 \times 100) = v \times 100$

$\Rightarrow 100\,v = 2000 \Rightarrow v = \frac{2000}{100}$

2. (b) We have, $F = kx$
where, F, x and k are force, len
$\therefore \quad 5 = kx$
and $7 = ky$
Multiplying eq. (2) by 2
$14 = 2ky$
Subtracting eq. (1) from (3),
$14 - 5 = 2ky - kx$ or $9 = k(2y -$
Hence, required length $= 2y -$
3. (b) In the given equation $[\rho] = [b]$
$\therefore [b] = [\rho]/[x]$. But ρ is mass p
$[b] = ML^{-1}/L = ML^{-2}T^0$
4. (d) Point A is at rest w.r.t. motion,
horizontal velocities. Hence, v
5. (d) $mg = 2TL \Rightarrow \pi r^2 Ldg = 2TL \Rightarrow$
This relation is independent o

6. (d) $\omega_{rod} = \omega_{point} = \left(\frac{v_{rel}}{r}\right)$,

v_{rel} represents the velocity of c
$= \frac{3v - v}{r}$ and 'r' being the dis
$= \frac{2v}{r}$
7. (d) Both are diatomic gases and C
8. (b) More the initial temperature m
Hence, $T_3 > T_2 > T_1$
o
The rate of cooling decreases
between body and surroundin

9. (c) $\frac{1}{C_\infty} = \frac{1}{C_\infty + C} + \frac{2}{C} = \frac{3C + 2C}{C_\alpha (C_\alpha +}$

v. Then

$\frac{0}{} = 20\text{m}/\text{s}$

ngth and constant respectively.

......(1)

......(2)

......(3)

x)

x

[x];

er unit length and x is distance, therefore

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

$_B = 2v.$

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

f L.

one point w.r.t. other.

tance between them.

$C_P - C_V = R$ for all gases.

nore is the rate of cooling.

or

with decrease in temperature difference

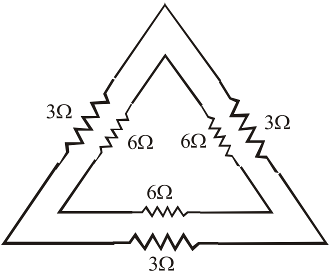
g.

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

10. **(b)** R increases with increasing ter
V = IR

Slope of graph $= \frac{I}{V} = \frac{1}{R}$; Slo
is less. This concludes that T_1

11. **(c)** $R_{eq} = \frac{R_1R_2}{R_1+R_2}$ (Parallel) $= \frac{4\times}{4+}$



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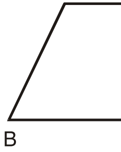
≡ 

12. **(d)** $i_R = \frac{V_0}{R} = \frac{100}{20} = 5$, $i_L = \frac{V_0}{X_L}$

Current, $i = \sqrt{i_R^2 + (i_C - i_L)^2}$ =

13. **(a)** $f_{max} = \mu mg$, $a_{max} = \mu g$.

If A is the amplitude $a_{max} =$ A

Therefore, $A = \frac{\mu g}{4\pi^2 V^2}$.

14. **(c)** Total time taken to travel dista

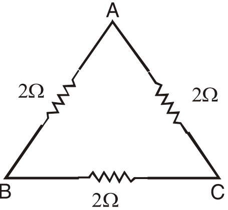
$\frac{d}{2n_1} + \frac{d}{2n_2} = d\left(\frac{n_1+n_2}{2n_1n_2}\right) =$

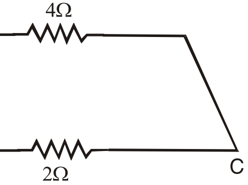
mp:

pe 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.

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





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

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

$\omega^2 = 4\pi^2 AV^2 = \mu g$.

nce d is :

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

However, if A_{12} and A_{34} hav
phase of A_{12} and A_{34}, no fring

16. (a) $mvr = \frac{nh}{2\pi}, \ \lambda = \frac{h}{mv};$

Using the two concept we get,

$$2\pi r = \frac{1 \times h}{mv}$$

$$\lambda = \frac{h}{mv}$$

Divide (2) by (1), $\frac{2\pi r}{\lambda} = \frac{h \times m}{mv \times}$

17. (d) 1. $\lambda = \frac{0.693}{t^{1/2}}$ 2. R

Radioactivity at T_1 is $R_1 = \lambda$ N

Radioactivity at T_2 is $R_2 = \lambda$ N

$\therefore$ Number of atoms decayed i

$(T_1 - T_2) = (N_1 - N_2)$ or $\frac{R_1 -}{\lambda}$

i.e., $\alpha\,(R_1 - R_2)T$

18. (d) In the graph given, slope of cu

$$\left(\frac{\gamma P}{V}\right)_2 > \left(\frac{\gamma P}{V}\right)_1 \Rightarrow \gamma_2 > \gamma_1$$

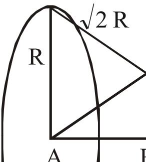
$$\gamma_{He} > \gamma_{O_2}$$

Since, $\gamma_{monoatomic} > \gamma_{diatomic}$

Hence, curve 2 corresponds

oxygen.

19. (b) $V_A = \frac{1}{4\pi \in_0}\left[\frac{Q_1}{R} + \frac{Q_2}{\sqrt{2}R}\right];$



e equal magnitude because of random
ges will be seen.

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

....(1)

....(2)

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

$$= \lambda N_t$$

N_1,

N_2

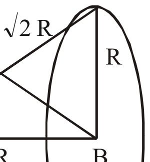
n time

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

rve 2 is greater than the slope of curve 1.

to helium and curve 1 corresponds to

$$V_B = \frac{1}{4\pi \in_0}\left[\frac{Q_2}{R} + \frac{Q_1}{\sqrt{2}R}\right]$$



$$V_A - V_B = \frac{1}{4\pi \in_0 R}\left[Q_1 + \frac{Q_2}{\sqrt{2}}\right.$$

Work done $= Q \times V = q \times (V_A -$

$$= \frac{q}{4\pi \in_0 R}\left[Q_1 + \frac{Q_2}{\sqrt{2}}\right.$$

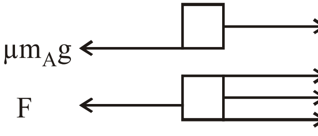
$$= \frac{q}{4\pi \in_0 R} \times \frac{1}{\sqrt{2}}\left[\sqrt{2}Q\right.$$

$$= \frac{q(Q_1 - Q_2)(\sqrt{2} - 1)}{(\sqrt{2}\ 4\pi \in_0 R)}$$

20. **(b)** When there is no change in li
Change in volume in liquid re

$\Delta V_{app} = V\gamma'_{app}\,\Delta\theta = V(\gamma'_{rea}$

21. **(10)** Here, $m_A = 0.5\text{kg}$; $m_B = 1\text{kg}$



Force on block A
$T = \mu m_A g$
Force acting on block B
$F = T + \mu m_A g + \mu(m_A + m_B)g$
From (1) & (2),
$F = \mu m_A g + \mu m_A g + \mu m_A g + \mu$
$F = 3\mu m_A g + \mu m_B g = \mu g(3m_A$
$= 0.4 \times 10 \times (3 \times 0.5 + 1) = 1$

22. **(10.6)**

Work done in going from a dis
of the earth, by a body of mass
$W = GMm\,(1/r_1 - 1/r_2)$,
For our case we should have
$1/2\,mv^2 = GMm\,[(1/R_e) - (1/10$

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

$V_B)$

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

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

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

$-\gamma'_{vessel})$

$\rightarrow T$

$\rightarrow \mu m_A g$
$\rightarrow T$
$\rightarrow \mu(m_A + m_B)g$

......(1)

......(2)

$m_B g$
$+ m_B)$
10N

tance r_1 to a distance r_2 away from centre
s m, is,

$0R_e)]$

23. **(300)**

Here the number of molecules

$$T_{final} = \frac{T_1 + T_2}{2} = \frac{200 + 400}{2}$$

24. **(83.3)** Power of source $= EI = 240 \times$

$$\Rightarrow \text{Efficiency } = \frac{140}{166} \Rightarrow \eta = 83$$

25. **(0.5)** Magnetic induction at O due t

$$B_Y = \frac{\mu_0}{4\pi} \times \frac{2\pi I(2r)^2}{\left[(2r)^2 + d^2\right]^{3/2}}$$

Similarly, the magnetic induct

$$B_X = \frac{\mu_0}{4\pi} \times \frac{2\pi Ir^2}{\left[r^2 + (d/2)^2\right]^{3/2}}$$

From eq. (1) & (2) $\qquad \frac{B_Y}{B_X}$

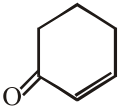
CHEM

26. **(b)** The molecule 2,3 - pentadiene
time it does not have any mirro

27. **(a)** In such a case there is no char

$$u = \sqrt{(3RT/M)} = \sqrt{(3PV/M}$$

The increase in temperature = 4
also the increase in pressure = 4

28. **(b)**  $+(CH_3)_2CHOH -$

29. **(d)** In N_2^+, there is one unpaired e is same. Hence,

$= 300\,K$

$\times 0.7 = 166$

3.3%

to coil Y is given by,

......(1)

tion at O due to coil X is given by

......(2)

$= \frac{1}{2}$

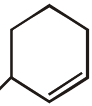
ISTRY

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

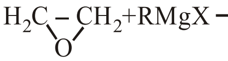
$\xrightarrow[{[(CH_3)_2CHO]_3Al}]{}$



$+ (CH_3)_2C = O$

electron hence it is paramagnetic.

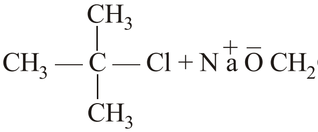
31. **(c)** We know that



32. **(c)** Tertiary amine do not have hy
not form an amide with acid ch

33. **(a)** No. of dipeptides = 2^n ; n= no.
be formed.

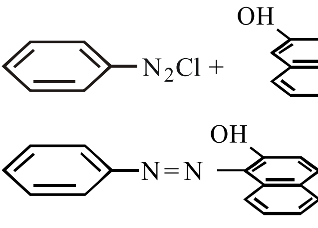
34. **(d)** Tertiary halides on treatment wi
undergo elimination resulting i
Synthesis)



35. **(b)** $s_0 = \sqrt{K_{sp}}; s_1 = K_{sp} / 0.02$ M

Obviously $s_0 > s_2 > s_1 > s_3$

36. **(b)** $C_6H_5NH_2 + NaNO_2 + HCl$ –



Red dye

37. **(c)** Multiple bonds formation tend
from sulphur to tellurium.
CS_2 (S = C = S) is moderately
CSe_2 (Se = C = Se) decompose
CTe_2 (Te = C = Te) does not ex

38. **(d)** Liquation is the principle base

39. **(c)** In NO_2^+ odd (unpaired) elect
unpaired electrons are persen

one more electron each for

$$\longrightarrow \underset{\substack{|\\ OMgX}}{CH_2}-\underset{\substack{|\\ R}}{CH_2} \xrightarrow[-Mg(OH)X]{H_2O} \underset{\substack{|\\ OH}}{CH_2}-\underset{\substack{|\\ R}}{CH_2}$$

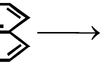
drogen atom to replace Cl. Hence it will
loride.
of amino acids i.e., $2^2 = 4$ dipeptides can

th base, such as sodium methoxide, readily
n the formation of alkenes. (Williamson's

$$CH_3 \xrightarrow{E2} CH_3-\underset{\substack{|\\ CH_3}}{C}=CH_2$$

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

$$\xrightarrow[0°C]{} C_6H_5N = NCl$$



lency with carbon and nitrogen decreases

stable,
es readily whereas,
xist
d on difference in melting points.
tron is removed. In peroxides (O_2^{2-}) no
t as the antibonding pi M.O.'s acquired

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

40. **(a)** The two solutions are isotonic

41. **(b)** Hydrated $CoCl_2 . 6H_2O$ is p
$[Co(H_2O)_6]^{2+}$ ions. If this is p
coloured tetrahedral ions [Co(

$$[Co(H_2O)_6]^{2+} \rightleftharpoons [Co(H_2O)$$
pink blue

42. **(c)** In $(NH_4)_2 [(TiCl_6)]$, Ti^{4+} ($3d^0$
In $K_2Cr_2O_7$, Cr^{6+} ($3p^6$ d^0) has n
In $CoSO_4$, Co^{2+} (d^7) has unpa
paramagnetic and coloured.
In $K_3[Cu(CN)_4]$, Cu^+ ($3d^{10}$), h

43. **(b)** $\log K = \log A - \frac{E_a}{2.303R} \frac{1}{T}$ (A

Plot of log K Vs 1/T gives a str

44. **(b)**
- Li does not form peroxide
- Solubility of carbonates down the group.
- The increasing order of $Li^+ > Na^+ > K^+ > Rb^+ > C$
- Cesium used in photoel statements (b) is the only

45. **(d)** Cell reaction $Zn + Cu^{++} \longrightarrow$

$$E_1 = E^\circ_{cell} - \frac{0.059}{2} \log \frac{0.01}{1.0}$$

$$E_2 = E^\circ_{cell} - \frac{0.059}{2} \log \frac{1.0}{0.01}$$

$\therefore E_2 = (E^\circ_{cell} - 0.059)\,V$. Thu

46. **(69.60)** $\frac{P^\circ - P_S}{P^\circ} = \frac{w/m}{W/M}$; (640–60

$40/640 = 2.175 \times 78/m \times 39.08$
$m = 2.175 \times 78 \times 640 / 39.08 \times 4$

47. **(0.17)** $\Delta x = (h/4\pi) \times m \times \Delta v$

hence there will be no movement of H_2O.
ink coloured and contains octahedral
artially dehydrated by heating, then blue
$H_2O)_4]^{2+}$ are formed.

$_4]^{2+} + 2H_2O$

$4s^0$) has no unpaired electrons.
o unpaired electrons.
aired electrons in *d*-orbitals, so it is both

as no unpaired electron.

rrhenius equation)

aight line with slope $-E_a/2.303R$
e or superoxide due to it small size.
and biocarbonates increases on moving

size of hydrated ions of alkali metals is
s^+
lectric cells due to its low I.E. Hence
correct choice.

$\rightarrow Zn^{++} + Cu$

$$\therefore E_1 = (E^\circ_{cell} + 0.059)\,V$$

s, $E_1 > E_2$.

$0)/640 = wM/mW$

$40 = 69.458 \cong 69.60$

48. **(3.8)** $K = \frac{[H_3O^+][HCO_3^-]}{[CO_2][H_2O]^2}$ As pH

$K = \frac{[H_3O^+][HCO_3^-]}{[CO_2][H_2O]^2}$ (H_2O

constant)

$\frac{[HCO_3^-]}{[CO_2]} = \frac{K}{[H_3O^+]} = \frac{3.8\times}{10}$

49. **(136800)** ν for hydrogen like speci
$= \nu_H \times Z^2 = 15200 \times 3^2 = 15200$

50. **(32.06)** Calorific value of butane $= \frac{}{m}$

Cylinder consist 14 Kg of buta

$\therefore$ 1g gives = 45.8 kJ/

$\therefore$ 14000 g gives = $14000 \times$

Family need 20,000 kJ/day

So gas full fill the requirement

MATHE

51. **(b)** $(a^2 + b^2 + c^2)p^2 - 2(ab + bc +$
$+ b^2 + c$

$\Rightarrow (a^2p^2 - 2abp + b^2) + (b^2p^2$
$+ (c^2p^2 -$

$\Rightarrow (ap - b)^2 + (bp - c)^2 + (cp -$

$\Rightarrow ap - b = 0,\ bp - c = 0\ \&\ cp$

$= 6.0 [H_3O]^+ = 10^{-6}$

) is in excess, therefore its conc. remains

$$\frac{\times 10^{-6}}{)^{-6}} = 3.8$$

ies

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

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

ine means 14000 g of butane

/g

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

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

MATICS

$- cd)p$

$^2 + d^2 \le 0$

$^2 - 2bcp + c^2)$

$2cdp + d^2) \le 0$

$- d)^2 \le 0$

$- d = 0$

52. (c)

(a) $\log(a+2b)=\frac{1}{2}\log(a+2b)^2$

$=\frac{1}{2}\log(a^2+4b^2+4ab)$

$=\frac{1}{2}\log(12ab+4ab)$

$=\frac{1}{2}\log(2^4.ab)$

$=\frac{1}{2}(4\log 2+\log a+\log b)$

(b) Let $\frac{\log x}{b-c}=\frac{\log y}{c-a}=\frac{\log z}{a-b}=k$

$\Rightarrow \log x=k(b-c),\ \log y=k($

$\log z=k(a-b)$

$\therefore x^a\ .\ y^b\ .\ z^c=p^{k[a(b-c))+b($

$=p^{k(0)}=1$

where p is any arbitrary base

(c) Given expression

$=\log_{xyz}xy+\log_{xyz}yz+\log_{x}$

$=\log_{xyz}(xy\ .\ yz\ .\ zx)\ =\log_{x}$

$=2\log_{xyz}(xyz)=2\times 1=2$

53. (b) $\alpha+\beta+\gamma=\frac{\pi}{2}\ \Rightarrow \alpha+\gamma=\frac{\pi}{2}-$

so that $\cot(\alpha+\gamma)=\ \cot\left(\frac{\pi}{2}-\right.$

$\Rightarrow \frac{\cot\alpha\cot\gamma-1}{\cot\alpha+\cot\gamma}=\frac{1}{\cot\beta}$

$c-a),$

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

of the log.

$yz\ zx$

$yz(x^2 . y^2 . z^2)$

$\beta.$

$\beta\Big)$

54. **(c)** We know, $1+\omega+\omega^2+...+\omega^{n-}$

But $\omega^n = \cos\left(\frac{n\pi}{n}\right)+i\sin\left(\frac{n\pi}{n}\right.$

$= \cos\pi + i\sin\pi = -1$

and $1-\omega = 2\sin^2\frac{\pi}{2n} - 2i\sin$

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

Thus, $1+\omega+\omega^2+...+\omega^{n-1}$

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

$$= \frac{i\cos\frac{\pi}{2n}}{\sin\frac{\pi}{2n}} - i^2\frac{\sin\frac{\pi}{2n}}{\sin\frac{\pi}{2n}} = 1+i$$

55. **(a)** $C_1\,(1,0);\ C_2\,(0,-2)$

$r_1 = \sqrt{1+15} = 4,\ \ r_2 = \sqrt{4-3}$

$C_1C_2 = \sqrt{1+4} = \sqrt{5}$

$r_1 - r_2 = 3 \Rightarrow C_1C_2 < r_1 - r_2$

Hence, C_2 lies inside C_1.

56. **(d)**

(a) We have $|AB| = |A|\,|B|$

Also for a square matrix of orde
of the matrix A is multiplied b
common

$\therefore\ |3AB| = 3^3\,|A|\,|B| = 27(-1$

(b) Since A is invertible, therefore

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

$\Big)$

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

$\frac{\pi}{2n}\Big]$

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

$\cot\ (\pi/2\mathrm{n})$

$= 1$

er 3, $|\,\mathrm{kA}\,| = \mathrm{k}^{3}\,|\,\mathrm{A}\,|$ because each element

y k and hence in this case we will have k^{3}

$)(3) = -81$

A^{-1} exists and

$$\Rightarrow \det(A)\det(A^{-1}) = 1$$

$$\Rightarrow \det(A^{-1}) = \frac{1}{\det(A)}$$

(c) $(A+B)^2 = (A+B)(A+B)$

$= A^2 + AB + BA + \text{I}$

$= A^2 + 2AB + B^2$ i

57. **(b)** For trivial solution,

$$\begin{vmatrix} 1 & -2 & 1 \\ 2 & -1 & 3 \\ \lambda & 1 & -1 \end{vmatrix} \neq 0 \Rightarrow -5\lambda - 4$$

58. **(d)** $f(x) = |x-1| = \begin{cases} -x+1, & x<1 \\ x-1, & x \geq 1 \end{cases}$

Consider $f(x^2) = (f(x))^2$

If it is true it should be $\forall\ x$

$\therefore$ Put $x = 2$

LHS $= f(2^2) = |4-1| = 3$

RHS $= (f(2))^2 = 1$

$\therefore$ (a) is not correct

Consider $f(x+y) = f(x) + f(y)$

Put $x = 2, y = 5$ we get

$f(7) = 6; f(2) + f(5) = 1 + 4 = 5$

$\therefore$ (b) is not correct

Consider $f(|x|) = |f(x)|$

Put $x = -5$ then $f(|-5|) = \text{f}(5)$ =

$|f(-5)| = |-5-1| = 6$

$\therefore$ (c) is not correct.

Hence (d) is the correct alterna

59. **(d)** Let $a = \tan\ \theta$ and $b = \tan\phi$

$\therefore\ \sin^{-1}\left[\frac{2a}{1+a^2}\right] = \sin^{-1}\left[\frac{2\,\text{t}}{1+\ldots}\right.$

B^2

f $AB = BA$.

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

$= 4$

ative.

$\left.\begin{matrix} \text{an}\,\theta \\ \hline \end{matrix}\right]$

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

$= \sin^{-1}[\sin 2\phi] = 2\phi$

Thus, $\sin^{-1}\left[\frac{2a}{1+a^2}\right] = 2\tan^{-1}$

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

$\therefore \quad 2\tan^{-1}x = \sin^{-1}\left[\frac{2a}{1+a^2}\right]$

$= 2\tan^{-1} a + 2\,\mathrm{t}$

$\Rightarrow \quad \tan^{-1} x = \tan^{-1}a + \tan^{-1}$

$\tan^{-1} x = \tan^{-1}\frac{a+b}{1-ab}$

$\therefore \quad x = \frac{a+b}{1-ab}$

60. (a) We have,

$AB = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}\Bigg[$

$= \Bigg[\begin{matrix} \cos^2\theta\cos^2\phi + \cos\theta\cos\phi\,\mathrm{s} \\ \cos\theta\sin\theta\cos^2\phi + \sin^2\theta\,\mathrm{c} \end{matrix}$

$\cos^2\theta\cos\phi\sin\phi + \mathrm{c}$

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

$= \cos(\theta-\phi)\Bigg[\begin{matrix} \cos\theta\cos\phi & \cos\theta \\ \sin\theta\cos\phi & \sin\theta \end{matrix}$

Since $AB = 0$, $\therefore \cos(\theta - \phi) = 0$

$$\left.\frac{2\tan\phi}{1+\tan^2\phi}\right]$$

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

a and

b

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

$\tan^{-1} b$

b

$$\left.\begin{matrix}\cos^2\phi & \cos\phi\sin\phi \\ \cos\phi\sin\phi & \sin^2\phi\end{matrix}\right]$$

$\sin\theta\sin\phi$

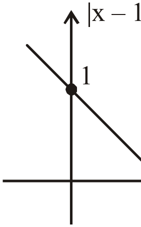
$\cos\phi\sin\phi$

$$\left.\begin{matrix}\cos\theta\sin\theta\sin^2\phi \\ +\sin^2\theta\sin^2\phi\end{matrix}\right]$$

$$\left.\begin{matrix}\theta\sin\phi \\ \theta\sin\phi\end{matrix}\right]$$

0

61. **(c)** Since | x | is not diff. at x = 0



$\Rightarrow |x-1|$ is not diff at x = 1.

$x^n |x|$ in n times diff. at x = 0

$\Rightarrow (x-1)^2 |x-1|$ is twice diff

but not thrice diff. at x = 1

62. **(c)** $f(x)=\dfrac{1}{x-1}$ is discontinuous at

$(gof)(x)=g(f(x))=-\dfrac{(x-1)}{(2x-1)(x}$

Hence the set of points where (

63. **(a)** $\sum\limits_{r=0}^{m} {}^{n+r}C_n = \sum\limits_{r=0}^{m} {}^{n+r}C_r \quad (\because {}^{n}$

$= {}^{n}C_0 + {}^{n+1}C_1 + {}^{n+2}C_2 + {}^{n+}$

Using, ${}^{n}C_0 = 1 = {}^{n+1}C_1$

$= ({}^{n+1}C_0 + {}^{n+1}C_1) + {}^{n+2}C_2 +$

Using, ${}^{n}C_r + {}^{n}C_{r+1} = {}^{n+1}C_{r+1}$

$= ({}^{n+2}C_1 + {}^{n+2}C_2) + {}^{n+3}C_3$

Using this again and again, we

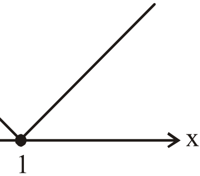
$= {}^{n+m}C_{m-1} + {}^{n+m}C_m$

$= {}^{n+m+1}C_m = {}^{n+m+1}C_{n+1}$

64. **(b)** As $x \to \dfrac{1}{3}$; $\{x+1\} \to \{1+1/3$

Similarly $\{x+2\} \to \dfrac{1}{3}$ as $x \to$

|



f. at x = 1

x =1.

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

(gof) (x) is discontinuous is {1/2, 1, 2}

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

${}^{3}C_3 + ... + {}^{n+m}C_m$

${}^{n+3}C_3 + ... + {}^{n+m}C_m$

$+ ..... + {}^{n+m}C_m$

are left with

$\} \to 1/3$

$\frac{1}{3}$

65. **(b)** Squaring both sides we get hi

66. **(d)** $I = \int_{\pi/4}^{\pi/4} (\underset{\text{odd f}}{\underset{\downarrow}{x\,|x|}} + \underset{\text{odd f}}{\underset{\downarrow}{\sin^3 x}} + \underset{\text{odd}}{\underset{\downarrow}{x \tan^2}}$

$I = \int_{-\pi/4}^{\pi/4} dx = \frac{\pi}{2}$ $\quad [\because \int_{-a}^{a}$

67. **(b)** $(1-x-2x^2)^6 = (1+x)^6 (1-2x)^6$

$= 1 + a_1x + a_2x^2 + \ldots\ldots.. + a_{12}x^{12}$

Putting $x = 1/2$, we have

$a_4/2^4 + \ldots\ldots..+ a_{12}/2^{12}$

Putting $x = -1/2$, we have

$1 = 1 - a_1/2 + a_2/2^2 - a_3/2^3 + a_4/$

Adding (1) and (2), we have

$1 = 2\,(1 + a_2/2^2 + a_4/2^4 + \ldots..+$

$\Rightarrow a_2/2^2 + a_4/2^4 + a_6/2^6 \ldots..+ a$

68. **(b)** $y^2 = 4x \;\&\; \frac{x^2}{8} + \frac{y^2}{2} = 1$

Equation of tangent to above

$y^2 = mx + \frac{1}{m}$ and $y = mx +$

Comparing $\frac{1}{m} = \sqrt{8m^2 + 2}$

$\Rightarrow m^2 (8m^2 + 2) = 1$

seeing the options

$m = \pm\frac{1}{2}$ satisfy the equation

$\Rightarrow y = \pm\frac{1}{2}x \pm 2 \;\Rightarrow 2y = \pm x \pm$

i.e. $2y = x + 4 \;\&\; x + 2y + 4 = 0$

69. **(b)** Let the point be (x_1, y_1).

ghest order as 2.

^{2} x+1) dx

f

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

a

6

2

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

$/2^4 - \ldots.. + a_{12}/2^{12}$....(2)

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

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

curves are respectively.

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

± 4

$2(x_1 - 3)$, but it is equal to 1.

Therefore, $2(x_1 - 3) = 1 \Rightarrow x_1$

$$y_1 = \left(\frac{7}{2} - 3\right)^2 = \frac{1}{4}.$$

Hence the point is $\left(\frac{7}{2}, \frac{1}{4}\right)$.

70. **(c)** $x = \tan A, y = \tan B, -z = \tan C.$

$\Rightarrow \tan A + \tan B + \tan C = \tan A$

$\Rightarrow A + B + C = \pi \quad \Rightarrow 2A + 2$

$\Rightarrow \tan(2A + 2B) = \tan(2\pi - 2C$

$\Rightarrow \tan 2A + \tan 2B + \tan 2C = \tan$

$$\Rightarrow \frac{2\tan A}{1 - \tan^2 A} + \frac{2\tan B}{1 - \tan^2 B} + \frac{}{1-}$$

$$= \frac{2\tan A}{1 - \tan^2 A} \cdot \frac{2\tan B}{1 - \tan^2 B} \cdot \frac{2\tan}{1 - \tan}$$

Put the value of $\tan A$, $\tan B$,

$$\Rightarrow \frac{2x}{1 - x^2} + \frac{2y}{1 - y^2} - \frac{2z}{1 - z^2}$$

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

71. **(12.25)** $4^2 + 4p + 12 = 0 \Rightarrow p = -$

The equation $x^2 + px + q = 0$ h

or $\quad p^2 = 4q \Rightarrow q = \frac{49}{4}$

72. **(0.125)**

$\cos 36° \cos 42° \cos 78°$

$= \cos 36° \cos(60° - 18°) \cos(60°$

$$= \frac{\sqrt{5} + 1}{4}\left(\cos^2 60° - \sin^2 18°\right)$$

$= \frac{7}{2}$

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

tanB tanC

$3 = 2\pi - 2C$

$) = -\tan 2C$

n2A.tan2B.tan2C

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

$\frac{n\,C}{n^2 C}$

tanC, we get

7

as equal roots then D = 0.

$+ 18°)$

)

$$= \left(\frac{\sqrt{5}+1}{4}\right)\frac{1}{4} - \left(\frac{\sqrt{5}+1}{4}\right)\left(\frac{5+1-}{16}\right.$$

$$= \left(\frac{\sqrt{5}+1}{16}\right) - \frac{\left(\sqrt{5}+1\right)\left(\sqrt{5}-1\right)^2}{64} =$$

$$= \frac{\sqrt{5}+1}{16}\left[\frac{4-6+2\sqrt{5}}{4}\right] = \frac{1}{8}$$

73. **(0.2)** The given expression is equal

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

$= \cos\left(\frac{\pi}{2} + \sin^{-1} x\right) = -\sin(\sin$

[Using $\cos^{-1} x + \sin^{-1} x = \frac{\pi}{2}$]

74. **(4)** Let $\tan\theta_1, \tan\theta_2$ be the roots of
$\tan\theta_1 + \tan\theta_2 = 4/2 = 2; \tan\theta_1 t$
Now $\tan(\theta_1 + \theta_2) = [(\tan\theta_1 + t$
$= 2/[1-(1/2)] = 4.$

75. **(2.25)** Given, in ΔABC $\begin{vmatrix} 1 & a & b \\ 1 & c & a \\ 1 & b & c \end{vmatrix}$

$\Rightarrow$ $1(c^2 - ab) - a(c-a) + b(b$
$\Rightarrow$ $a^2 + b^2 + c^2 - ab - bc - c$
$\Rightarrow$ $2a^2 + 2b^2 + 2c^2 - 2ab - 2$
$\Rightarrow$ $(a^2 + b^2 - 2ab) + (b^2 + c^2$
$\Rightarrow$ $(a-b)^2 + (b-c)^2 + (c-a$
Here, sum of squares of three m
$\Rightarrow$ ΔABC is equilateral.

$\Rightarrow \angle A = \angle B = \angle C = 60°$

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

$= (\sin^2 60° + \sin^2 60° + \sin^2 6$

$$\left. \frac{\;2\sqrt{5}}{6} \right)$$

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

to

$)$

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

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

$an\theta_2 = 1/2.$

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

$$\left.\begin{matrix} b \\ a \\ c \end{matrix}\right| = 0$$

$- c) = 0$

$a = 0$

$bc - 2ca = 0$

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

$)^2 = 0$

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

$0°)$

PHY

1. (c) Resolving power of eye $= \lambda / a$

$$= \frac{500 \times 10^{-9}}{5 \times 10^{-3}} = 10^{-4} \text{ radians}$$

Now, arc = angle × radius

$$= 10^{-4} \times (500 \times 10^{3})\text{m} = 50\,\text{m}$$

2. (b) Frequency does'nt depend on

$$\frac{\mu_1}{\mu_2} = \frac{V_2}{V_1} = \frac{\lambda_2 f}{\lambda_1 f}, \quad \text{or} \quad \mu_2 \lambda_2 =$$

$\mu_2 = 3680$ Å

3. (a) Total momentum will be conse

Initial momentum = Final mom

$$M.v = m \times 0 + (M - m)v'$$

$$\therefore v' = \frac{Mv}{M - m}$$

4. (c) Force, $F = \frac{1}{4\pi\varepsilon_0} \frac{q_1 q_2}{r^2}$

$$\Rightarrow \varepsilon_0 = \frac{q_1 . q_2}{4\pi F r^2}$$

So dimension of ε_0

$$= \frac{[AT]^2}{[MLT^{-2}][L^2]} = [M^{-1}L^{-3}T$$

5. (c) Heat radiated by black body

$$E = \sigma A T^4 \Rightarrow E \,\alpha\, T^4$$

$$\text{or } \frac{E_1}{E_2} = \frac{T_1^{\,4}}{T_2^{\,4}}$$

$$\text{or } \frac{20}{E_2} = \left(\frac{500}{1000}\right)^4 = \left(\frac{1}{2}\right)^4 = \frac{}{1}$$

$$\Rightarrow E_2 = 16 \times 20 \text{ cal m}^{-2}\text{ s}^{-1}$$
$$= 320 \text{ cal m}^{-2}\text{s}^{-1}$$

6. (c) Velocity of wave $v = n\lambda$

TEST-3

SICS

a

medium

$= \lambda_1 \mu_1$

erved.

entum

$^4 A^2]$

$\frac{1}{6}$

v

$n_2 = \frac{v_2}{\lambda_2} = \frac{396}{100 \times 10^{-2}} = 396$

no. of beats $= n_1 - n_2 = 4$

7. **(a)** Terminal velocity attained by

$$V_t = \frac{3r^2(d-\rho)g}{a\eta}$$

thus, $V_t \propto r^2$

8. **(d)** Young's modulus, $Y = \frac{\text{Stress}}{\text{Strain}}$

or stress = Y. strain

or strain = Stress / Y

or $\Delta l = \frac{Fl}{YA}$; $\frac{\Delta l_1}{\Delta l_2} = \frac{F_1 l_1}{A_1 Y_1}$.

$l_1 = l_2$ & $Y_1 = Y_2$, $F_1 = F_2$

$$\Rightarrow \frac{\Delta l_1}{\Delta l_2} = \frac{\pi r_2^{\ 2}}{\pi r_1^{\ 2}} = \frac{4r^2}{r^2} = 4$$

9. **(b)** $E = mc^2 = (2 \times 1.6 \times 10^{-27}) \times$

$= 28.8 \times 10^{-27} \times 10^{16}\,J = 28.8$

$= 28.8 \times 10^{-10}\,J$

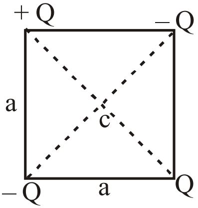
10. **(b)** $y = 2\sin\left(\frac{\pi t}{2} + \phi\right)$

velocity of particle $\frac{dy}{dt} = 2 \times$

acceleration $\frac{d^2y}{dt} = -\frac{\pi^2}{2}\sin$

Thus, $a_{max} = \frac{\pi^2}{2}$

11. **(a)**



Hz

falling object

$\frac{s}{n}$

$\frac{{}_2 Y_2}{F_1 l_1}$

$(3 \times 10^8)^2$

$\times 10^{-11}\,\mathrm{J}$

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

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

12. **(a)** Let the body be depressed by
The extra upthrust created is x
acceleration created then,

$$x\rho Ag = mga \Rightarrow a = \frac{\rho A}{m}x$$

Since, acceleration α x. So it is

$$\text{So, } \omega^2 = \frac{\rho A}{m} \Rightarrow T = 2\pi\sqrt{\frac{m}{\rho A}}$$

$$T \ \alpha \ \frac{1}{\sqrt{A}}$$

13. **(b)** The specific resistance (ρ) is d

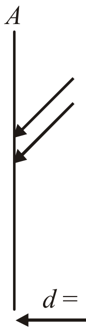
$$\rho = \frac{X\pi D^2}{4L}$$

where symbols have their usua

14. **(b)** Clearly the co-ordinates of A a

$$\therefore f = \frac{40}{2} = 20 \text{ cm.}$$

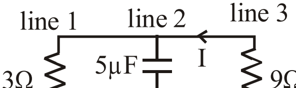
15. **(a)** Number of electrons falling on
$= 10^{16} \times (5 \times 10^{-4})$



$\therefore$ Number of photoelectrons e
is

$$n_e = \frac{(5 \times 10^{-4}) \times 10^{16}}{10^6} \times 10 =$$

16. **(b)**



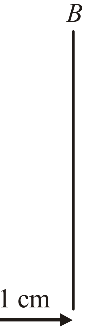
distance x from its equilibrium position.
ρAg which applies to whole body. If a be

s equation of S.H.M.

letermined by the formula

al meaning.
re (2f, 2f)

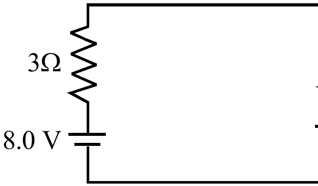
the metal plate *A*



mitted from metal plate *A* upto 10 seconds

5×10^7

In steady state capacitor is fu
through line 2.
By simplyfing the circuit



Hence resultant potential diffe

Thus current $I = \frac{V}{R} = \frac{8.0}{3+9} =$

or, $I = \frac{2}{3} = 0.67\ A$

17. **(c)** **Given:** Amplitude of electric fie
$E_0 = 4$ v/m
Absolute permitivity,
$\varepsilon_0 = 8.8 \times 10^{-12}$ c²/N-m²
Average energy density $u_E =$
Applying formula,

Average energy density $u_E =$

$\Rightarrow \quad u_E = \frac{1}{4} \times 8.8 \times 10^{-12} \times (4)$
$= 35.2 \times 10^{-12}$ J/m³

18. **(a)** When springs are in parallel, t

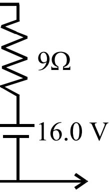
$T = 2\pi\sqrt{\frac{m}{K_1 + K_2}} \Rightarrow \frac{2\pi}{T} = \omega =$

19. **(c)** Lateral magnitude = v/u;

Mag. along axis $= \left|\frac{dv}{du}\right| = \frac{u^2}{v^2} =$

20. **(d)** In linear S.H.M., the restoring
proportional to the displaceme

ully charged hence no current will flow



erence across resistances will be 8.0 V.

$= \frac{8}{12}$

eld,

?

$\frac{1}{4}\varepsilon_0 E^2$

^{2}

hen

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

$= 1$ if $v = u$, $\therefore u = 2$

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

21. **(6)** According to Doppler's effect

$$f = \left(\frac{\nu \pm \nu_0}{\nu \pm \nu_s}\right) f$$

here $\upsilon_0 = 0$ and $\upsilon_s = 0.5\upsilon$

$$\therefore f = \left(\frac{\nu}{\nu - .5\nu}\right) 3 = 6\,\text{kHz}$$

22. **(300)** $$\eta = \left(1 - \frac{T_c}{T_H}\right) \times 100$$

$$\Rightarrow 70 = \left(1 - \frac{T_c}{1000}\right) \times 100$$

$$0.7 = 1 - \frac{T_c}{1000}$$

$$\therefore \frac{T_c}{1000} = 0.3 \text{ or } T_c = 300\text{K.}$$

23. **(11.2)** Escape velocity $v_e = \sqrt{2gR}$

thus, it doesn't depend on ma

24. **(0.4)** $r = 5$ cm. $= 5 \times 10^{-2}$m

$B_E = 0.5 \times 10^{-5}$ W/m^2

we know that field due to coil

centre $B = \dfrac{\mu_0 I}{2r}$

it annuals the earth's megnetic

So, $\dfrac{\mu_0 I}{2r} = 0.5 \times 10^{-5}$

$$I = \frac{2R \times 0.5 \times 10^{-5}}{\mu} = \frac{5}{4\pi} A =$$

25. **(1.2×10^{-7})** Pressure of light on tot

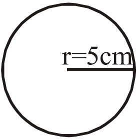
$$P = \frac{2I}{C} \qquad (C =$$

$$P = \frac{F}{A} = \frac{2I}{C}$$

$$\Rightarrow F = \frac{2IA}{C} = \frac{2 \times 12 \times 1.5 \times 10}{}$$

ass.

at



c field

= 0.4A

cally reflecting surface

velocity of light)

-4

26. **(d)** (a) $\underset{CH_2Cl}{\overset{CH_2Cl}{|}} \xrightarrow[\text{alcohol}]{\text{KOH}} \underset{CH}{\overset{CH}{|||}}$;

$\underset{CH}{\overset{CH_3Cl}{|}} \xrightarrow[\text{alcohol}]{\text{KOH}} \underset{CH}{\overset{CH}{|||}}$;

(b) Both are position isomers

(c) Since, they are isomers, p

same.

(d) $\underset{CH_2Cl}{\overset{CH_2Cl}{|}} \xrightarrow{\text{hydrolysis}}$ C

$\underset{CHCl_2}{\overset{CH_3}{|}}$ —

Hence, statement (d) is wrong.

27. **(d)** Sodium carbonate is the salt o

(NaOH). In solution, it is comp

CO_3^{2-} ion being the conjugate

hydrolysis in solution accordi

$CO_3^{2-} + H_2O \rightleftharpoons OH^- + H$

The OH^- ion produced being

hence the pH of the solution w

28. **(a)** According to the kinetic theo

molecules in the gas is given

the absolute temperature and

velocity can be taken as propo

temperature. Hence the ratio o

50ºC will be equal to $\sqrt{\frac{273+2}{273+5}}$

29. **(d)** No. of atoms of hydrogen in 0.

$= \frac{0.046}{46} \times 6 \times 10^{23} \times 6$

$= 1 \times 10^{-3} \times 6 \times 10^{23} \times 6 = 3.6 \times$

30. **(b)** Since the gas B turns $CuSO_4$ s hence true

s
precentage of C, H and Cl in both will be

H_2OH

$CHOH$;

$$\xrightarrow{\text{hydrolysis}} \underset{|}{\overset{CH_3}{}}\!\!C\,H(OH)_2 \xrightarrow{-H_2O} \overset{CH_3}{\underset{}{|}}\!\!CHO$$

.
f a weak acid (H_2CO_3) with a strong base

letely ionised as Na^+ and CO_3^{2-} ions. The

e base of the weak acid H_2CO_3 undergoes
ng to the equilibrium of hydrolysis:

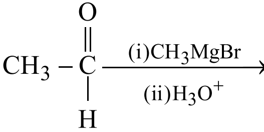
HCO_3^-
a strong base makes the solution basic, vill be greater than 7.
ry of gases, the average velocity of the

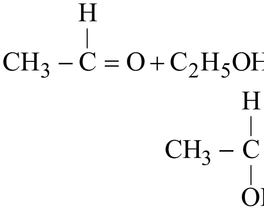
by the expression $v = \sqrt{\dfrac{8RT}{\pi M}}$ where T is

R is the gas constant. Thus the average rtional to the square root of the absolute f the average velocity at 200ºC to that at

$\overline{00}$ which is 1.21.
50
046 g of alcohol

$\times 10^{21}$
olution blue, it can be NH_3.

31. **(c)** (i) 

(ii) 

Hemia

32. **(b)** The temperature of 383 K is
increase the boiling point of
temperature.

33. **(b)** Since each of (i), (ii) and (iii) ar
of the chlorines (chloride ions
and in (iii), two such chlorides a
chlorides in (i) is three in (ii) it
Primary valency means the va

34. **(b)** Polyethylene or Polyethene,
is made from a single monome

35. **(d)** Energy requirements of the b
through blood and glycogen s

36. **(c)** More the *s* - character, more i
correct order is $sp > sp^2 > sp^3$.

37. **(a)** The total number of electrons i
are 17, 16 and 18. Write down t
species and observe the num
which are respectively 7, 6 an

38. **(c)** Deviation from ideal gas beha
and the gas is closed to its liqu
Thus, the conditions of –100ºC
causes maximum deviation.

39. **(b)** Heat of neutralisation of stron

40. **(b)** Average atomic weight = 85

41. **(b)** In Kjeldahl′s method of estim
most of the organic compo
ammonium sulphate. The (N
excess of NaOH solution to gi

$$\rightarrow CH_3-\underset{\underset{\displaystyle CH_3}{|}}{\overset{\overset{\displaystyle H}{|}}{C}}-OH$$

2-Propanol

$$H \xrightarrow{HCl}$$

$$-OC_2H_5 \xrightarrow[C_2H_5OH]{HCl} CH_3-\overset{\overset{\displaystyle H}{|}}{C}(OC_2H_5)_2$$

Acetal

H

cetal

equal to 110°C. Although the salts will
f water, it should boil at or below this

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

$$-CH_2-CH_2 \rbrack_n,$$

r, it is a homopolymer.

ody are met by glucose that is circulated
tored in the muscles.

s the stability of the carbanion. hence the

n the molecular species given, respectively
he electronic configuration of the molecular
ber of electrons in antibonding orbitals
d 8.

iour is greater, when the pressure is higher
efaction point or its critical temperature.
C and 4 atm pressure among the sets given

g acid and strong base is always 13.7 kcal.

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

ation of nitrogen, the nitrogen present in
unds is quantitatively converted into
$H_4)_2SO_4$ so obtained is decomposed with
ve NH_3 which is absorbed in an excess of

43. **(a)** Addition of a catalyst to a react
activation energy of the reactio
the reaction. The reaction r
equilibrium constant and the en

44. **(c)** $Be(OH)_2$ is amphoteric that mea

45. **(d)** Lithium, sodium and potassiu
reactive metals. When any o
reaction is so swift and intens
instantaneously. The reaction
quinch fires caused by these
Likewise CO_2 and nitrogen too
by asbestos blanket or by cove
prevents contact with oxyge
effective.

46. **(0.107)** $N_1V_1 = N_2V_2$

$N_{NaOH} = M_{NaOH} = 0.164$

$\Rightarrow 25 \times N = 32.63 \times 0.164$

$$N = \frac{32.63 \times .164}{25} = 0.214\ N$$

But $N_{H_2SO_4} = 2 \times M_{H_2SO_4}$

$$\Rightarrow M = \frac{\text{Normality}}{2} = \frac{0.214}{2} =$$

47. **(50)** Eq. of $KMnO_4$ used $= \frac{50 \times 1}{1000 \times 1}$

$\therefore$ Eq of FAS reacted $= 0.005$

$\therefore$ weight of FAS needed $= 0.00$

$= 1$

Thus, percentage purity of FA

48. **(4)** In a '*fcc*' crystal atoms are loc
8 corners.

On each face their is 1 atom w
atoms/ unit cell $= 6/2 = 3$

Again the corner atom is share
$8 = 1$

No. of atoms/unit cell $= 1 + 3 =$

49. **(800)** As $AgNO_3$ dissociates compl
therefore in 0.1 M $AgNO_3$ solu

$AgNO_3 \longrightarrow Ag^+ + NO_3^-$

tion mixture has the effect of lowering the
on by changing the path or mechanism of
rate increases manifold. However, the
nthalpy (ΔH) of the reaction are unaffected.
ans it can react with both acids and alkalies
um are highly electropositive and highly
f these come in contact with water, the
se that the hydrogen evolved catches fire
thus is doubly exothermic, using water to
metals makes it explosively dangerous.
o are reactive. Small fires can be quinched
ring with dry sand, since these measures
en and water vapour and thus become

$= 0.107$

$\overline{10} = 0.005$

05×392

$.96$ g

S is 50%.

ated at the centre of the 6 faces and at the

hich is shared by 2 cells. Hence, the no. of

d by 8 other cells. Hence no. of atoms =8/

$= 4$

etely,

ution, $[Ag^+] = 0.1$ M

$K_{sp} = [Ag^+]^2[CO_3^{2-}]$
$= 8 = (0.1 + 2s)^2 \times s$
$= 0.01\ s = 8\ ; (0.1 + 2s \approx$
$s = 800$

50. **(317)** $\underset{x}{CH_4} + \underset{2x}{2O_2} \rightarrow CO_2 + 2H_2O$

$\underset{(5-x)}{C_3H_8} + \underset{5(5-x)}{5O_2} \rightarrow 3CO_2 + 4H_2$

$2x + 5(5-x) = 16 \Rightarrow x = 3\ L$

$\therefore$ Heat released $= \frac{3}{22.4} \times 890 -$

MATHE

51. **(d)** Given $f(x) = \tan^{-1}(\sin x + \cos x$

$f'(x) = \frac{1}{1 + (\sin x + \cos x)^2}.(\cos$

$= \frac{\sqrt{2}.\left(\frac{1}{\sqrt{2}}\cos x - \frac{1}{\sqrt{2}}\sin x\right)}{1 + (\sin x + \cos x)^2}$

$\therefore\ f'(x) = \frac{\sqrt{2}\cos\left(x + \frac{\pi}{4}\right)}{1 + (\sin x + \cos x)^2}$

if $f'(x) > 0$ then $f(x)$ is increasin
Hence $f(x)$ is increasing, if

$-\frac{\pi}{2} < x + \frac{\pi}{4} < \frac{\pi}{2} \Rightarrow -\frac{3\pi}{4} < x$

Hence, $f(x)$ is increasing when

52. **(a)** $\sqrt{1 + x^2} + \sqrt{1 + y^2} = \lambda(x\sqrt{1 +$

$\Rightarrow \sqrt{1 + x^2}(1 + \lambda y) = \sqrt{1 + y^2}\ ($

$\approx 0.1)$

O

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

MATICS

x)

$\text{s}\, x - \sin x)$

ng function.

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

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

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

$(\lambda x - 1)$

$$\Rightarrow \frac{x^2+1}{y^2+1} = \frac{\lambda^2 x^2 - 2\lambda x + 1}{\lambda^2 y^2 + 2\lambda y + 1}$$

$$\Rightarrow (y^2+1)(\lambda^2 x^2 - 2\lambda x + 1)$$

$$= (x^2+1)(\lambda^2 y^2 + 2\lambda y + 1$$

$$\Rightarrow \lambda^2 x^2 y^2 - 2\lambda x y^2 + y^2 + \lambda^2$$

$$= \lambda^2 x^2 y^2 + 2\lambda x^2 y + x^2$$

$$\Rightarrow \lambda^2 (x^2 - y^2) - 2\lambda (x y^2 + x^2$$

$$\Rightarrow \lambda^2 (x+y)(x-y) - 2\lambda \ [xy$$

$$\Rightarrow \lambda(x+y)[\lambda(x-y) - 2xy -$$

$$\Rightarrow (x+y)[\lambda(x-y) - 2xy - 2]$$

$$\Rightarrow \lambda(x-y) - 2xy - 2 = 0$$

$$\Rightarrow \frac{2xy+2}{x-y} = \lambda \ \Rightarrow \frac{xy+1}{x-y} =$$

$$\Rightarrow \frac{\left(x\frac{dy}{dx} + y\right)(x-y) - (xy+}{(x-y)^2}$$

This is the first order differenti

Hence degree of the differentia

53. **(c)** $I = \int_0^2 [x^2] dx$

The function $[x^2]$ varies as foll

$$\begin{cases} 0 \text{ if } 0 \le x^2 < 1, \text{ or } 0 \le \\ 1 \text{ if } 1 \le x^2 < 2 \text{ or } 1 \le x \end{cases}$$

$)$

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

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

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

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

$2\big] = 0$

$\big| = 0$

$\frac{\lambda}{2}$

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

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

al equation is 1.

ows between x = (0, 2)

x < 1

$x < \sqrt{2}$

$$\Rightarrow I = \int_0^1 0.dx + \int_1^{\sqrt{2}} 1.dx + \int_{\sqrt{2}}^{\sqrt{3}} 2.dx$$

$$= 0 + (\sqrt{2} - 1) + 2(\sqrt{3} - \sqrt{2}) +$$

$$= \sqrt{2} - 1 + 2\sqrt{3} - 2\sqrt{2} + 6 - 3\sqrt{}$$

54. **(c)** $\alpha + \beta = 3; \alpha\beta = a$; $\gamma + \delta = +$

$\alpha, \beta, \gamma, \delta$ are in increasing G.P.

$\beta = \alpha x, \gamma = \alpha x^2, \delta = \alpha x^3$

$\alpha + \beta = \alpha + \alpha x = 3 = \alpha(1 + x)$

$\gamma + \delta = \alpha x^2 + \alpha x^3 = 12 = \alpha x^2($

Divding $\frac{3}{12} = \frac{\alpha(1+x)}{\alpha x^2(1+x)}$ or

$\Rightarrow \beta = 2\alpha$ and $\alpha + 2\alpha = 3 \Rightarrow$

$\therefore a = \alpha\beta = 2$

$\gamma = \alpha x^2 = 1 \times 2^2 = 4; \delta = \alpha x^3$

$\therefore b = \gamma\delta = 4 \times 8 = 32$

55. **(a)** Consider the example: Let A =

R = {(1, 1), (1,2)} and S = {(2, 2

Clearly R and S are transitive r

$R \cup S$ = {(1, 1), (2, 2), (1, 2), (2,

$R \cup S$ is not transitive as (1,3)

56. **(d)** $I = \int \log 2x \, dx = \int \log 2x.1.dx$

Using Integration by parts

$$I = \log 2x. x - \int \frac{2}{2x}.\int 1.dx$$

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

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

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

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

$.....(1)$

$(1+x) \qquad .....(2)$

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

$\alpha = 1$ and $\beta = 2$

$= 1 \times 2^3 = 8$

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

$), (2, 3)\}$

relations on A.

$3)\}$

$\notin R \cup S.$

57. **(a)** For $k = 0$,
it is obvious from the given interval that graph will be increasing from – 1 to 1
Similar graphs can be obtained for all values of k.

58. **(a)** It can be also solved by compa

with the linear equation $\frac{dy}{dx} +$

The integrating factor, I.F. = e

Therefore, $y\,\text{I.F} = \int 2e^{2x}.\text{I.F} +$

$$y.e^{x} = \int 2e^{2x}.e^{x} + C$$

$$y.e^{x} = 2\int e^{3x} + C = \frac{2}{3}e^{3x} + C$$

59. **(c)** $\Delta = \begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} =$

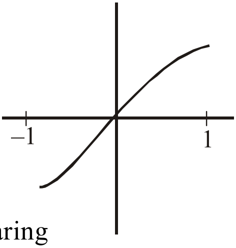
$$\Rightarrow \Delta = \begin{vmatrix} 3a-x & a-x & a-x \\ 3a-x & a+x & a-x \\ 3a-x & a-x & a+x \end{vmatrix}$$

$$= (3a-x)\begin{vmatrix} 1 & a-x & a-x \\ 1 & a+x & a-x \\ 1 & a-x & a+x \end{vmatrix} =$$

Using $R_2 \to R_2 - R_1$ and R_3

$$\Rightarrow \Delta = (3a-x)\begin{vmatrix} 1 & a-x & a- \\ 0 & 2x & \\ 0 & 0 & 2 \end{vmatrix}$$

or, $4x^2(3a-x) = 0 \Rightarrow x = 0$ or



aring

$Py = Q$

$\int 1.dx = e^{x}$

C

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

)

$, \ C_1 \to C_1 + C_2 + C_3$

0

$\to R_3 - R_1$

$- x$

$0 \quad = 0$

$2x$

$3a$

$= \frac{2}{3} \times 3a = 2a$

Centre of the (given) circle is C

$(x-0)^2 + (y-0)^2 = (2a)^2 \Rightarrow x^2$

61. **(b)** Its contropositive is 'sum of d

$\Rightarrow$ n is not divisible by 9

62. **(c)** $n = 7$

Prob. of getting any no. out 1,

$\therefore \quad q = 6/5$

$P(x = 7) = {}^7C_7 p^7 q^0$

$= \left(\frac{9}{15}\right)^7 = \left(\frac{3}{5}\right)^7$

63. **(a)** For $x \geq a$, the equation becom

$x^2 - 2a(x-a) - 3a^2 = 0 \Rightarrow x = ($

for $x \leq a$, the equation become

$x^2 - 2a[-(x-a)] - 3a^2 = 0 \Rightarrow x^2$

$\Rightarrow x = -(1+\sqrt{6})a, \ (-1+\sqrt{6})$

This shows $(-1+\sqrt{6})a$ is one

64. **(c)** $X \cap (X \cup Y)^c = X \cap (X^c \cap$

$= \phi \cap Y^c = \phi$

65. **(a)** $y = \log_2 \{\log_2(x)\} = \log_2\{\log$

$\Rightarrow y = \log_e\{\log_e x.\log_2 e\}.\log_2 e$

$\Rightarrow \frac{dy}{dx} = \log_2 e \frac{d}{dx}[\log_e\{\log_e$

$\Rightarrow \frac{dy}{dx} = \log_2 e.\frac{1}{\log_e x.\log_2 e}$

(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.

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

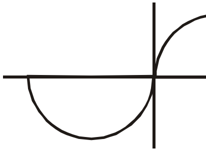
$_{e}$ x.$\log_2$ e}

e

x.$\log_2$ e}]

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

66. **(c)** The function breaks at x = 0 a
differentiable at all other point
pts.



At $x = 0$, for $f(x)$ to be contino

$\lim_{x\to 0} f(0^-) = f(x = 0) = \lim_{x\to 0} f$

$f(x) = 0$ at $x = 0$

$RHL = \lim_{x\to 0} \sin(x+h) = \sin\ h$

$L.H.L. = \lim_{x\to 0} \sin(x-h) = \sin$

Hence, not differentiable at x =
Similarly, $f(x)$ is not differential
1, 2..............

67. **(d)** $\int_0^{\pi/3} \frac{\cos x + \sin x}{\sqrt{1+\sin 2x}} dx$

$= \int_0^{\pi/3} \frac{\cos x + \sin x}{\sqrt{\sin^2 x + \cos^2 x + 2\sin}}$

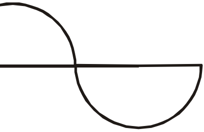
$= \int_0^{\pi/3} \frac{\cos x + \sin x}{\sqrt{(\cos x + \sin x)^2}} dx =$

68. **(c)** The equation of the pair of tan
$(3x^2 + 2y^2 - 5)(3.1^2 + 2.2^2 -$
$9x^2 - 4y^2 - 24xy + 40y + 30x -$
further angle, θ between them

$\tan\theta = \frac{2\sqrt{h^2 - ab}}{a+b} = \frac{2\sqrt{(12)}}{9}$

and multiples of x. Hence the function is

s as the function is continuous at all these



us

(0^+)

> 0

$(-h) < 0$

$= 0$

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

$\overline{}\, dx$

$x \cos x$

$/3$

$\int dx = \frac{\pi}{3}$

$)$

gents is given by $SS_1 = T^2$

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

$55 = 0$

n can be found by using

$\overline{{}^2 - (9)(-4)}$

$+ (-4)$

69. **(d)** The roots of the equation $x^2 +$
$\& \beta = \omega^2$
$\alpha^{19} = \omega^{19} = (\omega^3)^6\omega = \omega; \beta^7 = ($
Hence the equation is $x^2 + x +$

70. **(c)** $\sin^{-1}(1-x) = \left(\frac{\pi}{2} - \sin^{-1} x\right) -$

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

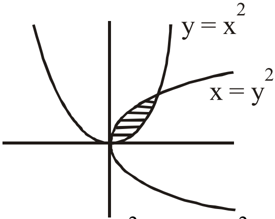
Taking sum of both sides

$1 - x = \sin\left(\frac{\pi}{2} - 2\sin^{-1} x\right) =$ co

$= \cos 2\theta$, where $\sin^{-1} x = \theta$

$1 - x = 1 - 2\sin^2\theta = 1 - 2x^2$ or

71. **(0.33)**

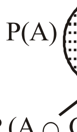


Solving, $y = x^2$ and $x = y^2$
$y = y^4$ or $y(y^3 - 1) = 0 \Rightarrow y =$
$\therefore$ Point of intersection are (0,

To find the shaded area, $A = \int_0^1$

$= \frac{2}{3}\left[x^{3/2}\right]_0^1 - \left[\frac{x^3}{3}\right]_0^1 = \frac{2}{3} - \frac{1}{3}$

72. **(0.63)**



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

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

$1 = 0$

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

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

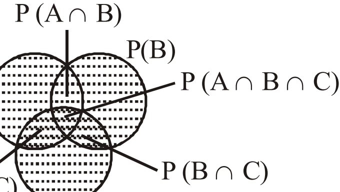
$r\ x(1-2x) = 0 \text{ or } x = 0, \frac{1}{2}$

$0 \text{ or } y = 1$

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

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

$= \frac{1}{3}$



Req. prob. $= P(A) + P(B) + P($

$= \frac{1}{4} + \frac{1}{4} + \frac{1}{4} - 0 - 0 - \frac{1}{8} + 0 \ =$

73. **(1)** $T_{r+1} = 6_{C_r} x^{6-r}\left(\frac{1}{x^2}\right)^r = {}^6C_r(x)^6$

For coefficient of x^6, $6 - r - 2r =$
This means the term is the first

$\Rightarrow T_1 = {}^6C_0 x^6 = 1.x^6$

$\Rightarrow$ coefficient of $x^6 = 1$

74. **(3)** For $f(x)$ to be continuous, $\lim\limits_{x \to}$

$f(0) = k \ \ \lim\limits_{x \to 0} f(x) = \lim\limits_{x \to 0} = \frac{\sin}{\sin}$

$\Rightarrow k = 3$

75. **(1.33)** Line is $\perp$ to $3x + y = 3$

$\therefore$ Slope of line, $m = \frac{1}{3}$

Equation is, $y = mx + c = \frac{x}{3}$

It passes through $(2, 2) \Rightarrow 2$

$\Rightarrow \ c = \frac{4}{3}$

$\Rightarrow y - \frac{x}{3} = 4/3 \Rightarrow 3y - x = 4$

$\therefore$ y-intercept $= 4/3$

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

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

$\frac{5}{8}$

$6 - r - 2r$

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

term.

$_{0} f(x) = f(0)$

$$n\,3x \over n\,x \quad = \lim_{x \to 0} \frac{3 \cdot \frac{\sin 3x}{3x}}{\frac{\sin x}{x}} = 3$$

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

$+ c$

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

1. **(d)** $v=\sqrt{\dfrac{2gh}{1+\dfrac{I}{mr^2}}}=\sqrt{\dfrac{2\times10\times3}{1+\dfrac{mr^2}{2\times mr^2}}}$

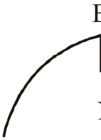
$\Rightarrow v=r\omega \Rightarrow r=\dfrac{v}{\omega}=\dfrac{\sqrt{40}}{2\sqrt{2}}=\sqrt{}$

2. **(a)** By conservation of energy

$\text{mg}(3\text{h})=\text{mg}(2\text{h})+\dfrac{1}{2}\text{mv}^2$ (v

$\text{mgh}=\dfrac{1}{2}\text{mv}^2$; $\text{v}=\sqrt{2\text{gh}}$

From free body diagram of bloc



$\text{N}+\text{mg}=\dfrac{\text{mv}^2}{\text{h}}=2\text{mg}$; $\text{N}=$

3. **(b)** Bulk modulus, $B=-V_0\dfrac{\Delta p}{\Delta V}\Rightarrow$

$\Rightarrow V=V_0\left[1-\dfrac{\Delta p}{B}\right]$

$\therefore$ Density, $\rho=\rho_0\left[1-\dfrac{\Delta p}{B}\right]^{-1}=$

where, $\Delta p=p-p_0=h\rho_0 g$

= pressure difference between

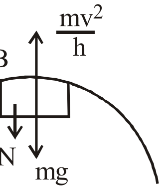
SICS

$$= \sqrt{\frac{2\times10\times3}{\frac{3}{2}}} = \sqrt{40}$$

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

= velocity at B)

ck at B



mg

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

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

depth and surface of ocean

4. **(b)** Here, $\vec{E} = 5\hat{i} - 3\hat{j}\,kV/m$

$$V_B - V_A = -\int_{r_A}^{r_B} \vec{E}\,.\,\partial r$$

$$= -\int_{(4,0,3)}^{(10,3,0)} \left(5\hat{i} - 3\hat{j}\right).\left(\partial x\hat{i} + \partial y\hat{j}\right.$$

$$= -\int_4^{10} 5\partial x - \int_0^3 (-3)\,\partial y + 0 = -5[$$

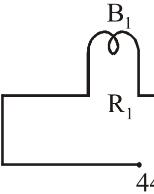
$$= -5(10-4) + 3(3-0) = -30 + 9$$

5. **(c)** The current upto which bulb of

$$I_1 = \frac{W_1}{V_1} = \frac{25}{220}\ \text{Amp}$$

Similarly, $I_2 = \dfrac{W_2}{V_2} = \dfrac{100}{220}$ Am

The current flowing through th



$$I = \frac{440}{R_{eff}}$$

$$R_{eff} = R_1 + R_2$$

$$R_1 = \frac{V_1^2}{P_1} = \frac{(220)^2}{25}\ ; \quad R_2 = \frac{V_2^2}{P}$$

$$I = \frac{440}{\dfrac{(220)^2}{25} + \dfrac{(220)^2}{100}} = \frac{}{(220)^2}$$

$$I = \frac{40}{220}\ \text{Amp}$$

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

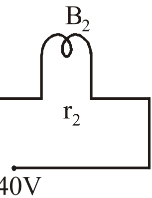
$x]_4^{10} + 3[y]_0^3$

$= -21 kV$

marked 25W -220V, will not fuse

p

e circuit



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

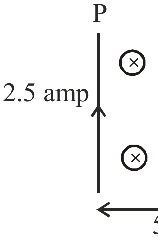
$\frac{440}{\left[\frac{1}{25} + \frac{1}{100}\right]}$

6. (c) When the current flows in both
field at half way due to the wire

$$\vec{B}_p = \frac{\mu_0 I_1}{2\pi \frac{5}{2}} = \frac{\mu_0 I_1}{\pi \cdot 5} = \frac{\mu_0}{2\pi}$$

(where $I_1 = 5$ amp)

The direction of $\vec{B}_p$ is downw



Magnetic field at half way due

$$\vec{B}_Q = \frac{\mu_0 I_2}{2\pi \frac{5}{2}} = \frac{\mu_0}{\pi}$$ [upwar

[where $I_2 = 5$amp.]

Net magnetic field at half way

$$\vec{B} = \vec{B}_P + \vec{B}_Q = -\frac{\mu_0}{2\pi} + \frac{\mu_0}{\pi} = \frac{\mu}{2}$$

Hence, net magnetic field at mi

7. (b)

8. (a) Limiting friction between block

$= \mu_s m_A g = 0.6 \times 10 \times 9.8 = 58.8$ N

But applied force on block A is

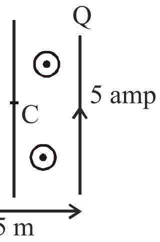
Now kinetic friction works bet

$F_k = \mu_k m_A g = 0.4 \times 10 \times 9.8 = 39$

This kinetic friction helps to m

wires in the same direction then magnetic
e P,

ard $\odot$



to wire Q

rd $\odot$]

$\frac{0}{\pi}$ (upward)

dpoint $= \frac{\mu_0}{2\pi}$

k and slab
N
100 N. So the block will slip over a slab.
ween block and slab
.2 N
nove the slab

9. **(a)** $V_p = \frac{dx_p}{dt} = a + 2bt$

and $V_Q = \frac{dx_Q}{dt} = f - 2t$, Given,

$\therefore a + 2bt = f - 2t \Rightarrow t = \frac{f-a}{2(b+1)}$

10. **(c)** Intensity of light

$\mathrm{I} = \frac{\mathrm{Watt}}{\mathrm{Area}} = \frac{\mathrm{nhc}}{\mathrm{A\lambda}} \Rightarrow$ Number of

$\therefore$ Number of photoelectrons e

$= \frac{1}{100} \times \frac{1 \times 10^{-4} \times 300 \times 10^{-9}}{6.6 \times 10^{-34} \times 3 \times 10^{8}} =$

11. **(c)** The wavelength of spectral line

by $\frac{1}{\lambda} = \mathrm{R}\left[\frac{1}{2^2} - \frac{1}{\mathrm{n}^2}\right]$

For first line of Balmer series, n

$\Rightarrow \frac{1}{\lambda_1} = \mathrm{R}\left[\frac{1}{2^2} - \frac{1}{3^2}\right] = \frac{5\mathrm{R}}{36}$; Fo

$\Rightarrow \frac{1}{\lambda_2} = \mathrm{R}\left[\frac{1}{2^2} - \frac{1}{4^2}\right] = \frac{3\mathrm{R}}{16}$

$\therefore \frac{\lambda_2}{\lambda_1} = \frac{20}{27} \Rightarrow \lambda_2 = \frac{20}{27} \times 6561$

12. **(d)** In pure semiconductor electron

$\mathrm{n_{initial}} = \mathrm{n_h} + \mathrm{n_e} = 14 \times 10^{15}$ after

$\mathrm{N_D} = \frac{5 \times 10^{28}}{10^7} = 5 \times 10^{21}$ and n

So, $\mathrm{n_{final}} = \mathrm{n_h} + \mathrm{n_e}$

$\Rightarrow \quad \mathrm{n_{final}} \approx \mathrm{n_e} \approx 2.5 \times 10^{21}$

Factor $= \frac{\mathrm{n_{final}} - \mathrm{n_{initial}}}{\mathrm{n_{initial}}}$

$V_p = V_Q$

photon $= \dfrac{IA\lambda}{hc}$

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

1.5×10^{12} per sec

e in Balmer series is given

$= 3$

or second line n = 4.

$= 4860$ Å

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

r doping donor Impurity

$_e = \dfrac{N_D}{2} = 2.5 \times 10^{21}$

$(\because n_e >> n_h)$

13. **(a)** According to Wien's displacem

$\lambda_m \propto \frac{1}{T} \Rightarrow \lambda m_2 < \lambda_{m_1}$ [$\because T_1 <$

Therefore I-λ graph for T_2 has l
will shift towards left side.

14. **(b)** At resonance, amplitude of osci
$\Rightarrow 2\omega^2 - 36\omega + 9$ is minimum
$\Rightarrow 4\omega - 36 = 0$ (derivative is zer
$\Rightarrow \omega = 9$

15. **(b)** Average speed of gas molecules

molecules mass. So the average

16. **(c)** Apparent frequency

$$n' = n\frac{(u + v_w)}{(u + v_w - v_s \cos 60°)} =$$

$$= 510 \times \frac{350}{340} = 525 \text{ Hz}$$

17. **(c)** The area swept by radius OC in
time T/2 is thus ($\pi r^2 B/2$). The
$\left[\because T = \frac{2\pi}{\omega}\right]$
The induced current is then I =

18. **(a)** The Instantaneous value of vo
E = 100 sin (100t) V
We get
$E_0 = 100$V, $\omega = 100$ rad s^{-1}
The rms value of voltage is

$$E_{rms} = \frac{E_0}{\sqrt{2}} = \frac{100}{\sqrt{2}} \text{V} = 70.7\text{V}$$

The instantaneous value of cur

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

Compare it with
$I = I_0 \sin(\omega t + \phi)$
we get
$I_0 = 100$ mA, $\omega = 100$ rad s^{-1}
The rms value of current is

ent law

T_2]

esser wavelength (λ_m) and so curve for T_2

llation is maximum

ro)

is $\sqrt{\dfrac{8kT}{\pi m}}$. 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

rrent is

19. **(c)** Incident momentum, $p = \frac{E}{c}$

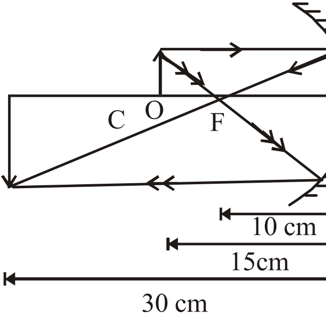
For perfectly reflecting surface

$$\Delta p = 2p = \frac{2E}{c}$$

$$F = \frac{\Delta p}{\Delta t} = \frac{2E}{ct}$$

$$P = \frac{F}{A} = \frac{2E}{ctA}$$

20. **(a)**



According to New Cartesian si

Object distance u = – 15 cm

Focal length of a concave lens,

Height of the object h_0 = 2.0 cm

According to mirror formula, $\frac{1}{v}$

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-10} - \frac{1}{-15} \Rightarrow v =$$

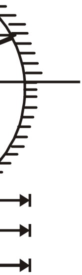
This image is formed 30 cm fro

It is real image.

Magnification of the mirror, m

$$\Rightarrow \frac{-(-30)}{-15} = \frac{h_1}{2} \Rightarrow h_1 = -4\ c$$

with normal incidence



gn convention,

f = – 10 cm

n

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

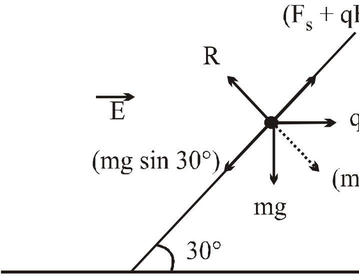
$-30cm.$

m the mirror on the same side of the object.

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

m

21. (1.319)



From the figure

$R = mg\cos 30^\circ + qE\sin 30^\circ$

$= \frac{10\sqrt{3}}{2} + \frac{0.01 \times 100}{2}$

$= 5\sqrt{3} + 0.5 = 9.16\,N$

Frictional force $F_s = \mu R = 0.2 \times 9$

Resultant force along the plane

$F = mg\sin 30^\circ - (F_s + qE\cos 3$

$= 5 - \Big(1.832 + 0.01 \times 100 \times \frac{1}{}$

$= 5 - 2.698 = 2.3N$

$\therefore$ Acceleration along the plane

Distance along the plane = 1 ×

$s = ut + (1/2)\,ft^2,\ u = 0$

$\therefore\ t = \left(\frac{2s}{f}\right)^{1/2} = \left(\frac{2 \times 2}{2.3}\right)^{1/2}$

$= 1.319$ sec

22. (3.57×10^7)

Time period of satellite,

$T = \frac{2\pi(R_E + h)}{\sqrt{\frac{GM_E}{}}} = \frac{2\pi(R_E + h)^{3/}}{\sqrt{GM_E}}$

E cos 30°)

qE

g cos 30° + qE sin 30°)

.16 = 1.832 N

in the downward direction

0°)

$\left. \frac{.732}{2} \right)$

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

cosec 30° = 2 m

/2

$$T^2 = \frac{4\pi^2 (R_E + h)^3}{GM_E}$$

$$(R_E + h)^3 = \frac{GM_E T^2}{4\pi^2}$$

$$(R_E + h) = \left(\frac{GM_E T^2}{4\pi^2}\right)^{1/3}$$

or $h = \left(\frac{GM_E T^2}{4\pi^2}\right)^{1/3} - R_E$

Here, $M_E = 6 \times 10^{24}$ kg
$R_E = 6400$ km $= 6400 \times 10^3$ m $=$
$T = 24$ h $= 24 \times 60 \times 60$ s $= 864$
$G = 6.67 \times 10^{-11}$ N m^2 kg^{-2}
On substituting the given valu

$$h = \left(\frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times (86}{4 \times (3.14)^2}\right.$$

$= 4.21 \times 10^7 - 6.4 \times 10^6 = 3.57 \times$

23. **(7)** Let initial e.m.f. induced = e.

$\therefore$ Initial current $i = \frac{E - e}{R}$ i.e.,

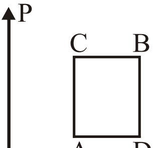
This gives e = 12 – 2 = 10 volt.
when speed is halved, the valu

$$\frac{e}{2} = \frac{10}{2} = 5 \text{ volt}$$

$\therefore$ New value of current

$$i' = \frac{E - e}{R} = \frac{12 - 5}{1} = 7 \text{ A}$$

24. **(40)**



$.4 \times 10^6 m$

$0 s$

es, we get

$400)^2 \Big)^{1/3} - 6.4 \times 10^6$

$10^7 m$

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

As $e \propto \omega$.

e of induced e.m.f. becomes

$\Delta Q_{ACB} = \Delta W_{ACB} + \Delta U_{ACB}$
$\Rightarrow 60\text{ J} = 30\text{ J} + \Delta U_{ACB}$
$\Rightarrow U_{ACB} = 30\text{ J}$
$\therefore\ \Delta U_{ADB} = \Delta U_{ACB} = 30\text{ J}$
$\Delta Q_{ADB} = \Delta U_{ADB} + \Delta W_{ADB}$
$= 10\text{ J} + 30\text{ J} = 40\text{ J}$

25. (1.324)

Energy produced in one day = 1

$\eta = 0.8 = \frac{\text{output energy}}{\text{input energy}} = \frac{10^6}{\text{in}}$

So input energy = $\frac{10^6 \times 24 \times 6}{0.8}$

Energy released in one fission

$= 200 \times 10^6 \times 1.6 \times 10^{-19} = 3.2$

No. of fissions per day = $\frac{10.8}{3.2 \times}$

Mass of U^{235} consumed per da

= no. of nuclei disintegrating p

$= 3.375 \times 10^{21} \times 235 \times 1.67 \times 10$

CHEM

26. (b) When the temperature is incr
which increases the kinetic en
increase the number of collisio
be enhanced.

27. (b) In lanthanides, there is poorer
resulting in greater attraction
contraction of the atomic radii

28. (b) $(CH_3)_2\ CHCH_2MgBr \xrightarrow{C_2H_5OH}$

29. (c) Using the relation $K_p = K_c . (RT$

$0^6 \times 24 \times 60 \times 60$ joule

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

$$\frac{0 \times 60}{} = 10.8 \times 10^{10}\,\text{J}$$

$\times 10^{-11}$ J

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

ay

er day $\times$ mass of U^{235}

$^{-27} = 1.324$ mg

ISTRY

eased, energy in form of heat is supplied
ergy of the reacting molecules. This will
ns and ultimately the rate of reaction will

shielding of $5d$ electrons by $4f$ electrons
n of the nucleus over $5d$ electrons and
.

$\xrightarrow{H} (CH_3)_2CHCH_3 + Mg\begin{matrix} OC_2H_5 \\ Br \end{matrix}$

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

Thus $\frac{K_p}{K_c}$ will be highest for t

The Δn values for various reac

(a) $\Delta n = 1 - \left(1 + \frac{1}{2}\right) = -\frac{1}{2}$

(b) $\Delta n = 2 - (1 + 1) = 0$

(c) $\Delta n = (1 + 1) - 1 = 1$

(d) $\Delta n = (2 + 4) - (7 + 2) = -3$

Thus, maximum value of $\Delta n =$

30. (d) According to Fajan's rule :

$$\text{Covalent character} \propto \frac{1}{\text{size of}}$$

$$\propto \text{size of a}$$

Among the given species orde

$N^{3+} < O^{2+} < Pb^{2+} < Ba^{2+}$

Order of size of anions $O^{2-} > C$

Hence the order of covalent ch

$NCl_3 > Cl_2O > PbCl_2 > BaCl$

$\therefore$ $BaCl_2$ is most ionic in natur

31. (c)

Element	%	Relative
C	49.3	49.3 1.5
H	6.84	6.84
O	43.86	43.86

$\therefore$ Empirical formula $= C_3H_5O_2$

Empirical formula mass

$= (3 \times 12) + (5 \times 1) + (2 \times 16) =$

Molecular mass $= 2 \times$ Vapour

$= 2 \times 73 = 146$

$$n = \frac{\text{molecular mass}}{\text{empirical formula mass}} =$$

Molecular formula = Empirical

=

the reaction having highest value of Δn.

ctions are

1

cation

anion

er of size of cations

Cl^-.

haracter is

2

re.

no. of atoms	Simplest ratio of atoms
/12 = 4.1	4.1/2.74 = 1.5
× 2 = 3	
/1 = 6.84	6.84/2.74 = 2.5
	= 2.5 × 2 = 5
/16 = 2.74	2.74/2.74 = 1
	1 × 2 = 2

2

$36 + 5 + 32 = 73$

density

$= 146/73 = 2$

formula × 2

$(C_3H_5O_2) \times 2 = C_6H_{10}O_4$

33. **(b)** $\Delta G = \Delta H - T\Delta S$

At equilibrium, $\Delta G = 0$

$\Rightarrow 0 = (170 \times 10^3\ \text{J}) - T(170\ \text{JK}$

$\Rightarrow T = 1000\ \text{K}$

For spontaneity, ΔG is – ve, wh

34. **(b)** According to gas law

$$PV = nRT,\ n = \frac{PV}{RT}$$

$$\frac{n_A}{n_B} = \frac{\frac{P_1V_1}{RT_1}}{\frac{P_2V_2}{RT_2}}; \frac{n_A}{n_B} = \frac{P_1V_1}{T_1} \times \frac{T_2}{P_2V_2}$$

$$\frac{n_A}{n_B} = \frac{2P \times 2V}{2T} \times \frac{T}{PV}; \frac{n_A}{n_B} = \frac{2}{1}$$

35. **(b)** Due to inent pair effect oxidati
the group in *p*-block.

36. **(a)** Carbon atom is connected with

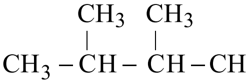
37. **(c)** Sr^{90} is harmfull radiological po

38. **(d)** Here, A_2B_3 can also be written
Since, *hcp* has six atoms, so '
void.

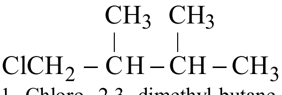
Total tetrahedral voids = 12

∴ Fraction of tetrahedral void

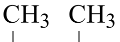
$A = 4/12 = \frac{1}{3}$

39. **(c)**  . Sinc

hence it will give only two mon



1–Chloro–2,3–dimethyl butane



K^{-1})

hich is possible only if $T > 1000$ K.

ion state decrease by 2 while going down

n four different groups in chiral structure.

ollutant.

n as A_4B_6.

B' forms *hcp* lattice and 'A' is present in

ds occupied by

ce it contains only two types of H-atoms

no chlorinated compounds viz.

40. **(c)** Let solubility of $PbCl_2 = s$

$$\underset{s}{PbCl_2} \rightleftharpoons \underset{s}{Pb^{2+}} + \underset{2s}{2C}$$

Moles

$$K_{sp} = [Pb^{2+}][Cl^-]^2$$

$\therefore$ $1.7 \times 10^{-5} = (s)(2s)^2$

or $1.7 \times 10^{-5} = 4s^3$

$\therefore$ $s = \sqrt[3]{\dfrac{1.7 \times 10^{-5}}{4}}$

41. **(d)** d^4 in high spin octahedral com

e_g ↑ —

t_{2g} ↑ ↑ ↑

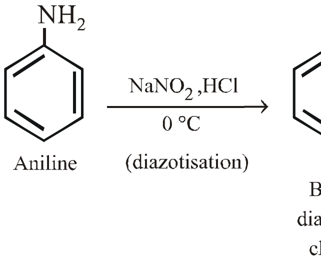
CFSE $= (-0.4x + 0.6y)\Delta_0$

Where, $x \rightarrow$ electrons in t_{2g} or

$y \rightarrow$ electrons in e_g or

CFSE $= [0.6 \times 1] + [-0.4 \times 3] =$

42. **(d)**



43. **(b)** Nylon is a polyamide polymer

44. **(a)** Reaction involved:

$\overset{+3}{C}_2 O_4^{2-}$ ——

↑

Cl^-

s

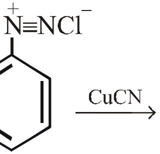
$= 1.62 \times 10^{-2}$

plex

bital

bital

$-0.6\ \Delta_0$

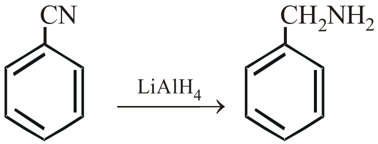


(A)

enzene

zonium

hloride



(B) Cyanobenzene

(C) Benzylamine

$\longrightarrow 2\overset{+4}{C}O_2 + 2e^-$

$\uparrow$

45. (d) $\lambda = \dfrac{h}{mv}$

$$\therefore \quad mv = \frac{h}{\lambda} = \frac{6.625 \times 10^{-34}}{0.33 \times 10^{-9}} = 2.01$$

46. (300) ΔH = Heat of formation at c

ΔE = Heat of formation at co

T = 27 °C = 27 + 273 = 300 K.

R = 2 cal/degree/mole.

$$C(s) + \frac{1}{2}O_2(g) \longrightarrow CO(g$$

$$\Delta n = n_p - n_r = 1 - \frac{1}{2} = \frac{1}{2}$$

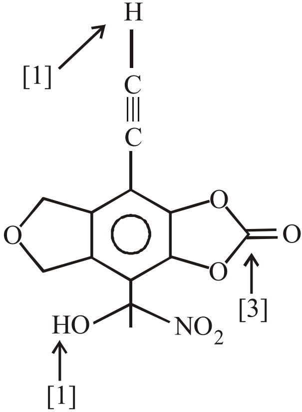
$$\Delta H = \Delta E + \Delta n_g RT \quad \text{or} \quad \Delta H$$

$$= \frac{1}{2} \times 2 \times 300$$

$\therefore$ Heat of formation of CO at

at 27 °C will differ from one an

47. (5)



T

48. (32) $O_2\% = 20\%$

Metal% = 80%.

100g of metal oxide contains 8

$\therefore$ Eq. wt. of metal = mass of m

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

onstant pressure

nstant volume

)

$-\Delta E = \Delta n_g RT$

$= 300$ cal

constant pressure and at constant volume

other by 300 cal.

Total = 5.

0g metal and 20g oxygen

metal × 8/ mass of oxygen

49. **(4)** The total number of isomers fo

$[Cu^{II}(NH_3)_4][Pt^{II}Cl_4]$ is fo

These four isomers are

$[Cu(NH_3)_3Cl]\,[Pt(NH_3)Cl_3$

$[Cu(NH_3)Cl_3]\,[Pt(NH_3)_3Cl]$

$[CuCl_4][Pt(NH_3)_4]$

and $\left[Cu(NH_3)_4\right]\,\left[PtCl_4\right]$.

The isomer $[Cu\,(NH_3)_2\,Cl_2][$

parts being neutral.

50. **(3)** 10 volume solution of H_2O_2

give 10 L of oxygen at STP.

$$\underset{\substack{2\times 34g\\=68g}}{2H_2O_2(l)} \longrightarrow \underset{22.7\text{ L at STP}}{O_2(g)} + H_2O(l)$$

Thus, 22.4L of O_2 is produced

is produced from $\dfrac{68\times10}{22.4}$ g

$= 29.9 g H_2O_2 = 30$ g

Therefore, strength of H_2O_2 i

$= 30$ g/L $= 3\%$ H_2O_2 solution.

MATHE

51. **(a)** Since $\left(7+4\sqrt{3}\right)\left(7-4\sqrt{3}\right)=1$

$\therefore$ The given equation becom

$y+\dfrac{1}{y}=14$ where $y=\left(7-4\right.$

$\Rightarrow y^2-14y+1=0 \Rightarrow y=7\pm$

Now $y=7+4\sqrt{3} \Rightarrow x^2-4x+$

Also $y=7-4\sqrt{3} \Rightarrow x^2-4x+$

52. **(a)** $f(x)=x^{3/2}+x^{-3/2}-4\left(x+\dfrac{1}{x}\right.$

r the complex compound

ur.

],

,

Pt $(NH_3)_2$ 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

n 10 volume of H_2O_2 solution,

MATICS

,

es

$\sqrt{3})^{x^2-4x+3}$

$4\sqrt{3}$

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

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

)

Let $\sqrt{x}+\frac{1}{\sqrt{x}}=t\ (x>0)$

Let $g(t)=t^3-3t-4t^2+8$

$g(t)=t^3-4t^2-3t+8$

$g'(t)=3t^2-8t-3=(t-3)($

$g'(t)=0 \Rightarrow t=3\ (t\neq -1/3)$

$g''(t)=6t-8$

$g''(3)=10>0 \Rightarrow g(3)$ is minim

$g(3)=27-9-36+8=-10$

53. **(a)** term of $\left(\frac{x}{2}-\frac{3}{x^2}\right)^{10}$ is ${}^{10}C_t\left(\right.$

Here, $x^{-t+10-2t}=x^4 \Rightarrow -3t+10$

Hence coefficient of x^4 is ${}^{10}C_2$

54. **(b)** Given plane $3x+y+2z+6=0$

and line $\frac{x-1/3}{2b/3}=\frac{y-3}{-1}=\frac{z-1}{a}$

Since plane is parallel to line, t

$3\left(\frac{2b}{3}\right)+(1)(-1)+2(a)=0$

$\Rightarrow 2b-1+2a=0 \Rightarrow a+b=1/$

Now, $3a+3b=3/2$

55. **(b)** $f(x)=\sqrt{1+\log_e(1-x)}$ value o

$1+\log_e(1-x)\geq 0$ and $1-x>$

$\Rightarrow \log_e(1-x)\geq -1$ and $x<1$

$\Rightarrow \log_e(1-x)\geq \log_e e^{-1}$ and x

$\Rightarrow 1-x\geq \frac{1}{e}$ and $x<1 \Rightarrow x\leq \frac{e}{}$

56. **(c)** $f(x)=[x]^2-[x^2]$

Check continuity at x = 0

$\lim_{x\to 0^+} f(x)=\lim_{x\to 0^+}[x]^2-[x^2]$

$\lim f(x)=\lim [x]^2-[x^2]$

$3t+1)$

mum

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

$= 4 \Rightarrow t = 2$

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

1

then

/2

of $f(x)$ is real when

0

< 1

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

$= 0$

Thus, discontinuous at x = 0

Check continuity at x = 1

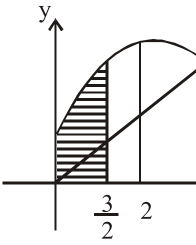
$\lim_{x \to 1^+} f(x) = 1 - 1 = 0$

$\lim_{x \to 1^-} f(x) = 0 - 0 = 0$

Also $f(1) = 0$

Hence continuous at x = 1.

57. (a) $y = 1 + 4x - x^2 = 5 - (x-2)^2$



We have $\int_0^{3/2} (1 + 4x - x^2)dx =$

$$= \frac{3}{2} + 2\left(\frac{9}{4}\right) - \frac{1}{3}\left(\frac{27}{8}\right) = m \cdot \frac{9}{4}$$

On solving we get $m = \frac{13}{6}$

58. (b) Series 3 + 33 + 333 + ...+ n ter

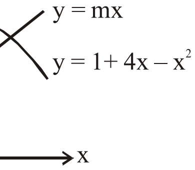
Given series can be written as,

$$= \frac{1}{3}[9 + 99 + 999 + ... + n \text{ term}$$

$$= \frac{1}{3}[(10-1) + (100-1) + (100$$

$$= \frac{1}{3}[10 + 10^2 + ... + 10^n] - \frac{1}{3}[1$$

$$= \frac{1}{3} . \frac{10(10^n - 1)}{10-1} - \frac{1}{3}n = \frac{1}{3}\left[\frac{10}{}\right.$$



$$2\int_{0}^{3/2} mx\,dx$$

ms

s]

$0-1)+....+n$ terms]

$+1+1+.....+n$ terms]

$$\frac{\ldots^{n+1}-10}{9}-n\Bigg]$$

59. **(a)** Let $I = \int \frac{1}{1+\sin x} dx = \int \frac{}{1+\frac{}{1-}}$

$$\int \frac{\left(1+\tan^2 \frac{x}{2}\right) dx}{1+\tan^2 \frac{x}{2} + 2\tan \frac{x}{2}} = \int \frac{}{1+}$$

Substitute

$\tan \frac{x}{2} = t \Rightarrow \frac{1}{2} \sec^2 \frac{x}{2} dx =$

Then

$$I = \int \frac{2dt}{1+t^2+2t} = 2\int \frac{dt}{(1+t)^2} =$$

$$= \frac{-2}{1+\tan \frac{x}{2}} + C = 1 - \frac{2}{1+\tan \frac{x}{2}}$$

Where b = $C - 1$, a new consta

$$= -\frac{1-\tan \frac{x}{2}}{1+\tan \frac{x}{2}} + b = -\tan\left(\frac{\pi}{4} -\right.$$

Clearly $a = -\frac{\pi}{4}$ and $b \in \mathbf{R}$

60. **(d)** Given expression can be writte

$$y = \tan^{-1}\left[\frac{2^x(2-1)}{1+2^x.2^{x+1}}\right] = \tan^{-1}\left[\right.$$

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

$$\Rightarrow \frac{dy}{dx} = \frac{2^{x+1}\log 2}{1+2^{2(x+1)}} - \frac{2^x \log 2}{1+2^{2x}}$$

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

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

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

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

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

ant

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

n as

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

61. **(d)** We have, $\cos\frac{2\pi}{7}+\cos\frac{4\pi}{7}+c$

$$=\frac{1}{2\sin\frac{\pi}{7}}\left[2\sin\frac{\pi}{7}\cos\frac{2\pi}{7}+2\sin\right.$$

$$=\frac{1}{2\sin\frac{\pi}{7}}\left[\left(\sin\frac{3\pi}{7}-\sin\frac{\pi}{7}\right)+\left(\sin\frac{5\pi}{7}\right.\right.$$

$$=-\frac{1}{2} \qquad \left[\because \sin\right.$$

62. **(b)** Consider the differential equat

$$\frac{dy}{dx}=y\tan x-y^2\sec x$$

Divide by y^2 on both the sides

$$\frac{1}{y^2}\left(\frac{dy}{dx}\right)=\frac{\tan x}{y}-\sec x$$

Let $\frac{1}{y}=z$

Differentiating both sides, we

$$\frac{-1}{y^2}\cdot\frac{dy}{dx}=\frac{dz}{dx}$$

Put value of $\frac{1}{y^2}\frac{dy}{dx}$ in the equ

$$-\left(\frac{dz}{dx}\right)-(\tan x)z=-\sec$$

$$\Rightarrow \left(\frac{dz}{dx}\right)+(\tan x)z=\sec x$$

This is the linear diff equation

This is of the form $\frac{dz}{dx}+\mathrm{P}.z=$

$\text{os}\,\dfrac{6\pi}{7}$

$\dfrac{\pi}{7}\cos\dfrac{4\pi}{7}+2\sin\dfrac{\pi}{7}\cos\dfrac{6\pi}{7}\Big]$

$-\sin\dfrac{3\pi}{7}\Big)+\Big(\sin\dfrac{7\pi}{7}-\sin\dfrac{5\pi}{7}\Big)\Big]$

$\text{n}\,\dfrac{7\pi}{7}=\sin\pi=0\Big]$

tion

s, we get

...(1)

get:

ation(1) , we get

x

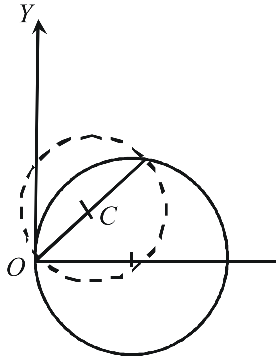
in 'z' i.e.

Q

$\therefore$ In the given question

I.F. $= e^{\int \tan x\, dx} = e^{\log(\sec x)} =$

63. (c) Here equation of the circle
$(x^2 + y^2 - 10x) + \lambda(y - 2x) = 0$
Now centre $C(5 + \lambda, -\lambda/2)$ lies



$\therefore \dfrac{-\lambda}{2} = 2(5 + \lambda)$

$\therefore \lambda = -4$

Hence $x^2 + y^2 = 10x + 4y - 8x$

or $x^2 + y^2 - 2x - 4y = 0$

64. (c) Since, $\vec{a}$ and $\vec{b} + \vec{c}$ are mutual

$\therefore \quad \vec{a}.(\vec{b} + \vec{c}) = 0 \Rightarrow \vec{a}.\vec{b} + \vec{c}$

Similarly, $\vec{b}.\vec{c} + \vec{a}.\vec{b} = 0$

and $\vec{c}.\vec{a} + \vec{b}.\vec{c} = 0$

On adding eqs. (i), (ii) and (iii)

$2(\vec{a}.\vec{b} + \vec{b}.\vec{c} + \vec{c}.\vec{a}) = 0$

Now, $|\vec{a} + \vec{b} + \vec{c}|^2 = |\vec{a}|^2 + |\vec{b}|$

$= |\vec{a}|^2| + |\vec{b}|^2 + |\vec{c}|^2$

$= 9 + 16 + 25 \quad (\because |\vec{a}| = 3, |\vec{b}$

$\sec x$

s on the chord again.

$\rightarrow X$

lly perpendicular.

$.\vec{a} = 0$ ...(i)

...(ii)

...(iii)

, we get

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

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

65. **(c)** $$\begin{vmatrix} a-x & c & b \\ c & b-x & a \\ b & a & c-x \end{vmatrix} = 0$$

$$\Rightarrow \begin{vmatrix} a+b+c-x & c & b \\ a+b+c-x & b-x & a \\ a+b+c-x & a & c-x \end{vmatrix}$$

$$\Rightarrow (\Sigma a - x)\begin{vmatrix} 1 & c & b \\ 1 & b-x & a \\ 1 & a & c-x \end{vmatrix}$$

$\Rightarrow x = \Sigma a = 0$

or $1\{(b-x)(c-x)-a^2\}-c\{c-x-$

(by expar

or $x^2-(a^2+b^2+c^2)+(ab+bc$

or $x^2-\Sigma a^2+\Sigma ab=0$

or $x^2-(\Sigma a^2)-\dfrac{1}{2}(\Sigma a^2)=0$

$[\because\ a+b+c=0 \Rightarrow (a+b+c)$

$\Rightarrow \Sigma a^2+2\Sigma ab=0 \Rightarrow \Sigma ab=-$

or $\qquad x=\pm\sqrt{\dfrac{3}{2}\Sigma a^2}$

$\therefore$ the solution is $x=0$ or $\pm\sqrt{}$

66. **(b)** $I_1=\int_0^1 2^{x^2}dx,\ I_2=\int_0^1 2^{x^3}dx,\ I_3=$

$\forall$

$\Rightarrow \int_0^1 2^{x^2}dx > \int_0^1 2^{x^3}dx \Rightarrow I_1 >$

$\Big| = 0$

$x \Big|$

$= 0$

$a\} + b\{a - b + x\} = 0$

nding the determinant.)

$c + ca) = 0$

${}^2 = 0$

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

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

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

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

$> I_2 \cdot$

$\int^2 \dots$

67. **(c)** Given, $f(x) = |x|$ and $g(x) =$

For $-\frac{8}{5} < x < \frac{8}{5}; \ 0 \le f(x) < \frac{8}{5}$

Now, for $\quad 0 \le f(x) < 1,$

$g(f(x)) = [f(x) - 3] = -3$

for $1 \le f(x) < 1.6$

$g(f(x)) = -2 \qquad [\because -2 \le$

$\therefore$ required set is $\{-3, -2\}$.

68. **(d)** We know that $P(A \cup B) \ge \max$

$P(A \cap B) \le \min\ \{P(A), P(B)\} =$

and $P(A \cap B) = P(A) + P(B) -$

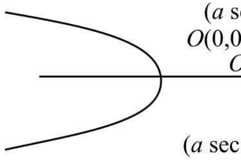
$\Rightarrow \frac{1}{6} \le P(A \cap B) \le \frac{1}{2}$

$P(A' \cap B) = P(B) - P(A \cap B)$

$\therefore \frac{2}{3} - \frac{1}{2} \le P(A' \cap B) \le \frac{2}{3} -$

$\Rightarrow \frac{1}{6} \le P(A' \cap B) \le \frac{1}{2}$

69. **(d)** Let $P(a \sec\theta, b\tan\theta)$ and $Q(a$
ordinates and $C(0, 0)$, is the ce
Now $PQ = 2b\tan\theta$



$[x-3]$

$\frac{3}{3}$

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

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

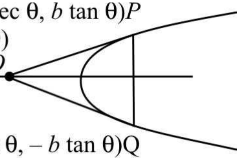
$\{P(A), P(B)\} = \frac{2}{3}$

$\frac{1}{2}$

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

$\frac{1}{6}$

sec θ, – b tan θ) be end points of double
ntre of the hyperbola.



$\therefore\ OQ = OP = PQ,$

$\therefore\ 4b^2 \tan^2 \theta = a^2 \sec^2 \theta + b^2$ ta

$\Rightarrow 3b^2 \tan^2 \theta = a^2 \sec^2 \theta \Rightarrow 3b$

$\Rightarrow 3a^2 (e^2 - 1) \sin^2 \theta = a^2,$

$\Rightarrow 3(e^2 - 1) \sin^2 \theta = 1$

$\Rightarrow \dfrac{1}{3(e^2-1)} = \sin^2 \theta < 1, \quad (\because$

$\Rightarrow \dfrac{1}{e^2-1} < 3 \Rightarrow e^2 - 1 > \dfrac{1}{3} \Rightarrow$

70. **(b)** Let p be the length of the perpe
Then its equation in normal fo

$x \cos 30° + y \sin 30° = p \Rightarrow \sqrt{3}$

This meets the coordinate axe

$\therefore$ Hence, area of $\Delta OAB = \dfrac{1}{2}\Big($

$= \dfrac{2p^2}{\sqrt{3}}$

$\because$ are a of triangle is $\dfrac{50}{\sqrt{3}}$.

$\therefore\ \dfrac{2p^2}{\sqrt{3}} = \dfrac{50}{\sqrt{3}} \Rightarrow p = \pm 5.$

Hence the lines are $\sqrt{3}x + y \pm$

71. **(6)** The first equation can be writt

$2 \sin \dfrac{1}{2}(x+y) \cos \dfrac{1}{2}(x-y)$

$= 2 \sin \dfrac{1}{2}(x+y) \cos \dfrac{1}{2}$ (

$\therefore$ Either $\sin \dfrac{1}{2}(x+y) = 0$ or sin

$\text{an}^2\,\theta$

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

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

$\sin^2\theta < 1)$

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

ndicular from the origin on the given line.

rm is

$3x + y = 2p$

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

$\left.\frac{2p}{\sqrt{3}}\right)2p$

$10 = 0.$

en as

$x + y)$

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

or $x-y=-1$ which gives $\left(\frac{1}{2}, -\right.$

Again solving with $x=0$, we g
$(\pm 1, 0)$ as the other solution. T
and y.

72. (120) Using L-Hospital's rule,

$$\lim_{x\to 0}\left\{\frac{\sin x - x + \frac{x^3}{6}}{x^5}\right\} = \lim_{x\to 0}\frac{\text{co}}{}$$

$$= \lim_{x\to 0}\frac{-\sin x + \frac{6x}{6}}{20x^3} = \lim_{x\to 0}\frac{-\text{cos}}{60}$$

$$= \lim_{x\to 0}\frac{\sin x}{120x} = \lim_{x\to 0}\frac{\cos x}{120} = \frac{1}{12}$$

73. (750) Let edge of the cube be x cm.

Volume of the cube be $x^3 cm^3$.

Given, $\frac{dx}{dt} = 10$ cm/sec

Now, $v = x^3 \Rightarrow \frac{dv}{dt} = 3x^2\frac{dx}{dt}$

$$\Rightarrow \frac{dv}{dt} = 3(5)^2(10)\, cm^3/\text{sec} =$$

74. (0) Given $2x = -1 + \sqrt{3}i \quad \Rightarrow \quad x =$

Now $(1-\omega^2+\omega)^6 - (1-\omega+\omega$
$= (-\omega^2-\omega^2)^6 - (-\omega-\omega)^6 \qquad ($
$= (-2\omega^2)^6 - (-2\omega)^6 = (-2)^6(\omega^3)$
$= (-2)^6 - (-2)^6 = 0 \qquad (\because$

75. (13986)

The non-zero perfect square di
1 can occur at units place in 3
$\therefore$ Sum due to 1 at units place i
sum due to 1 at tens place is 1
sum due to 1 at hundreds place

$-\frac{1}{2}\Big)$ 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

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

$$s\,x + 1$$
$$x^2$$

$$0$$

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

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

$^2)$

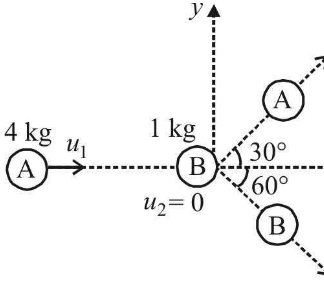
$\because \quad 1 + \omega + \omega^2 = 0)$

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

$\omega^3 = 1)$

igits are 1, 4 and 9.
$\times\, 3 = 9$ ways.
s 1×9. Similarly,
$\times\, 10 \times 9$ and

1. (a)



Apply the law of conservation
perpendicular to the direction
$0 + 0 = 4v_1 \sin 30° - v_2 \sin 60°$
$4v_1 \sin 30° = v_2 \sin 60°$

$$\frac{v_1}{v_2} = \frac{\sin 60°}{4\sin 30°} = \frac{\sqrt{3}}{4}$$

2. (d) Mass per unit length of the wi
Mass of L length, $M = \rho L$
and since the wire of length L i

$$2\pi R = L \Rightarrow R = \frac{L}{2\pi}$$

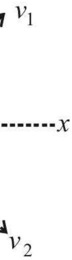
Moment of inertia of loop abou

$$= \frac{3}{2}\rho L\left(\frac{L}{2\pi}\right)^2 = \frac{3\rho L^3}{8\pi^2}$$

3. (c) $V_{in} = \frac{-GM}{2R}\left[3 - \left(\frac{r}{R}\right)^2\right],$

$$V_{surface} = \frac{-GM}{R}, V_{out} = \frac{-GM}{r}$$

4. (c) Electric field, $E \propto \frac{1}{V}$



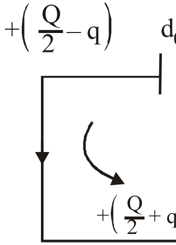
n of linear momentum along a direction of motion (i.e. along y-axis), we get

re = ρ

is bent in a form of circular loop therefore

ut given axis = $\frac{3}{2}MR^2$

5. **(a)** Let each plate moves a distanc
Let q charge flows in the loop. U



$$\frac{\left(\frac{Q}{2}-q\right)(d_0+x)}{\epsilon_0 A}-\frac{\left(\frac{Q}{2}+q\right)(}{\epsilon_0 A}$$

$$\therefore\ q=\frac{Qx}{2d_0}\ ;\ I=\frac{dq}{dt}=\frac{Q}{2d_0}\Big($$

6. **(a)** The magnetic field varies inver

That is, $B \propto \frac{1}{d}$

so, graph (a) is the correct one

7. **(d)** Applying dimensional method

$v_c = \eta^x \rho^y r^z$

$[M^0LT^{-1}] = [ML^{-1}T^{-1}]^x\ [ML^{-3}$

Equating powers both sides

$x + y = 0; -x = -1\ \therefore\ x = 1$

$1 + y = 0\ \therefore\ y = -1$

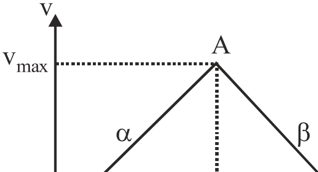
$-x - 3y + z = 1$

$-1 - 3(-1) + z = 1$

$-1 + 3 + z = 1$

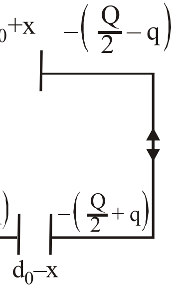
$\therefore\ z = -1$

8. **(d)**



e x from its initial position.

sing Kirchoff's voltage law



$$(d_0 - x)$$

$$\overline{\quad\quad\quad} = 0$$

A

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

sely with the distance for a long conductor.

e.

l :

$T^0]^y\,[M^0LT^0]^z$

In fig., $AA_1 = v_{max.} = \alpha t_1 = \beta t_2$

But $t = t_1 + t_2 = \frac{v_{max}}{\alpha} + \frac{v_{max}}{\beta}$

$= v_{max}\left(\frac{1}{\alpha} + \frac{1}{\beta}\right) = v_{max}$

or, $v_{max} = t\left(\frac{\alpha\beta}{\alpha+\beta}\right)$

9. **(c)** Given, $u\cos\theta = \frac{\sqrt{3}u}{2}$

$\Rightarrow \cos\theta = \frac{\sqrt{3}}{2} \Rightarrow \theta = 30°$

Range (R) $= \frac{u^2 \sin 2\theta}{g} = \frac{u^2 \sin}{g}$

Maximum height $= \frac{u^2 \sin^2\theta}{2g} =$

Now, Range = P × H

$\Rightarrow \frac{\sqrt{3}u^2}{2g} = P \times \frac{u^2}{8g} \Rightarrow P = 4$

10. **(d)** The electron ejected with max
field E =4N/C after travelling a

$\frac{1}{2}mv_{max}^2 = eEd = 4eV$

The energy of incident photon

From equation of photo electri

$\frac{1}{2}mv_{max}^2 = h\nu - \phi_0$

$\therefore \phi_0 = 6.2 - 4 = 2.2$ eV

11. **(d)** Shortest wavelength comes fro
comes from $n_1 = 6$ to $n_2 = 5$ in

x

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

$$\frac{\ldots 60^\circ}{\ldots} = \frac{\sqrt{3}\,u^2}{2g}$$

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

$$4\sqrt{3}$$

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

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

ic effect

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

$$\frac{1}{\lambda_{max}} = R\left(\frac{1}{5^2} - \frac{1}{6^2}\right) = R\left(\frac{36}{25}\right.$$

$$\therefore \frac{\lambda_{max}}{\lambda_{min}} = \frac{900}{11}$$

12. **(c)** The range of energy of β-partic

13. **(c)** According to Newton's law decreasing with time non-line

14. **(c)** The equation for the line is

$$P = \frac{-P_0}{V_0} V + 3P \text{ [slope} = \frac{-P_0}{V_0}$$

$$PV_0 + P_0V = 3P_0V_0$$

But $\quad PV = nRT$

$$\therefore P = \frac{nRT}{V}$$

From (i) and (ii)

$$\frac{nRT}{V} V_0 + P_0V = 3P_0V_0$$

$$\therefore nRT\,V_0 + P_0V^2 = 3P_0V_0$$

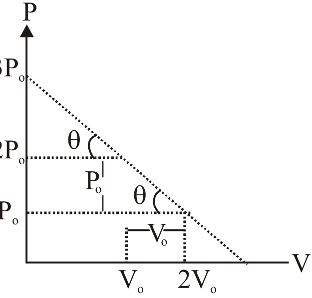
For temperature to be maximur

Differentiating e.q. (iii) by 'V' v

$$nRV_0 \frac{dT}{\ } + P_0(2V) = 3P_0V_0$$

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

cles is from zero to some maximum value.
of cooling, the temperature goes on
arly.



, $c = 3P_0$]

...(i)

...(ii)

...(iii)

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

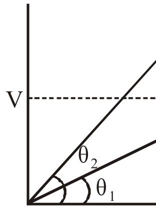
we get

$$\frac{dT}{dV} = \frac{3P_0V_0 - 2P_0V}{nRV_0} = 0$$

$$V = \frac{3V_0}{2} \qquad \therefore\ P = \frac{3P_0}{2}$$

$$\therefore\ T_{max} = \frac{9P_oV_o}{4nR} \quad \text{[From (iii)]}$$

15. **(b)** $P_1 > P_2$



As V = constant $\Rightarrow P \propto T$

Hence from V–T graph $P_1 > P_2$

16. **(d)** At t = 2 sec, the particle cross

At t = 4 sec, its velocity is 4 m

For simple harmonic motion,

$$\therefore\ y = a\sin\left(\frac{2\pi}{T}\right)t$$

$$y_1 = a\sin\left[\left(\frac{2\pi}{16}\right)\times 2\right] = a\sin($$

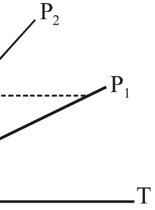
After 4 sec or after 2 sec from

velocity = 4 ms^{-1}

$$\therefore\ \text{Velocity} = \omega\sqrt{a^2 - y_1^2}$$

$$\Rightarrow\ 4 = \left(\frac{2\pi}{16}\right)\sqrt{a^2 - \frac{a^2}{2}}$$

[From (i)]



ses mean position.

ns^{-1}

$y = a \sin \omega t$

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

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

[from (i)]

17. **(d)** Here, induced e.m.f. 

$$e = \int_{2\ell}^{3\ell} (\omega x) B dx = B\omega \frac{[(3\ell)^2 - (}{2}$$

$$= \frac{5B\ell^2\omega}{2}$$

18. **(c)** Charge on the capacitor at any

$q = CV\,(1 - e^{t/\tau})$

at $t = 2\tau$

$q = CV\,(1 - e^{-2})$

19. **(b)** $\because$ The E.M. wave are transver

$$= \frac{\vec{k} \times \vec{E}}{\mu\omega} = \vec{H}$$

where $\vec{H} = \dfrac{\vec{B}}{\mu}$

and $\dfrac{\vec{k} \times \vec{H}}{\omega\varepsilon} = -\vec{E}$

$\vec{k}$ is $\perp$ $\vec{H}$ and $\vec{k}$ is also $\perp$ t

or In other words $\vec{X} \parallel \vec{E}$ and

20. **(b)** Acceleration of block AB $= \dfrac{}{3\text{r}}$

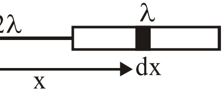
Acceleration of block CD $= \dfrac{}{2\text{r}}$

Acceleration of image in mir

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

Acceleration of image in mirro

$\therefore$ Acceleration of the two ima



$(2\ell)^2]$

y time t is given by

se in nature i.e.,

$\ldots(i)$

$\ldots(ii)$

to $\vec{E}$

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

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

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

ror AB $= 2 \times$ acceleration of mirror $=$

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

ages w.r.t. each other

21. **(2.5)** If C_e be the effective capacitan

$$V_C = \frac{1}{2}V_0$$

$$\frac{q}{C_e} = \frac{q_0}{2C_e}$$

$$\Rightarrow \quad q_0(1-e^{-t/RC_e}) = \frac{q_0}{2} \Rightarrow t = R$$

For parallel grouping

$$C_e = \frac{2C}{2}$$

$$\therefore \quad t_2 = 2RC\ln 2$$

For series grouping,

$$C_e = \frac{C}{2}$$

$$\therefore \quad t_1 = \frac{RC}{2}\ln 2$$

$$\therefore \quad \frac{t_2}{t_1} = \frac{1}{4} \Rightarrow t_2 = 2.5s$$

22. **(22)** $v_e = 11$ Km/s.

$R_p = 2R$ $\qquad \rho' = \rho$

$$\because g = \frac{GM}{R^2} = \frac{G.\frac{4}{3}\pi R^3\rho}{R^2} = 4$$

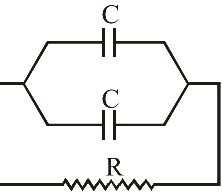
$$g_p = \frac{G\frac{4}{3}\pi R_p{}^3\rho}{R_p{}^2} = 4\pi GR_p\rho$$

$$= 2\times(4\pi GR\rho) = 2\times g$$

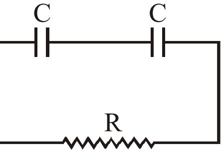
$$v_e' = \sqrt{2g_pR_p} = \sqrt{2\times 2g\times 2R}$$

$$= 2\times 11 = 22 \text{ km/s}$$

nce, then



$RC_e \ln 2$

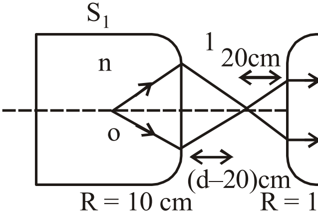


$\pi GR\rho$

ρ

$= 2\sqrt{2gR}$

23. **(70)**



At glass rod S_2

$1 \rightarrow n$ refraction

$$\frac{n}{\infty}-\frac{1}{u_2}=\frac{n-1}{+10}$$

$\Rightarrow u_2 = -20\text{cm}$

At glass rod S_1

For $n \rightarrow 1$ refraction

$v_1 = d - 20$

$$\frac{1}{d-20}-\frac{n}{(-50)}=\frac{1-n}{-10}$$

$$\frac{1}{d-20}-\frac{n}{(-50)}=\frac{1-n}{-10}$$

$$\frac{1}{d-20}+\frac{n}{50}=+\frac{1}{20}$$

$d = 70\text{ cm}$

24. **(0.3)** The displacement of particle,

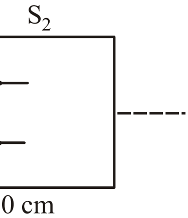
$$y = 5\sin\left(4t+\frac{\pi}{3}\right)$$

Velocity of particle, $\frac{dy}{dt}=\frac{5d}{dt}$

$$= 5\cos\left(4t+\frac{\pi}{3}\right)4 = 20\cos\left(\right.$$

Velocity at $t=\left(\frac{T}{4}\right)$

$$\left(\frac{dy}{\right.$$



executing SHM

...(i)

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

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

$$\Big)$$

$$\Rightarrow\ u = 20\cos\left(T + \frac{\pi}{3}\right)$$

Comparing the given equation

$(\omega t + \phi)$, we get $\omega = 4$.

$$\text{As}\ \omega = \frac{2\pi}{T} \Rightarrow T = \frac{2\pi}{\omega} \Rightarrow T =$$

Now, putting value of T in Eq.

$$u = 20\cos\left(\frac{\pi}{2} + \frac{\pi}{3}\right) = -20\sin$$

$$= -20 \times \frac{\sqrt{3}}{2} = -10 \times \sqrt{3}$$

The kinetic energy of particle,

$$KE = \frac{1}{2}mu^2$$

$$\because\ m = 2g = 2 \times 10^{-3}\,kg$$

$$= \frac{1}{2} \times 2 \times 10^{-3} \times \left(-10\sqrt{3}\right.$$

$$= 10^{-3} \times 100 \times 3 = 3 \times 10^{-1} \Rightarrow$$

25. (0.144) Here, $E = 9V$; $V_z = 6$; $R_L =$

Potential drop across series re

$V = E - V_Z = 9 - 6 = 3V$

Current through series resista

$$I = \frac{V}{R} = \frac{3}{100} = 0.03\,A$$

Current through load resistanc

$$I_L = \frac{V_Z}{R_L} = \frac{6}{1000} = 0.006\,A$$

Current through Zener diode i

$I_Z = I - I_L = 0.03 - 0.006 = 0.02$

Power dissipated in Zener dio

...(ii)

n with standard equation of SHM y = a sin

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

. (ii), we get

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

,

$$)^2$$

$K.E. = 0.3J$

1000Ω and $R_s = 100\Omega$,

esistor

nce R_S is

ce R_L is

s

4 amp.

de is

26. **(d)** (a) $Ba(N_3)_2 \xrightarrow{\Delta} Ba + 3N_2$

(b) $(NH_4)_2Cr_2O_7 \xrightarrow{\Delta} Cr_2C$

(c) $NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H$

(d) $(NH_4)_2SO_4 \xrightarrow{\Delta} 2NH_3$

NH_3 is evolved in case of (d) .

27. **(b)** Aspirin is analgesic and antipy

28. **(b)** $\Delta H = E_{a(f)} - E_{a(b)}$

Thus energy of activation for
reaction is exothermic or endot

If reaction is exothermic, ΔH

If reaction is endothermic, Δ

29. **(c)** Liquation process, Mond's p
refining processes that are ap
metal under treatment and natu
process is used for the extract
from native ores. The metal is r
it to distillation, where the mer

Ore + Hg → Amalgam $\xrightarrow{\text{Distill}}$

30. **(b)** PbO_2 is a powerful oxidizing
acids.

$2PbO_2 + 4H$

31. **(d)** Soap helps to lower the surfac
to the dust particles and grea
water.

32. **(d)** H_3BO_3 acts as a Lewis acid an

33. **(a)** $\underset{P_0 - 2x}{2NH_3(g)} \rightleftharpoons \underset{x}{N_2(g)} + \underset{3x}{3H_2(}$

$O_3 + N_2 + 4H_2O$

$_2O$

$+ H_2SO_4$

yretic.

r reverse reaction depend upon whether
thermic.

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

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

process and, van Arkel process are the
pplied depending upon the nature of the
re of the impurities whereas amalgamation
ion of noble metals like gold, silver, etc,
recovered from the amalgam by subjecting
cury distils over leaving behind the metal.

Hg-vapours
ed
Metal

agent and liberate O_2 when treated with

$NO_3 \longrightarrow 2Pb(NO_3)_2 + 2H_2O + O_2 \uparrow$

ce tension of solution, thus soap get stick
se, and these are removed by action of

d accepts OH^- ions to form $[B(OH)_4]^-$

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

$$\Rightarrow P^2_{NH_3} = 3^3 x^4 K_p$$

$$\Rightarrow P_{NH_3} = 3^{\frac{3}{2}} x^2 K_p^{\frac{1}{2}}$$

$$= \frac{3^{\frac{3}{2}} . P^2 K_p^{\frac{1}{2}}}{16}$$

34. **(d)** We can distinguish between fo on Fehling's solution. Formic acetic acid does not give red p

35. **(c)** $E^\circ_{cell} = \frac{0.0591}{n} \log K_{eq}$

$$\therefore 0.591 = \frac{0.0591}{1} \log K_{eq}$$

$$\text{or } \log K_{eq} = \frac{0.591}{0.0591} = 10$$

or $K_{eq} = 1 \times 10^{10}$

36. **(d)** $Hg_2Cl_2 + 2NH_4OH \longrightarrow Hg_2$

37. **(c)** In a DNA molecule, A = T (Tw

C ≡ G (Thre

Purine → Adenine (A), Guanin

Pyrimidine → Cytosine (C), Th

So the complimentary sequenc

38. **(c)** $-CH_3$ group is *o, p*–directing.

39. **(b)** Sodium cyanide (Na + C + N –

(Lassaigne's test)

40. **(b)** Magnesium reacts with air to water the oxide gives hydroxide

$$2Mg + O_2 \rightarrow \underset{(X)}{2MgO}$$

$$3Mg + N_2 \rightarrow \underset{(Y)}{Mg_3N_2}$$

$$MgO + H_2O \rightarrow Mg(OH)_2$$

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

$NH_2Cl + NH_4Cl + 2H_2O$

o H–bond)

ee H–bond)

ne (G)

hymine (T)

e of ATGCTTGA is TACGAACT.

$\rightarrow$ NaCN).

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

41. **(c)** Peptization involves conversic
loidal particles using a suitabl

42. **(b)** $\Delta T_b = K_b \times m \times i = 0.52 \times 1 \times 2$
$\therefore\ \Delta T_b = 100 + 1.04 = 101.04\,^{\circ}$C

43. **(d)** Oxidation state of Cr in [Cr(N

Let it be x, $1 \times x + 4 \times 0 + 2 \times ($

44. **(a)** Higher the value of reduction p
whereas lower the value of redu
power.

45. **(b)** $k = \dfrac{2.303}{t}\log\dfrac{a}{(a-x)}$

$(a-x)$ is the concentration lef

$$2.7\times10^{-3} = \frac{2.303}{100}\log\frac{0.29}{(a-x)}$$

$$\Rightarrow \frac{0.27}{2.303} = \log\frac{0.29}{(a-x)} \Rightarrow 0.11$$

$\Rightarrow (a-x) = 0.22$ M.

46. **(0)** It is zero order reaction

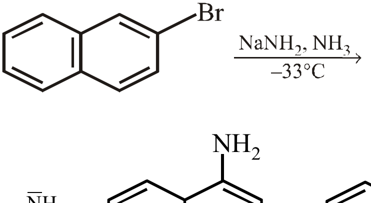
47. **(38)** $M(NO_3)_n \rightarrow M_2(SO_4)_n \ (n =$

g eq. $M(NO_3)_n$ = g eq. of $M_2(S$

$$\frac{1.0}{E(M)+E(NO_3^-)} = \frac{0.86}{E(M)+E(}$$

$$\Rightarrow \frac{1}{E+\frac{62}{1}} = \frac{0.86}{E+\frac{96}{2}} \Rightarrow E = 38g$$

48. **(2)**



on of freshly prepared precipitate into col-
e electrolyte.

$= 1.04$

C

$H_3)_4Cl_2]^+$.

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

otential higher will be the oxidising power
uction potential higher will be the reducing

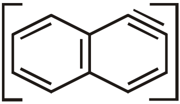
t after 100 sec.

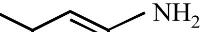
$$7 = \log \frac{0.29}{(a-x)}$$

= Valency of metal)

$O_4)_n$

$$\frac{6}{(SO_4^{2-})}$$

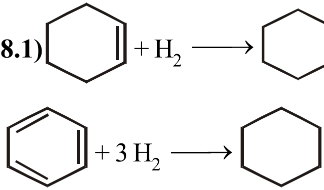




49. **(279)** $\wedge^{\infty}{}_{BaCl_2} = \frac{1}{2}\lambda^{\infty}{}_{Ba^{2+}} + 2\lambda^{\infty}{}_{C}$

$= 127 + 2 \times 76 = 279\ S\ cm^2\ mol$

50. **(–208.1)**



The resonance energy provid
so it has to be overcome, for h
So $\Delta H = -358.5 - (-150.4) = -$

MATHE

51. **(a)** The equation is $x^2 + px + q = 0$
Let α be one of the root, then
From the principle of quadrati

$\alpha^2 + \alpha = -p$

and $\alpha^3 = q$

From eq (1) + eq (2):

$\alpha^3 + \alpha^2 + \alpha = q - p$

$\Rightarrow \quad \alpha(\alpha^2 + \alpha + 1) = q - p$

$\Rightarrow \quad \alpha(-p + 1) = q - p$ [since

$\Rightarrow \quad \alpha = \frac{q-p}{1-p} = \frac{p-q}{p-1}$

Putting this value of α in equa

$\left(\frac{p-q}{p-1}\right)^2 + \left(\frac{p-q}{p-1}\right) = -p$

$\Rightarrow \quad \frac{p^2 - 2pq + q^2}{(p-1)^2} + \frac{p-q}{(p-1)} =$

$\Rightarrow \quad \frac{p^2 - 2pq + q^2 + (p-1)(p}{(p-1)^2}$

$\Rightarrow \quad p^2 - 2pq + q^2 + p^2 - pq -$

Cl^-

$^{-1}$

; $\Delta H = -119.5$ kJ

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

$= -358.5$ kJ

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

208.1 kJ

MATICS

)

as per problem, second root is α^2.

c equation.

.... (1)

...(2)

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

tion (1)

$-p$

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

$p + q = -p(p^2 - 2p + 1)$

52. **(b)** Let $M(h, k)$

Given, $AM = 2\,AB$

$\Rightarrow AB + BM = 2AB$

$\Rightarrow AB = BM$

So B is mid point of AM

$$B = \left(\frac{h}{2}, \frac{k+3}{2}\right)$$

$\because$ Point B lies on the circle.

$\therefore$ B satisfies the equation of cir

$$\left(\frac{h}{2}\right)^2 + 4\left(\frac{h}{2}\right) + \left(\frac{k+3}{2} - 3\right)^2 =$$

$$\Rightarrow \frac{h^2}{4} + \frac{8h}{4} + \frac{(k-3)^2}{4} = 0$$

or $x^2 + y^2 + 8x - 6y + 9 = 0$, whic

53. **(b)** We have $f(x) = \begin{cases} (x-1)\sin\left(\right. \\ 0 \end{cases}$

$$Rf'(1) = \lim_{h\to 0} \frac{f(1+h) - f(1)}{h}$$

$$= \lim_{h\to 0} \frac{h\sin\frac{1}{h} - 0}{h} = \lim_{h\to 0}$$

which does not exist.

$\therefore f$ is not differentiable at $x =$

Also $f'(0) = \left[\sin\frac{1}{(x-1)} - \frac{x}{(x}\right.$

$= -\sin 1 + \cos 1$

$\therefore f$ is differentiable at $x = 0$

54. **(b)** $n(\text{A}) = 40\%$ of $10{,}000 = 4{,}000$

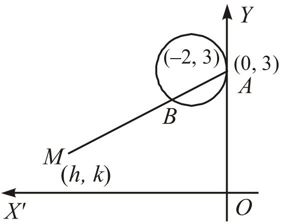
$n(\text{B}) = 20\%$ of $10{,}000 = 2{,}000$

$n(\text{C}) = 10\%$ of $10{,}000 = 1{,}000$

$n(A \cap B) = 5\%$ of $10{,}000 = 500$

cle. i.e.,

0



h is a circle.

$$\left(\frac{1}{x-1}\right) \text{ if } x \neq 1$$

$$\text{if } x = 1$$

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

1

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

$n(A \cap B \cap C) = 2\%$ of $10,000$

We want to find $n(A \cap B^c \cap C$

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

$= n(A) - n[(A \cap B) \cup (A \cap C)$

$= n(A) - [n(A \cap B) + n(A \cap C$

$= 4000 - [500 + 400 - 200] = 40$

55. **(d)** Given function $f(x) = Pe^{2x} +$

Given conditions $f(0) = -1$, f'

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

differentiate equation (i)

$f'(x) = 2Pe^{2x} + Qe^x + R$

Put $x = \log 2$ in equation (ii)

$f'(\log 2) = 2Pe^{2\log 2} + Qe^{\log 2}$

$31 = 8P + 2Q + R$

and, put $x = 0$ in equation (i)

$f(0) = Pe^{2 \times 0} + Qe^0 + R.0$

$= P + Q - 1 = P + Q$

$\Rightarrow P = -1 - Q$

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

$\Rightarrow \int_0^{\log 4} [Pe^{2x} + Qe^x + Rx - R$

$\Rightarrow \int_0^{\log 4} [Pe^{2x} + Qe^x]dx = \frac{39}{2}$

$\Rightarrow \left[\frac{Pe^{2x}}{2} + Qe^x\right]_0^{\log 4} = \frac{39}{2}$

$= 200$

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

$]$

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

$00 - 700 = 3300.$

$Qe^x + Rx \qquad ...(i)$

$(\log 2) = 31$

$...(ii)$

$+ R$

$...(iii)$

$...(iv)$

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

2

$\Rightarrow \quad \frac{15P}{2}+3Q=\frac{39}{2}$

From (iv) and (v), we get

$\frac{15P}{2}+3(-1-P)=\frac{39}{2}$

$\Rightarrow \quad \frac{9P}{2}=\frac{45}{2} \quad \Rightarrow \quad P=5$

and $Q=-1-P=-1-5=-6$

and from equation (iii)

$31=8\times 5+2\times -6+R$

$31=40-12+R$

$\therefore \quad P=5; Q=-6, R=3$

56. (a) $\lim\limits_{x\to 0^+} x^m(\log x)^n=\lim\limits_{x\to 0^+}\frac{(\log x}{x^{-}}$

$=\lim\limits_{x\to 0^+}\frac{n(\log x)^{(n-1)}\frac{1}{x}}{-mx^{-m-1}}$ [Us

$=\lim\limits_{x\to 0^+}\frac{n(\log x)^{(n-1)}}{-mx^{-m}}$, $\left(\frac{\infty}{\infty}\right.$ For

$=\lim\limits_{x\to 0^+}\frac{n(n-1)(\log x)^{(n-2)}\frac{1}{x}}{(-m)^2x^{-m-1}}$

$=\lim\limits_{x\to 0^+}\frac{n(n-1)(\log x)^{n-2}}{m^2x^{-m}}$, $\Bigg($

....

....

$=\lim\limits_{x\to 0^+}\frac{n!}{(-m)^n x^{-m}}=0$

57. (a) We have ; $f(x)=\sin x-\cos x$

$\Rightarrow f'(x)=\cos x+\sin x-a$

... (v)

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

ing L-Hospital's rule]

$$\text{m} \Big)$$

[Again using L-Hospital's rule]

$$\left. \frac{\infty}{\infty} \text{ Form} \right)$$

$$-\,ax + b$$

As the max. value of (cos x + s

The above is possible when a

58. (d) $\dfrac{\sin 3B}{\sin B} = \dfrac{3\sin B - 4\sin^3 B}{\sin B} =$

$= 3 - 4 + 4\cos^2 B = -1 + \dfrac{4(a^2}{}$

$= -1 + \dfrac{\left(\dfrac{a^2 + c^2}{2}\right)^2}{(ac)^2} = -1 + \dfrac{(a^2}{4(}$

$= \dfrac{(a^2 + c^2)^2 - 4a^2c^2}{4(ac)^2} = \left(\dfrac{c^2 - }{2ac}\right.$

59. (a) We have, $y = (1 + x)^y + \sin^{-1}($

when $x = 0$, we have $y = 1$

Differentiating (i) w.r.t. x we ge

$\dfrac{dy}{dx} = (1 + x)^y \left\{\dfrac{dy}{dx}\log(1 + x) + \right.$

$\Rightarrow \left(\dfrac{dy}{dx}\right)_{(0,1)} = 1 \Rightarrow -\left(\dfrac{dx}{dy}\right)_{(0,1)}$

So the equation of the normal

$y - 1 = -1(x - 0) \Rightarrow x + y = 1$

60. (b) Parametric equation of the hyp
and equation of circle is $x^2 + y$
Put $x = ct$ and $y = c/t$ in (i)

$(ct)^2 + \left(\dfrac{c}{t}\right)^2 = a^2$

$c^2 t^4 + c^2 - a^2 t^2 = 0$

$in x)$ is $\sqrt{2}$

$\geq \sqrt{2}$

$3 - 4\sin^2 B$

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

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

$$\left.\frac{a^2}{}\right)^2.$$

$\left(\sin^2 x\right)$ ...(i)

et

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

$= -1.$

at (0, 1) is

erbola $xy = c^2$ is $(ct, c/t)$

$^2 = a^2$ ...(i)

(ii)

61. **(b)** Integration by parts is given a

$$\int \underset{\mathrm{I}}{u}\, \underset{\mathrm{II}}{v}\, dx = u\int v\, dx - \int\left[\frac{d}{dx}(u)\right.$$

Let $I = \int 32x^3 (\log x)^2 dx$

Integrate it by parts, using IL

and x^3 as II^{nd} function

$$= 32\left\{(\log x)^2 \frac{x^4}{4} - \int 2\log x \frac{1}{x}\right.$$

$$= \frac{32}{4}x^4(\log x)^2 - 16\int x^3 \log x$$

$$= 8x^4(\log x)^2 - 16\left\{\log x.\frac{x^4}{4} -\right.$$

$$= 8x^4(\log x)^2 - 4x^4 \log x + 4\int$$

$$= 8x^4(\log x)^2 - 4x^4 \log x + x^4$$

$$= x^4\left\{8(\log x)^2 - 4\log x + 1\right\} +$$

62. **(a)** Let $u = \tan^{-1}\frac{2x}{1-x^2}$

and $v = \sin^{-1}\frac{2x}{1+x^2}$

In equation (i) put, $x = \tan\theta$

$$\therefore \quad u = \tan^{-1}\left[\frac{2\tan\theta}{1-\tan^2\theta}\right] = \tan$$

$$\Rightarrow u = 2\theta \quad \Rightarrow \quad \frac{du}{d\theta} = 2$$

In equation (ii), put $x = \tan\theta$

$$\therefore \quad v = \sin^{-1}\left[\frac{2\tan\theta}{}\right] = \sin$$

as

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

ATE so, we choose $(\log x)^2$ as I^{st} function

$.\frac{x^4}{4}\,dx \Big\}$

dx

$\int \frac{1}{x}.\frac{x^4}{4}\,dx \Big\}$

$\int x^3 dx$

$+C$

C

...... (i)

...... (ii)

$n^{-1}(\tan 2\theta)$

...... (iii)

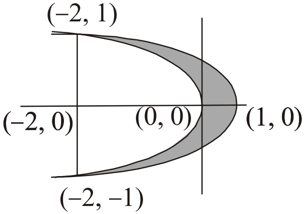
$^{-1}(\sin 2\theta)$

From equations (iii) and (iv),

$$\frac{du}{dv}=\frac{du}{d\theta}\times\frac{d\theta}{dv}=2\times\frac{1}{2}=1$$

$\therefore$ required differential coeffici

63. (c)



Parabola : $y^2=\frac{-x}{2}$ and $y^2=$

On solving, we get $x=-2, y=$

$\therefore$ required Area $= 2\left[\frac{1}{\sqrt{3}}\int_{-2}^{1}\sqrt{(1\right.$

$= 2\left\{\left[\frac{1}{\sqrt{3}}\times\frac{-2}{3}(1-x)^{3/2}\right]_{-2}^{1}-\left[\right.\right.$

$= 2\left\{\left(\frac{2}{3\sqrt{3}}.3\sqrt{3}\right)-\left(\frac{2}{3\sqrt{2}}.2\sqrt{2}\right.\right.$

64. (c) The inverse of the proposition

$\sim(p\wedge\sim q)\rightarrow\sim r$

$\equiv\sim p\vee\sim(\sim q)\rightarrow\sim r$

$\equiv\sim p\vee q\rightarrow\sim r$

65. (c) The rth term in the expansion o

$$T_{r+1}={}^{9}C_r\left(\frac{3}{2}x^2\right)^{9-r}\left(-\frac{1}{3x}\right)^r$$

ent will be 1.

$\frac{1}{3}(1-x)$

$= \pm 1$

$\overline{-x)}\, dx - \frac{1}{\sqrt{2}} \int_{-2}^{0} \sqrt{-x}dx \Big]$

$\frac{1}{\sqrt{2}} \times \frac{-2}{3}(-x)^{3/2} \Big]_{-2}^{0} \Big\}$

$\overline{2}\Big)\Big\} = \frac{4}{3}.$

$(p \wedge \sim q) \rightarrow r$ is

of $\left(\frac{3}{2}x^2 - \frac{1}{3x}\right)^9$ is

The coefficient of the term indepen

$$\left(\frac{3}{2}x^2-\frac{1}{3x}\right)^9$$

= Sum of the coefficient of the term

$$\left(\frac{3}{2}x^2-\frac{1}{3x}\right)^9.$$

For x^0 in (i) above, $18-3r=0 \Rightarrow r=$
for x^{-1} in (i) above, there exists no
For x^{-3} in (i), $18-3r=-3 \Rightarrow r=7$
$\therefore$ for term independent of x, in (ii)

$$=1\times {}^9C_6(-1)^6\left(\frac{3}{2}\right)^{9-6}\left(\frac{1}{3}\right)^6+2\times {}^9C$$

$$=\frac{9.8.7}{1.2.3}.\frac{3^3}{2^3}.\frac{1}{3^6}+2\frac{9.8}{1.2}(-1)\frac{3^2}{2^2}.\frac{1}{3^7}=$$

66. **(a)** We have $\dfrac{dy}{dx}=\dfrac{f'(x)}{f(x)}y-\dfrac{y^2}{f(x)}$

Divide by y^2

$$y^{-2}\frac{dy}{dx}-y^{-1}\frac{f'(x)}{f(x)}=-\frac{1}{f(x)}$$

Put $y^{-1}=z \Rightarrow -y^{-2}\dfrac{dy}{dx}=\dfrac{dz}{dx}$

$$-\frac{dz}{dx}-\frac{f'(x)}{f(x)}(z)=-\frac{1}{f(x)} \Rightarrow$$

$$\text{I.F.}=e^{\int\frac{f'(x)}{f(x)}dx}=e^{\log f(x)}=f($$

$\therefore$ The solution is $z(f(x))=\int$

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)

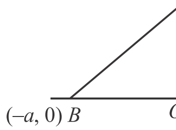
$$\cdot \frac{1}{f(x)}\left(f(x)\right)dx + c$$

67. **(d)** Given $\angle A - \angle B = \theta \Rightarrow \tan (A$

$$\Rightarrow \frac{\tan A - \tan B}{1 + \tan A - \tan B} = \tan\theta \quad ...$$

In right angled triangle CDA,

$$\tan A = \frac{k}{a-h}$$



Similarly in triangle CDB,

$$\tan B = \frac{k}{a+h}$$

Substitute the values of tan A

$h^2 - k^2 + 2hk \cot\theta = a^2$

Hence the locus is $x^2 - y^2 + 2x$

68. **(a)** Equation of planes passin

$3x - y - 4z = 0$ and $x + 3y + 6$

$(3x - y - 4z) + \lambda(x + 3y + 6) =$

$(3 + \lambda)x + (3\lambda - 1) - 4z + 6\lambda =$

Given, distances of plane (i) fr

$$\therefore \frac{6\lambda}{\sqrt{(3+\lambda)^2 + (3\lambda - 1)^2 + (-4)^2}}$$

or $36\lambda^2 = 10\lambda^2 + 26$ or $\lambda = \pm$

Put the value of λ in (i),

$\therefore (3x - y - 4z) \pm (x + 3y + 6) =$

or $4x + 2y - 4z + 6 = 0$ or $2x$

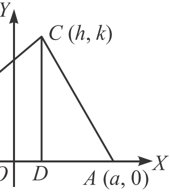
and $2x - 4y - 4z - 6 = 0$ or x

Thus the required planes are x

69. **(a)** Since, angles of Δ are in AP.

$-B) = \tan\theta$

(i)



and $\tan B$ in (i), we get

$y \cot\theta = a^2$.

ng through intersecting the planes

$6 = 0$ is,

$= 0$

0 ......(i)

om origin is 1.

$= 1$

1

$= 0$

$+ y - 2z + 3 = 0$

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

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

Use cosine law in ΔABC

$$\cos 60° = \frac{(10)^2+(9)^2-x^2}{2.(10).(9)} =$$

$\Rightarrow x^2 = 91 \Rightarrow x = \sqrt{91}.$

70. (a) $\vec{a} = (1,-1,2)$, $\vec{b} = (-2,3,5)$,

So, $\vec{a} = (1,-1,2) \equiv \hat{i} - \hat{j} + 2\hat{k}$

$= (-2,3,5) \equiv -2\hat{i} + 3\hat{j} + 5\hat{k}$

and $\vec{c} = (2,-2,4) \equiv 2\hat{i} - 2\hat{j} +$

$\Rightarrow \vec{a} - 2\vec{b} + 3\vec{c} = (\hat{i} - \hat{j} + 2\hat{k})$

$= 11\hat{i} - 13\hat{j} + 4\hat{k}$ and $(\vec{a} - 2\vec{b}$

71. (120) As the greater side of a triang

$\therefore$ The angle (say C) opposite

in this case.

Now, $\cos C = \dfrac{a^2+b^2-c^2}{2ab}$

$= \dfrac{a^2+b^2-(a^2+b^2+ab)}{2ab}$ [

$= \dfrac{-ab}{2ab} = \dfrac{-1}{2}$; $C = 120°$

72. (198) $\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}\begin{bmatrix} a & d & g \\ b & e & h \\ c & f & i \end{bmatrix}$

Sum of diagonal elements,

$a^2+b^2+c^2+d^2+e^2+f^2+g^2$

Case – I: Five (1's) and four (0

${}^9C_5 = 126$

Case – II: One (2) and one (1)

$\Rightarrow \frac{1}{2} = \frac{181 - x^2}{2.(90)}$

$\vec{c} = (2, -2, 4)$

$\hat{k}; \hat{b}$

$4\hat{k}$

$-2(-2\hat{k} + 3\hat{j} + 5\hat{k})$

$+3(2\hat{i} - 2\hat{j} + 4\hat{k})$

$+3c).\hat{i} = 11.$

le has greater angle opposite to it.

to $\sqrt{a^2 + b^2 + ab}$ = c (say) is the greatest

$\because c^2 = a^2 + b^2 + ab]$

$+ h^2 + i^2 = 5$

's)

73. (2) We know that, $|z_1 - z_2| \geq || z_1$

Here $|z_1| = 12$ and $|z_2 - 3 - 4i|$

but $|z_2 - (3 + 4i)| \geq ||z_2| - |3 +$

$\Rightarrow \quad 5 \geq |z_2| - 5$

$\Rightarrow \quad |z_2| \leq 10$

Also from (i) $|z_1 - z_2|$ will hav

i.e. 10

$\therefore \quad |z_1 - z_2| \geq 12 - 10 = 2$

Thus min. value of $|z_1 - z_2|$ is

74. (1875) $x_1 x_2 x_3 x_4 x_5 = 2 \times 3 \times 5^2 \times 7$ w

We can assign entire 5^2 to just

$5^2 = 5 \times 5$ to two variables in

${}^5C_1 + {}^5C_2 = 5 + 10 = 15$ ways

Required number of solutions =

75. (0.55) Total number of cases obtain

numbers out of $100 = {}^{100}C_2$.

Out of hundred (1, 2, ...,100

6, 9, 12, ..., 99, which are 33

is multiplied with any one of r

33 are multiplied, then the resu

number of numbers which are

are divisible by $3 = {}^{33}C_1 \times {}^{67}C$

Hence the required probability

$$= \frac{{}^{33}C_1 \times {}^{67}C_1 + {}^{33}C_2}{{}^{100}C_2} = \frac{273\ldots}{495\ldots}$$

$|-|z_2||$ ...(i)

$= 5$

$4i||$

e least value when $|z_2|$ has greatest value

2.

e can assign 2, 3 or 7 to any of variable.

one variable in 5 ways or can assign.

${}^5C_2$ ways

$= 5 \times 5 \times 5 \times 15 = 1875$

ed by taking multiplication of only two

) given numbers, there are the numbers 3,

in number such that when any one of these

emaining 67 numbers or any two of these

ulting products is divisible by 3. Then the

the products of two of the given number

${}_1 + {}^{33}C_2.$

$\frac{9}{0} = 0.55$