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JEE - ADVANCED
SAMPLE TEST PAPER-2

(MATHEMATICS + PHYSICS + CHEMISTRY)

PART : I MATHEMATICS

SECTION – 1

- This section contains **FIFTEEN** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct

1. A point is moving on the circle $(x-4)^2 + (y-8)^2 = 20$, then it broke away from it and moving along a tangent to the circle cut the x-axis at point (–2, 0). The coordinates of the point on the circle at which the moving point broke away can be

(A) $\left(\frac{42}{5}, \frac{36}{5}\right)$ (B) $\left(-\frac{2}{5}, \frac{44}{5}\right)$

(C) (6, 4) (D) (2, 4)

2. If the normal at P to the rectangular hyperbola $x^2 - y^2 = 4$ meets the x,y-axis at G and g respectively. If C is the centre of hyperbola, then

(A) PG = PC (B) Pg = PC

(C) PG = Pg (D) Gg = 2PC

3. If the quadratic equation $ax^2 + bx + c = 0 (a > 0)$ has $\sec^2\theta$ and $\cos ec^2\theta$ as it's roots ($\theta \in R$), then which of the following must hold good?

(A) b + c = 0 (B) $b^2 - 4ac \geq 0$

(C) $c \geq 4a$ (D) $4a + b \geq 0$

4. If the roots of equation $x^3 + px^2 + qx - 1 = 0$ form an increasing G.P., where p and q are real, then

(A) p + q = 0

(B) $p \in (-3, \infty)$

(C) one of the roots is unity

(D) 1 lies between the roots

5. If the axis of a parabola and transverse axis of rectangular hyperbola is same and the vertex of the parabola is same as center of rectangular hyperbola then if locus of the point whose chord of contact with respect to the parabola touches the hyperbola is a curve then

(A) curve is ellipse with the same center

(B) curve is ellipse whose axes concide with the axes of the hyperbola

(C) curve is hyperbola with the same center

(D) curve is hyperbola whose axes concide with the axes of the hyperbola

6. For positive real numbers a,b,c such that a + b + c = p, which of the following hold good ?

(A) $(p-a)(p-b)(p-c) \leq \frac{8}{27}p^3$

(B) $(p-a)(p-b)(p-c) \geq 8abc$

(C) $\frac{bc}{a} + \frac{ca}{b} + \frac{ab}{c} \leq p$

(D) (p – a) (p – b)(p – c) < 8abc

7. The number of ways of choosing triplet (x,y,z) such that z > max(x, y) and $x,y,z \in \{1,2,...n,n+1\}$ is

(A) ${}^{n+1}C_3 + {}^{n+2}C_3$

(B) $\frac{n(n+1)(2n+1)}{6}$

(C) $1^2 + 2^2 + ... + n^2$

(D) $2.{}^{n+2}C_3 - {}^{n+1}C_3$

8. Let A denotes the product of values of m, n and p where $m = \log_3 4$, $n = \log_4 6$ and $p = \log_6 27$, B denotes the value of $\log_{\sqrt{2}}(\sqrt{4+2\sqrt{3}} - \sqrt{4-2\sqrt{3}})$ and C denotes the value of 'a' for which the quadratic equation $(a-1)x^2 - (a+1)x + (a+1) = 0$, $a \in R$, is such that sum of the squares of roots is two less than their product. Then which of the following is/are correct ?

(A) A + B = 5 (B) A + B = 6

(C) (B + C ÷ A) = $\frac{5}{3}$ (D) (B + C ÷ A) = 3

9. If the divisors of n = $3^p . 5^q . 7^r$ are of the form 4k + 1, k ≥ 0 . Then
(A) p + r is always even
(B) p + q + r is always odd
(C) q can be any integer
(D) if p is odd then r is even

10. If the product of the roots of the equation $2x^2$ + ax + 4 sina = 0 is 1, then roots will be imaginary if

(A) $a \in R$ (B) $a \in \left\{-\frac{7\pi}{6}, \frac{\pi}{6}\right\}$

(C) $a \in \left\{\frac{\pi}{6}, \frac{5\pi}{6}\right\}$ (D) $a \in \left\{\frac{\pi}{2}, -\frac{3\pi}{2}\right\}$

11. The least positive solution of $\sin\pi(x^2 + x) - \sin\pi x^2 = 0$ is
(A) a rational number
(B) an irrational number of the form $\sqrt{\lambda}$
(C) an irrational number of the form $\frac{\sqrt{\lambda}-1}{4}$, where λ is an odd integer
(D) an irrational number of the form $\frac{\sqrt{1+\lambda}-1}{4}$, where λ is an even integer

12. In a ΔABC , A $\equiv (\alpha, \beta)$, B ≡ (1, 2), C ≡ (2, 3), point A lies on the line y = 2x + 3, where α, β are Integers, and the area of the triangle is S such that [S] = 2 where [.] denotes the greatest integer function. Then the possible coordinates of A can be
(A) (–7, –11) (B) (–6, –9)
(C) (2, 7) (D) (3, 9)

13. Let N = 2 + 22 + 222 + …. upto 30000 terms.
(A) last four digits of N are 8580
(B) last three digits of N are 580
(C) last four digits of N are 7580
(D) last digit of N is 0

14. ABCD is a square of unit area. A circle is tangent to two sides of ABCD and passes through exactly one of its vertices. The radius of the circle is less than or equal to
(A) $2-\sqrt{2}$ (B) $\sqrt{2}-1$
(C) $\frac{1}{2}$ (D) $\frac{1}{\sqrt{2}}$

15. The equation $\left(\frac{x}{x+1}\right)^2 + \left(\frac{x}{x-1}\right)^2 = a(a-1)$ has
(A) Four real roots if a > 2
(B) Four real roots if a < –1
(C) Two real roots if 1 < a < 2
(D) No real root if a < –1

SECTION – 2

- This section contains **FIVE** questions
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive

16. In a triangle ABC,
if cosA + sinA – $\frac{2}{\cos B + \sin B}$ = 0,
then the value of $\left(\frac{a+b}{c}\right)^4$ is

17. Number of solutions of $\sin^4 x - \cos^2 x.\sin x + 2\sin^2 x + \sin x = 0$ in $0 \le x \le 3\pi$ is

18. The tangent and normal to the parabola y^2 = 8x drawn at (2,4) intersect the line ℓx + y = 3 at the points A and B respectively. If AB subtend a right angle at the vertex of the parabola then absolute sum of all possible values of ℓ is

19. If N is the number of ways in which a person can walk up a stairway which has 7 steps if he can take 1 or 2 steps up the stairs at a time, then the value of $\frac{N}{3}$ is?

20. If the eccentricity of the hyperbola $x^2 - y^2\sec^2\theta = 5$ is $\sqrt{3}$ times the eccentricity of the ellipse $x^2\sec^2\theta + y^2 = 25$. Then the smallest positive value of θ is $\frac{\pi}{P}$. The value of P is?

PART - II : PHYSICS

SECTION – 1

- This section contains **FIFTEEN** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct

21. A train is moving with constant speed along a circular track. If length of the train is one fourth of length of circular track then which of the following is/are **correct** options (Assume that sound source is at engine) :
(A) Frequency observed by a passenger who is sitting in the middle of train (equidistant from front and rear end) will continuously increase.
(B) Frequency observed by a passenger who is sitting in the middle of train (equidistant from front and rear end) will remain constant but more than actual frequency.

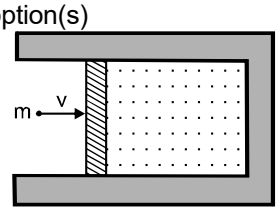
(C) Frequency observed by a passenger who is sitting in the middle of train (equidistant from front and rear end) will remains constant and equal to actual frequency.
(D) Wavelength observed by the person who is on the rear end of train is more than the actual wavelength of sound wave.

22. In a flexible balloon, 2 moles of SO_2 having initial volume of 1kl at a temperature of 27^0C is filled (SO_2 is a non-linear triatomic gas). The gas is first expanded to thrice its initial volume isobarically and then expanded adiabatically so as to attain its initial temperature. Assuming gas is ideal and R = $\frac{25}{3}$ $Jmol^{-1}K^{-1}$.

Choose the **INCORRECT** option(s).

(A) Change in internal energy of the gas in the isobaric process is 2.5×10^4 J
(B) Change in internal energy of the gas in the isobaric process is 3×10^4 J
(C) Work done by the gas in the whole process is 35 kJ
(D) Work done by the gas in the whole process is 40 kJ

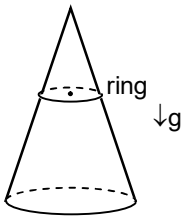
23. Consider one mole of an ideal monoatomic gas inside a fixed, perfectly insulating cylindrical vessel at temperature T and piston is at equilibrium initially as shown in figure. Now a particle of mass m strikes horizontally to piston of same mass at mid–point of piston and sticks to piston. Initially temperature T = $\frac{mv^2}{R}$, where R is universal gas constant) (Neglect heat loss through piston, assume that velocity is so small that change in the temperature of gas due to motion of piston is simultaneous in whole volume) (Gravity and friction is absent everywhere) Choose the correct option(s)



(A) Ratio of maximum temperature and minimum temperature of gas during motion of piston is 7 : 5
(B) Ratio of maximum temperature and minimum temperature of gas during motion of piston is 6 : 7
(C) If particle strikes elastically then ratio of maximum temperature to minimum temperature during motion of piston is 1 : 2
(D) If particle strikes elastically then ratio of maximum temperature to minimum temperature during motion of piston is 4 : 3

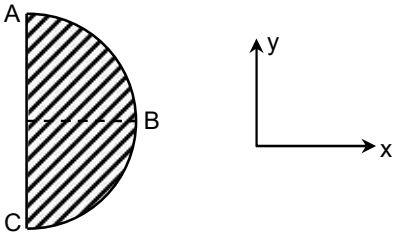
24. Choose the correct option(s)
(A) A tight string is fixed at both ends and sustaining standing wave then at the middle, antinode is formed in odd harmonic
(B) A tight string is fixed at one end and free at the other end then at the middle, neither node nor antinode is formed.
(C) Standing wave is formed in an open organ pipe and end correction is not negligible, then phase difference between SHMs of any two particles will be either π or zero.
(D) Standing wave is formed in a closed organ pipe and end correction is not negligible. then at the middle, neither node nor antinode is formed

25. An elastic ring of mass 'm' and force constant k (stiffness) is released from rest in a smooth cone of semi vertex angle θ from horizontal position as shown in figure. Initially the ring was in natural length : Choose the correct option(s)



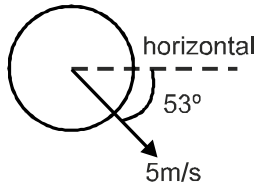
(A) initial acceleration of any point on circumference of ring is g
(B) initial acceleration of centre of ring is g $\cos^2\theta$
(C) maximum vertical displacement of centre of ring is $\frac{mg\cot^2\theta}{2\pi^2k}$
(D) at the moment of maximum vertical displacement acceleration of centre of ring is zero.

26. A semi circular disc of radius R is placed on a smooth horizontal surface. Figure shows top view of this. If temperature is increased by Δt then displacement of (coefficient of linear expansion is α) :



(A) A along y-axis is $R\alpha\Delta t$
(B) A along x-axis is $-\frac{4R}{3\pi}\alpha\Delta t$
(C) B along x-axis is $R\alpha\Delta t$
(D) B along y-axis is zero

27. An external force 6N is applied on a sphere of radius R = 10 cm of mass 1 kg and the sphere moves in a liquid with a constant velocity 5 m/s making 53^0 with the horizontal. The coefficient of viscosity of the liquid is $20/(6\pi)$, in S.I. units. (Take g = 10 m/s^2). Choose the correct option(s) :

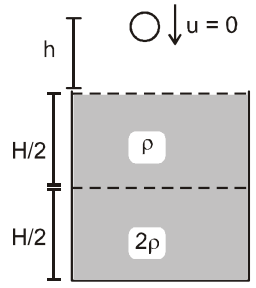


(A) The viscous force on the body is 10N.
(B) The effective weight (weight – upthrust) of the body is 8 N
(C) The direction of the external applied force must be horizontal.
(D) If the external force is suddenly removed the acceleration of the body just after the removal of the force will be 6 m/s^2.

28. A particle is subjected to two simple harmonic motions along x and y axis according to, x = 3 sin 100 πt, y = 4 sin 100 πt.

(A) The path of the particle will be ellipse and it is moving in clockwise direction.
(B) Motion of particle will be on a straight line.
(C) Motion will be a simple harmonic motion with amplitude 5.
(D) Phase difference between two motions is $\frac{\pi}{2}$.

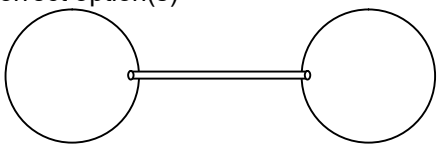
29. A small ball of mass m is released from rest from a height h above the liquid surface. The density of ball is $\frac{\rho}{3}$: (assume no splash)



(A) If h $\geq$ H, then the ball will be able to enter the liquid of higher density
(B) If h $\geq \frac{7H}{2}$, then the ball will be able to strike the bottom of the vessel
(C) If h = 2H, then the ball will cross the interface of two liquids with kinetic energy = mgH
(D) If h = 0 then ball will float on the surface

30. An experiment measures quantities a, b, c and x is calculated from $x = \frac{ab^2}{c^3}$. If the percentage errors in a, b, c are ± 1%, ± 3% and ± 2% respectively.
(A) The percentage error in x can be ± 13%
(B) The percentage error in x can be ± 7%
(C) The percentage error in x can be ± 20%
(D) The percentage error in x can be ± 26%

31. Two spherical soap bubbles in vaccum are connected through a narrow tube. Radius of left bubble is R and that of other is slightly smaller than R. Air flows from right to left very slowly. At any instant r_1, A_1, V_1, n_1 are radius, surface area, volume and number of moles of gas in the left bubble and r_2, A_2, V_2, n_2 are same for right bubble. Assume that temperature remains constant : Choose the correct option(s)



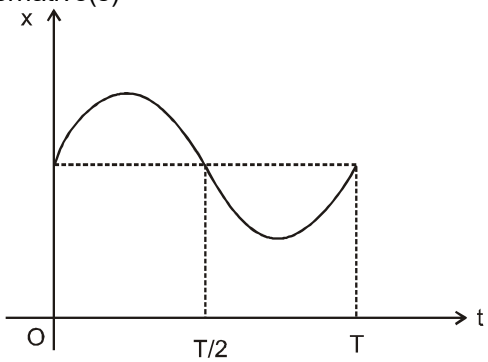
(A) The rate of change of " $n_1 + n_2$ " with respect to time is zero
(B) The rate of change of " $A_1 + A_2$ " with respect to time is zero
(C) If at an instant number of moles in left bubble is 4 times of number of moles in right bubble then $r_2 = R\sqrt{\frac{2}{5}}$
(D) If at an instant number of moles in left bubble is 4 times of number of moles in right bubble then $r_1 = R\sqrt{\frac{8}{5}}$

32. A boat crosses a river at a velocity $\vec{v}$ (relative to water) that is constant relative to water and perpendicular to the banks. The magnitude of the velocity $\vec{v}$ is 0.3 m/s. Width of the river is b = 63 m. Speed of the current varies according to the parabolic law.

$$u = u_0 - \frac{4u_0}{b^2}\left(x - \frac{b}{2}\right)^2$$

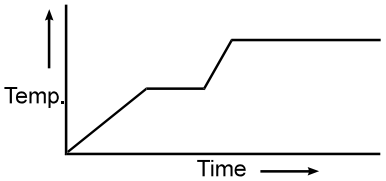
where x is distance from the banks and u_0 is constant equal to 5m/s. Choose the correct options.
(A) Drift of the boat during the time it crosses the river is 1050m.
(B) Drift of the boat during the time it crosses the river is 700m
(C) Time taken by the boat to crosses the river is 210 sec.
(D) Time taken by the boat to crosses the river is 12.6 sec.

33. Position verses time graph for a particle is shown in figure then select correct alternative(s)



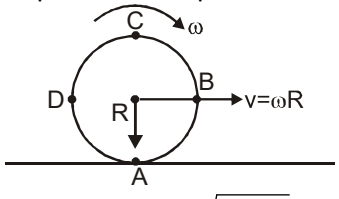
(A) Particle does not change its direction of motion during the motion from t = 0 to t = T
(B) Particle changes its direction twice during the motion from t = 0 to t = T
(C) Acceleration of particle changes its direction once during the motion from t = 0 to t = T
(D) Direction of force is reversed at t = $\frac{T}{2}$

34. Heat is supplied to a certain homogeneous sample of matter at a uniform rate. Its temperature is plotted against time as shown in the figure. Which of the following conclusions can be drawn?



(A) its specific heat capacity is greater in the solid state than in the liquid state.
(B) its specific heat capacity is greater in the liquid state than in the solid state.
(C) its latent heat of vaporization is greater than its latent heat of fusion.
(D) its latent heat of vaporization is smaller than its latent heat of fusion.

35. The ring shown in figure is performing pure rolling on a rigid surface. Radius of ring is 'R' and angular velocity of ring is 'ω'. There are four points marked on the ring as shown. After time t = $\frac{\pi}{\omega}$, choose the correct option(s) regarding displacement of points.

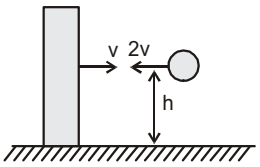


(A) Displacement of A is $R\sqrt{\pi^2+4}$
(B) Displacement of B is $(\pi - 2)$ R
(C) Displacement of C is $R\sqrt{\pi^2+4}$
(D) Displacement of D is $(\pi + 2)$ R

SECTION – 2

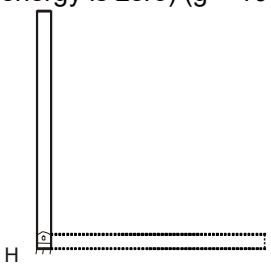
- This section contains **FIVE** questions
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive

36. A ball collides elastically with a massive wall moving towards it with a velocity of v as shown. The collision occurs at a height of h above ground level and the velocity of the ball just before collision is 2v in horizontal direction. Then the distance between the foot of the wall and the point on the ground where the ball lands (at the instant the ball lands) is $n \times v\sqrt{\frac{2h}{g}}$, where n is :

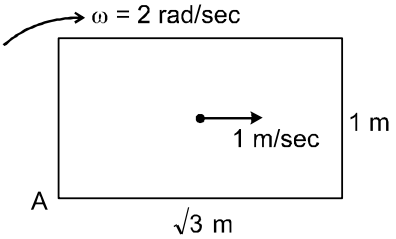


37. A particle is suspended by a light vertical inelastic string of length ℓ from a fixed support. At its equilibrium position it is projected horizontally with a speed $\sqrt{6g\ell}$. The ratio of the tension in the string when the string is in its horizontal position to that in the string when the particle is vertically above the point of support is x : 1. Find 'x'.

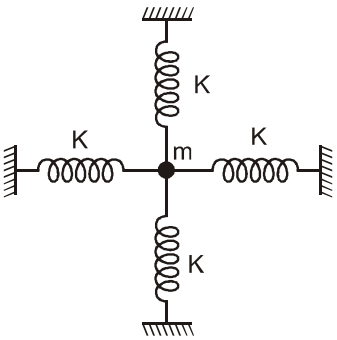
38. A thin rod of length 1 m is kept vertical and is hinged from the lower end 'H'. Its linear mass density varies with the distance (x) from the end 'H' as λ = (12 x) kg/m, where x is distance along rod from point H. The potential energy (in Joules) of the rod is 5N. Find N (at H the potential energy is zero) (g = 10 m/s^2)



39. A uniform rectangular plate of mass 1 kg is performing combined rotational motion and translational motion with constant angular speed 2 rad./sec (as shown in figure). Speed of centre of mass of plate is 1m/sec. If the kinetic energy of plate with respect to a point A (point A is on the plate) is $\frac{K}{3}$ Joule then 'K' is :



40. Figure shows a particle of mass m attached with 4 identical springs each of spring constant K and each of which are initially in their natural length L. The gravitational force is neglected. If the mass is slightly displaced by distance x along a line perpendicular to the plane of the figure and released then the force acting on particle just when it is released is proportional to x^n, find n.



PART - III : CHEMISTRY

Atomic masses : [H = 1, D = 2, Li = 7, C = 12, N = 14, O = 16, F = 19, Na = 23, Mg = 24, Al = 27, Si = 28, P = 31, S = 32, Cl = 35.5, K = 39, Ca = 40, Cr = 52, Mn = 55, Fe = 56, Cu = 63.5, Zn = 65, As = 75, Br = 80, Ag = 108, I = 127, Ba = 137, Hg = 200, Pb = 207]

SECTION – 1

- This section contains **FIFTEEN** questions
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is(are) correct

41. Which of the following expression(s) for the degree of dissociation of weak monobasic acid (HA) in aqueous solution is/are correct?

(A) $\frac{1}{1+10^{pK_a-pH}}$ (B) $\frac{K_a}{K_a+[H^+]}$

(C) $\frac{[H^+]}{K_a+[H^+]}$ (D) $\frac{1+10^{pK_a-pH}}{1}$

42. Select the incorrect statement(s) :
(A) At equilibrium, concentration of reactant always become equal to concentration of product.
(B) In presence of catalyst, rate of forward reaction increases and rate of backward reaction decreases by same amount.
(C) K_{eq} (equilibrium constant) may have zero or –ve value.
(D) As pressure increases K_{eq} increases for the reaction $N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$ at given temperature.

43. Which of the following statement(s) is/are incorrect ?
(A) Molar volume of every gas at STP is 22.4 L
(B) Under critical conditions compressibility factor is 1.
(C) For any gas Boyle's temperature (T_B) is greater than critical temperature(T_C).
(D) At absolute zero temperature kinetic energy of gas is $\frac{3}{8}R$.

44. Which of the following is/are exothermic process?
(A) Combustion of C_6H_6.
(B) Formation of CO from elements in their standard state.
(C) Solubility of gas in liquid.
(D) Atomisation of I_2 (s).

45. Salt AB undergoes anionic hydrolysis and its 0.1 M solution has pOH as 5 then select correct statement(s):
(A) K_h is equal to K_b of B^-
(B) pK_a of HB is 5
(C) h is 0.01%
(D) pH of 0.1 M HB is 3

46. Select the incorrect statement(s) :
(A) The PV work in a mechanically reversible process in a closed system is always equal to $-P\Delta V$.
(B) The infinitesimal PV work in a mechanically reversible process in a closed system is always equal to – PdV.
(C) The value of the work W in a reversible process in a closed system can be found so long as we know the initial state and the final state of the system.
(D) The value of the integral $\int_1^2 Pdv$ is fixed once the initial and final state 1 and 2 and the equation of state are known.

47. In the nuclear transmutation :

$${}^{9}_{4}Be + x \longrightarrow {}^{8}_{4}Be + y ,$$

(x, y) is/are :
(A) (γ, n) (B) (p, d)
(C) (n, d) (D) (γ, p)

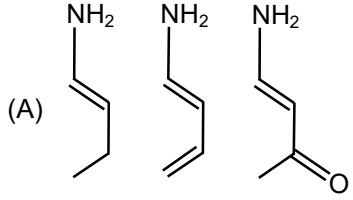
48. The wave functions of 3s and $3p_z$ orbitals are given by

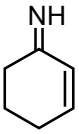
$$\Psi_{3s} = \frac{1}{9\sqrt{3}}\left(\frac{1}{4\pi}\right)^{1/2}\left(\frac{z}{a_0}\right)^{3/2}\left(6-\frac{4zr}{a_0}+\frac{4}{9}\frac{z^2r^2}{a_0^2}\right)e^{-zr/3a_0}$$

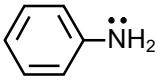
$$\Psi_{3p} = \frac{1}{9\sqrt{3}}\left(\frac{3}{4\pi}\right)^{1/2}\left(\frac{z}{a_0}\right)^{3/2}\left(4-\frac{2zr}{3a_0}\right)\left(\frac{2zr}{3a_0}\right)e^{-zr/3a_0}\cos\theta$$

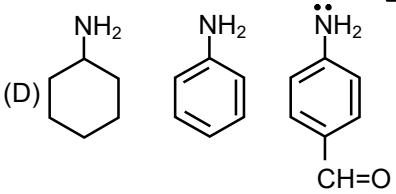
From these we can conclude :
(A) Number of nodal surface for $3p_z$ & 3s orbitals is equal.
(B) The equation of angular nodal surface of $3p_z$ orbital has $\theta = \pi/2$.
(C) The radial nodal surfaces of 3s orbital and $3p_z$ orbital are at equal distance from the nucleus.
(D) 3s electron have greater penetrating power into the nucleus in comparison to 3p electrons.

49. In the following options which is/are correctly arranged in decreasing order of C–N bond length?

(A) 

(B) $CH_3 - CH_2 - NH_2$  $CH_2 = NH$

(C) CH_3–  CH_2=CH–  

(D) 

50. Which of the following species will be diamagnetic in nature, if Hund's rule is violated while writing their molecular orbital configuration?
(A) O_2 (B) N_2^{2-}
(C) He_2^+ (D) B_2

51. Which of the following contain same number of linearly arranged carbon atoms in their respective molecules ?
(A) $CH_2 = CH - C \equiv CH$
(B) $HC \equiv C - C \equiv CH$
(C) $CH_2 = CH - CH = CH_2$
(D) $CH_3 - C \equiv C - CH_3$

52. Which of the following statement(s) is/are correct :
(A) CH_4 cannot be prepared by Wurtz reaction method.
(B) Wolft-Kishner reduction is used to prepare alkanes from carboxylic acid
(C) Lindlar's catalyst is used to prepare alkene from alkyne.
(D) Oxymercuration–demercuration process gives alcohols corresponding to Markovnikov addition of water to carbon carbon double bond.

53. Select the incorrect statement :
(A) H_2SO_5 acid has one S–OH linkage.
(B) Number of B–O–B linkage in borax is equal to number of P–O–P linkage in P_4O_{10}.
(C) Hybridization of both sulphur in $H_2S_2O_5$ is same but oxidation state of both sulphur are different.
(D) Basicity of phosphorus acid is three.

54. Which of the following statement is/are true for P_4S_3 molecule?
(A) It contains six P–S bonds and three P–P bonds.
(B) It contains six P–S bonds and ten lone pairs.
(C) It has all P atoms are sp^3 hybridised.
(D) It is a non planar compound.

55. $Ca_2B_6O_{11} + Na_2CO_3 \xrightarrow{\Delta}$ [x] + $CaCO_3$ + $NaBO_2$
(unbalanced equation)
Correct choice for [X] is/are.
(A) Structure of anion of crystalline [X] has one boron atom sp^3 hybridised and other three boron atoms are sp^2 hybridised.
(B) Aqueous solutions of [X] is alkaline.
(C) In the structure of [X] anion B–O–B bonds are presents.
(D) [X] on heating with chromium salts in oxidizing flame gives green coloured bead.

SECTION – 2

- This section contains **FIVE** questions
- The answer to each question is a **SINGLE DIGIT INTEGER** ranging from 0 to 9, both inclusive

56. Given is an equation of state for real gas, where A and B are constants. P : Pressure and V : Molar volume

$$PV = RT - \frac{A}{V} + \frac{2B}{V^2}$$

Find $\frac{1}{Z}$ at critical point.

57. A magnesium ribbon, when burnt in air, left an ash containing MgO and Mg_3N_2. The ash was found to consume 0.6 mol of HCl according to the reactions :

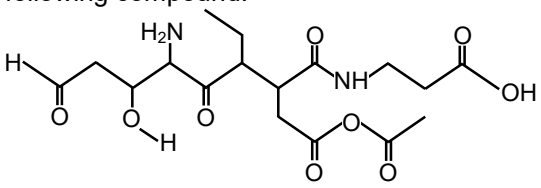
$MgO + 2HCl \longrightarrow MgCl_2 + H_2O$.

$Mg_3N_2 + 8HCl \longrightarrow 3MgCl_2 + 2NH_4Cl$.

The solution so obtained is treated with excess of NaOH, then 0.1 mol of NH_3 is evolved ($NaOH + NH_4Cl \rightarrow NH_3 + H_2O + NaCl$). The mass (in g) of magnesium burnt is.

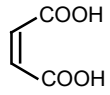
58. How many structural alcohol of formula $C_5H_{12}O$ can give instant turbidity with Lucas reagent ($HCl + ZnCl_2$)

59. How many functional groups are present in the following compound:

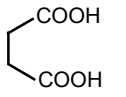


60. How many of the following compound have correct common name.

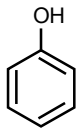
neo-pentane
(I)



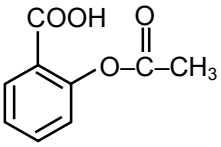
Maleic acid
(II)



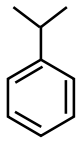
Succinic acid
(III)



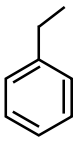
Carbolic acid
(IV)



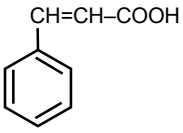
Aspirin
(V)



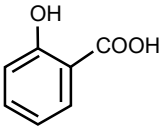
Styrene
(VI)



Cumene
(VII)



Cinnamic acid
(VIII)



Salicylic acid
(IX)

SOLUTIONS & ANSWER KEY

PART : I MATHEMATICS

1. A point is moving.....

Sol. Equation of chord of contact from (-2, 0) is $3x + 4y - 34 = 0$

Solving this with circle we get $x = 6$, $-\frac{2}{5}$

2. If the normal at.....

Sol. Equation of normal at $P(2\sec\theta, 2\tan\theta)$

is $\frac{2x}{\sec\theta} + \frac{2x}{\tan\theta} = 8$

then $G(4\sec\theta, 0)$ and $g(0, 4\tan\theta)$

3. If the quadratic .....

Sol. sum of roots = product of roots and roots are real

4. If the roots of .....

Sol. roots are a/r, a, ar where a > 0 and r > 1

$a/r + a + ar = -p$ .....(1)

$(a/r)a + a(ar) + (a/r)ar = q$ .....(2)

$(a/r)a(ar) = 1 \Rightarrow a = 1$

since $r + 1/r > 2 \Rightarrow$ from (1) $p < -3$

5. If the axis of .....

Sol : Let parabola be $y^2 = 4ax$ and let hyperbola be

$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$

Then chord of contact for (h, k) is $ky = 2a(x + h)$

And it touches the hyperbola so applying condition of tangency, we get equation of ellipse.

6. For positive .....

Sol. Using $A.M \geq G.M$

$\Rightarrow (b + c)(c + a)(a + b) \geq 8abc$

$\Rightarrow (p - a)(p - b)(p - c) \geq 8abc$

Also $\frac{(p-a)+(p-b)+(p-c)}{3} \geq \left[(p-a)(p-b)(p-c)\right]^{\frac{1}{3}}$

$\Rightarrow \frac{2p}{3} \geq \left[(p-a)(p-b)(p-c)\right]^{\frac{1}{3}}$

7. The number .....

Sol. When z = n + 1, we can choose x, y from {1,2,.....,n} $\Rightarrow$ n^2 ways

total no. of ways $= n^2 + (n-1)^2 + \ldots\ldots + 1$

8. Let A denotes .....

Sol. A = 3

B = $\log_{\sqrt{2}}((\sqrt{3} + 1) - (\sqrt{3} - 1)) = 2$

$(a - 1)x^2 - (a + 1)x + (a + 1) = 0$ — α, β

such that

$\therefore \alpha^2 + \beta^2 = \alpha\beta - 2$

$(\alpha + \beta)^2 - 3\alpha\beta + 2 = 0$

$\Rightarrow \left(\frac{a+1}{a-1}\right)^2 - 3\left(\frac{a+1}{a-1}\right) + 2 = 0$

$t^2 - 3t + 2 = 0$, where $t = \frac{a+1}{a-1}$

t = 1, t = 2

$\therefore \frac{a+1}{a-1} = 1$ (not possible) and $\frac{a+1}{a-1} = 2$

$\Rightarrow a = 3 \quad \therefore C = 3$

Hence A + B = 5; (B + C ÷ A) = 2 + 3 ÷ 3 = 3

9. If the divisors .....

Sol. $3^p = (4-1)^p = 4l + (-1)^p$

$5^q = (4 + 1)^q = 4m + 1$

$7^r = (7 - 1)^r = 8n + (-1)^r$

10. If the product .....

Sol. Since product of roots is 2 sin a = 1

or $a = n\pi + (-1)^n \pi/6$, $n \in I$.

Again since roots are imaginary, $a^2 < 16$

i.e., $-4 < a < 4$. Therefore

$a = -\frac{7\pi}{6}, \frac{\pi}{6}, \frac{5\pi}{6}$. Hence choices (B) and (C) are correct.

11. The least positive .....

Sol. We have $\sin\pi(x^2 + x) = \sin\pi x^2$

$\Rightarrow \pi(x^2 + x) = n\pi + (-1)^n \pi x^2$, $n \in Z$

$\Rightarrow x^2 + x = n + (-1)^n x^2$

Now, two cases arise.

Case 1 When n is an even integer say n = 2 m, $m \in Z$ In this case, Eq. (i) reduces to

$x^2 + x = 2m + x^2 \Rightarrow x = 2m, m \in Z$

Case 2 When n is an odd integer say n = 2m + 1, $m \in Z$ In this case, Eq. (i) reduces to $x^2 + x = (2m + 1) - x^2$

$\Rightarrow 2x^2 + x - (2m + 1) = 0$

$\Rightarrow x = \frac{-1 \pm \sqrt{1 + 8(2m+1)}}{4}$

$\Rightarrow x = \frac{-1 \pm \sqrt{\lambda}}{4}$

Where $\lambda = 8(2m+1) + 1$ is an odd integer.

12. In a ΔABC , ...

Sol. The point (α, β) lies on y = 2x + 3

$\Rightarrow \beta = 2\alpha + 3$

Area of triangle ABC

$= \frac{1}{2}|\alpha + 2| \Rightarrow 2 \leq \frac{1}{2}|\alpha + 2| < 3$

$\Rightarrow \alpha$ = -7, -6, 2, 3.

13. Let N = 2 + ...

Sol. $N = 2+22+222+(2222)\times(2997)+10{,}000$ m

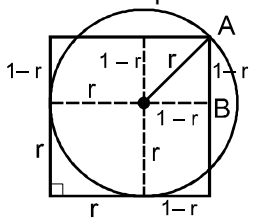
$= \frac{2}{9}[9 + 99 + 999.....]$

$= \frac{2}{9}[10 + 10^2 + 10^3.... - 30000]$

Where m is a positive integer

14. ABCD is a square.....

Sol.



In Δ ABO, $2\sqrt{1-r} = r$

$\sqrt{2}$ (1 – r) = r, $4(1-r) = r^2$

$\sqrt{2}$ = r (1 + $\sqrt{2}$)

$\frac{\sqrt{2}}{\sqrt{2}+1}$ = r

$\sqrt{2}\left(\sqrt{2}-1\right)$ = r

r = $2-\sqrt{2}$

15. The equation .....

Sol. $\left(\frac{x}{x+1}+\frac{x}{x-1}\right)^2 - 2\left(\frac{x}{x+1}\right)\left(\frac{x}{x-1}\right) = a(a-1)$

$\left(\frac{2x^2}{x^2-1}\right)^2 - \frac{2x^2}{x^2-1} - a(a-1) = 0$

Let t = $\frac{2x}{x^2-1}$

$\Rightarrow$ t = a or 1 – a

16. In a triangle .....

Sol. cosA.cosB + sinA.sinB + cosA.sinB + sinA.cosB = 2

$\Rightarrow$ cos(A – B) + sin(A + B) = 2

$\Rightarrow$ cos(A – B) = sin(A + B) = 1 $\Rightarrow$ A = B

$\Rightarrow$ a = b and sin2A = 1

$\Rightarrow$ A = 45° or 135º (not possible)

$\Rightarrow \frac{a+b}{c} = \frac{2a}{a\sqrt{2}} = \sqrt{2}$

17. Number of .....

Sol. $\sin x\left(\sin^3 x - \cos^2 x + 2\sin x + 1\right) = 0$

$\Rightarrow \sin^2 x\left(\sin^2 x + \sin x + 2\right) = 0$

$\Rightarrow$ sinx = 0, where x = 0, π, 2π, 3π

18. The tangent .....

Sol. (x – y + 2)(x + y – 6) = 0

$x^2 - y^2 - 4x + 8y - 12 = 0$

$x^2 - y^2 - 4x\left(\frac{\ell x+y}{3}\right) + 8y\left(\frac{\ell x+y}{3}\right) - 12\left(\frac{\ell x+y}{3}\right)^2 = 0$

cofficient of x^2 + coefficient of y^2 = 0

$12\ell^2 + 12\ell - 12 = 0$

$\ell^2 + \ell - 1 = 0$

Sum of values of ℓ = –1

19. If N is the .....

Sol. If x and y denote the no. of ways to take unit and 2 steps respectively, then x + 2y = 7.

X = 1, 3, 5.

If x = 1, then steps will be 1 2 2 2

No. of ways = $\frac{4!}{3!}$

If x = 3, the steps will be 1 1 1 2 2

No. of ways = $\frac{5!}{2!.3!}$

If x = 5, the steps will be 1 1 1 1 1 2 $\Rightarrow$ no. of ways = 6

If x = 7, the steps will be 1 1 1 1 1 1 1 $\Rightarrow$ no. of ways = 1

20. If the eccentricity.....

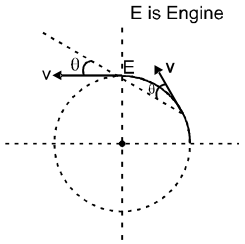
Sol. $e_1 = \sqrt{\frac{1+\sec^2\theta}{\sec^2\theta}}$ and

$e_2 = \sqrt{\frac{\sec^2\theta - 1}{\sec^2\theta}} \Rightarrow \cos\theta = \pm\frac{1}{\sqrt{2}}$

PART : II PHYSICS

21. A train is .....

Sol.



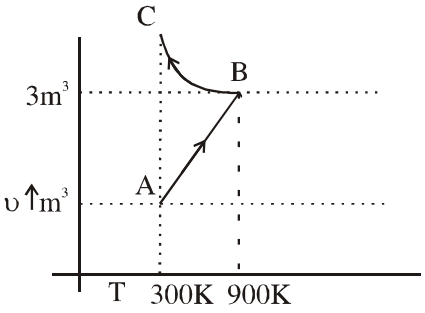
$f_{obs} = \frac{f\ [v_s + v\cos\theta]}{[v_s + v\cos\theta]} = f$

$\lambda_{obs} = \frac{v_s + v\cos\theta}{f}$

For any observer in train frequency observed is equal to original frequency but observed wavelength is more.

22. In a flexible .....

Sol. The V-T diagram for the process would be :



A) $\frac{V_1}{T_1}=\frac{V_2}{T_2}$ (for process AB)

$\frac{1}{300}=\frac{3}{T_2}\Rightarrow \quad T_2 = 900\ K$

$dU = nC_v dT = 2\left[\frac{6R}{2}\right][600] = 3\times10^4\ J$

C) $dW = W_{ab}+W_{bc} = Pdv+\frac{P_1V_1-P_2V_2}{\gamma-1}$

$= nRdT+\frac{nRdT}{\gamma-1} = 40kJ$

23. Consider one .....

Sol. After collision velocity of (particle + piston) = $\frac{v}{2}$

So, K.E. = $\frac{1}{2}(2m)\frac{v^2}{4}=\frac{mv^2}{4}$

As, $\Delta Q = 0$, $\Delta U = -\Delta W$

So, $\frac{mv^2}{4}=\frac{3R}{2}\Delta T \Rightarrow \Delta T = \frac{mv^2}{6R}$

So, $T_{max} = \frac{mv^2}{R}+\frac{mv^2}{6R}=\frac{7}{6}\frac{mv^2}{R}$

and $T_{min} = \frac{mv^2}{R}-\frac{mv^2}{6R}=\frac{5}{6}\frac{mv^2}{R}$

So, $\frac{T_{max}}{T_{min}}=\frac{7}{5}$.

D) When particle strikes elastically, particle comes to rest instantaneously and piston moves with velocity v.

So, $\frac{1}{2}mv^2=\frac{3}{2}R\Delta T$

$\Delta T = \frac{mv^2}{3R}$

So, $T_{max} = \frac{4}{3}\frac{mv^2}{R}$

and $T_{min} = \frac{mv^2}{R}$

So, $\frac{T_{max}}{T_{min}}=\frac{4}{3}$

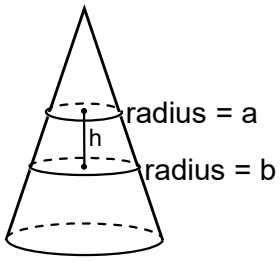
24. Choose the .....

Sol. (A) Number of loops (of length $\lambda/2$) will be even or odd and node or antinode will respectively be formed at the middle.
Phase of difference between two particle in same loop will be zero and that between two particles in adjacent loops will be π.
(B) and (D) Number of loops will not be integral. Hence neither a node nor an antinode will be formed in the middle.
Phase of difference between two particle in same loop will be zero and that between two particles in adjacent loops will be π.

25. An elastic .....

Sol. (A) initial acceleration of any point on circumference of ring is g cos θ
(B*) initial acceleration of centre of ring is g sinθ cosθ

(C)



$\tan\theta = \frac{b-a}{h}$

$h = (b-a)\cot\theta$

$mg\,(b-a)\cot\theta = \frac{1}{2}k(2\pi b-2\pi a)^2$

$mg\,(b-a)\cot\theta = \frac{1}{2}4\pi^2k(b-a)^2$

$b-a = \frac{mg\cot\theta}{2\pi^2k}$

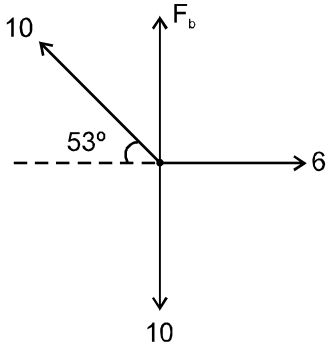
(D) at the moment maximum vertical displacement acceleration of centre of ring is upward.

26. A semi circular .....

Sol. Displacement of centre of mass is zero. So take centre of mass as origin then find displacement of all points.

27. An external .....

Sol. $F_{drag} = 6\pi\eta RV = 6\pi\ \frac{20}{6\pi}\times 0.1\times 5 = 10\ N$



$F_b + 8 = 10$

$F_b = 2$

28. A particle is .....

Sol. $\frac{x}{y} = \frac{3}{4}$

$y = \frac{4}{3}x$

and $\vec{a} = -(100\pi)^2 \vec{r}$

means SHM.

29. A small ball .....

Sol. $mg\left(h+\frac{H}{2}\right) = [v\rho g]\ \frac{H}{2}$

$h = H$

$mg\left(h+\frac{H}{2}+\frac{H}{2}\right) = [v\rho g]\ \frac{H}{2} + [v2\rho g]\ \frac{H}{2}$

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

$mg\left(h+\frac{H}{2}\right) - [v\rho g]\ \frac{H}{2} = K.E.$

$mg\left(\frac{5H}{2}\right) - \frac{3}{2}mgH = K.E.$

K.E. = mgH..

30. An experiment .....

Sol. $x = \frac{ab^2}{c^3}$

$\ln x = \ln a + 2\ln b - 3\ln c$

$\frac{1}{x}dx = \frac{1}{a}da + \frac{2}{b}db - \frac{3dc}{c} \times 100$

$\frac{dx}{x} \times 100 = \frac{da}{a} \times 100 + \frac{2db}{b} \times 100 - \frac{3dc}{c} \times 100$

$= 1 + 2 \times 3 - 3(-2)$

Maximum error = $\pm$ 13 %

31. Two spherical .....

Sol. Pressure in left bubble = $\frac{4s}{r_1}$

Volume of left bubble = $\frac{4}{3}\pi r_1^3$

Pressure in right bubble = $\frac{4s}{r} = \frac{4}{3}\pi r_2^3$

$n_1 + n_2 = 2n$

$r_1^2 + r_2^2 = 2R^2$

$A_1 + A_2$ and $n_1 + n_2$ are constant

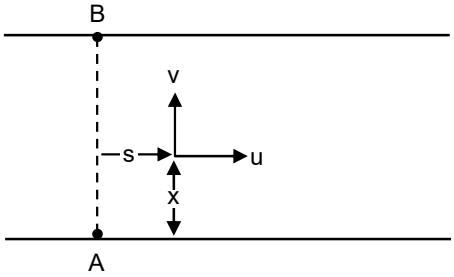
$\frac{n_1}{n_2} = \frac{r_1^2}{r_2^2} = \frac{4}{1} \Rightarrow r_2^2 = \frac{2R^2}{5}$

$r_2 = \sqrt{\frac{2}{5}}R$

$r_1 = \sqrt{\frac{8}{5}}R$

32. A boat crosses .....

Sol.



$\frac{ds}{dt} = u$

$\frac{dx}{dt} = v$

$\frac{ds}{dx} = \frac{u}{v}$

$\int_0^s ds = \frac{u}{v}\int_0^b dx \Rightarrow$ s = 700m

33. Position verses .....

Sol. It can be interpreted with the help of slope

Alternate :

$x = x_0 + A\sin\omega t$

$\frac{dx}{dt} = A\omega\cos\omega t$

$\frac{dx}{dt} = -A\omega^2\sin\omega t$

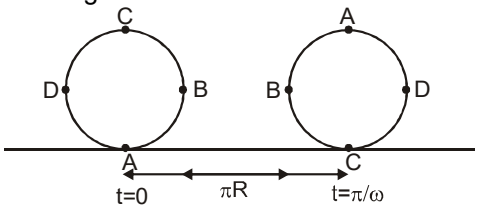
34. Heat is supplied .....

Sol. Slope of graph is greater in the solid state i.e., temperature is rising faster, hence lower heat capacity.

The transition from solid to liquid state takes lesser time, hence latent heat is smaller.

35. The ring shown .....

Sol.



36. A ball collides .....

Sol. Solve in the reference frame fixed to the wall.

Before collision, velocity of ball = 3v towards it.

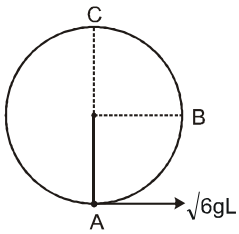
$\therefore$ After elastic collision of ball = 3v away from it (here we have used the result that a light mass is reversed by a heavy body at rest).

Time of flight = $\sqrt{\frac{2h}{g}}$

$\therefore$ Distance between wall and ball = $3v.\sqrt{\frac{2h}{g}}$.

37 A particle is .....

Sol.



Apply conservation of energy

$\frac{1}{2}$ m (6gL) = mgL + $\frac{1}{2}mV_B^2$

3 mgL = mgL + $\frac{1}{2}mV_B^2$

$V_B = \sqrt{4gL}$

$T_B = \frac{mV_B^2}{L}$ = 4 mg

$\frac{1}{2}$ m (6 gL) = 2 mgL + $\frac{1}{2}mV_C^2$

$mgL = \frac{1}{2}mV_C^2$

$V_C = \sqrt{2gL}$

$T_C + mg = \frac{mV_C^2}{L}$

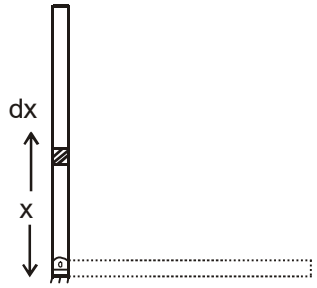
$T_C = 2mg - mg = mg$

$\frac{T_B}{T_C} = \frac{4mg}{mg} = 4$

38. A thin rod .....

Sol. Lets take an element of dx width at a distance x from the lowest end.

$dU = (dm)\, g\, x \int_{x=0}^{x=1} x^2 dx = 40J$



39. A uniform .....

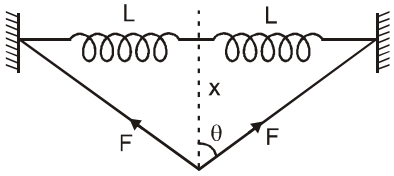
Sol. (K.E.) of plate w.r.to A = $\frac{1}{2}\, I_A\omega^2$

$I_A = \frac{4}{3}$ kg m^2

$(K.E.)_A = \frac{1}{2} \times \frac{4}{3} \times 4 = \frac{8}{3}$ J.

40. Figure shows .....

Sol.



$F_{net} = 4F\cos\theta$

$= 4K\left[\sqrt{L^2+x^2} - L\right].\frac{x}{\sqrt{L^2+x^2}}$

$= 4Kx\left[1 - \frac{L}{\sqrt{L^2+x^2}}\right]$

$= 4Kx\left[1 - \left(1+\frac{x^2}{L^2}\right)^{-1/2}\right]$

$= 4Kx\left(\frac{x^2}{2L^2}\right) = \frac{2K}{L^2}x^3$

PART : III CHEMISTRY

41. Which of the following .....

Sol. $HA \rightleftharpoons H^+ + A^-$

C O O

C(1-α) Cα Cα

$K_a = \frac{[H^+][A^-]}{[HA^-]} = \frac{c\alpha^2}{1-\alpha}$

$[H^+] = K_a \frac{[HA]}{[A^-]}$

$pH = pk_a + \log \frac{[A^-]}{[HA]}$

$pH = pk_a + \log \frac{c\alpha}{c(1-\alpha)}$

$pH = pk_a + \log \frac{\alpha}{1-\alpha}$

$\log \frac{1-\alpha}{\alpha} = pk_a - pH$

$\frac{1-\alpha}{\alpha} = 10^{pk_a - pH}$

$\alpha = \frac{1}{1+10^{pk_a - pH}}$

$k_a = \frac{c\alpha.\alpha}{1-\alpha}$

$k_a = \frac{[H^+]\alpha}{1-\alpha}$

43. Which of the following .....

Sol. (A) Molar volume of ideal gas at STP is 22.4 L

(B) Under critical conditions Z = $\frac{3}{8}$.

44. Which of the following .....

Sol. Formation of CO from constituent elements involves combustion.

45. Salt AB undergoes anionic .....

Sol. $B^- + H_2O \longrightarrow HB + OH^-$

c(1–h) ch ch

c = 0.1 M

ch = 10^{-5}

h = 10^{-4}

$K_h = ch^2 = 10^{-9}$

$K_{a(HB)} = 10^{-5}$

K_b of $B^- = 10^{-9}$

$pH = \frac{1}{2}(5 - (-1)) = 3$

48. The wave functions .....

Sol. (A) Total nodal surfaces in 3s = 2

Total nodal surfaces in 3p = 2

(B) Angular node in 3p, $\cos\theta = 0$

$\theta = \pi/2$

(C) Let $\frac{zr}{a_0} = x$

Radial nodes in 3s, $(6 - 4x + \frac{4}{9}x^2) = 0$

$\Rightarrow (3 - 2x + \frac{2}{9}x^2) = 0 \Rightarrow 27 - 18x + 2x^2 = 0$

$\Rightarrow x = \frac{18 \pm \sqrt{324 - 216}}{2 \times 2} = \frac{18 \pm \sqrt{108}}{4}$

$x = \frac{9 + 3\sqrt{3}}{2}, x = \frac{9 - 3\sqrt{3}}{2}$

Radial nodes in 3p. $4 - \frac{2}{3}x = 0$

$\Rightarrow x = 6$

Hence their radial nodes are not same.

(D) It is a fact.

49. In the following options .....

Sol. As bond order between carbon and nitrogen increases, bond length decreases.

50. Which of the following .....

Sol. (A) O_2 :- $\sigma_{1s}^2\ \sigma_{1s}^{*2}\ \sigma_{2s^2}\ \sigma_{2s^2}^*\ \sigma_{2pz}^2$

$\pi 2p_x^2 = \pi_{2py}^2\ \ \pi^* 2p_x^2 = \pi^* 2p_y^\circ$ (diamagnetic)

(B) N_2^{2-} :- $\sigma_{1s}^2\ \sigma_{1s^2}^*\ \sigma_{2s}^2\ \sigma_{2s^2}^*\ \pi 2p_x^2 = \pi_{2py}^2$

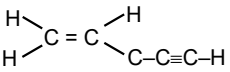
$\sigma_{2pz}^2\ \ \pi^* 2p_x^2 = \pi^* 2p_y^\circ$ (paramagnetic)

(C) He_2^+ :- $\sigma_{1s}^2\ \sigma_{1s^1}^*$ (paramagnetic)

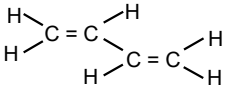
(D) B_2 :- $\sigma_{1s}^2\ \sigma_{1s^2}^*\ \sigma_{2s}^2\ \sigma_{2p^2}^*\ \pi 2px^2 = \pi 2p_y^\circ$

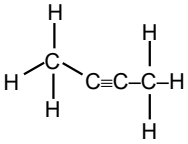
51. Which of the following.....

Sol. Structure Linearly arranged carbon atoms

(A)  3

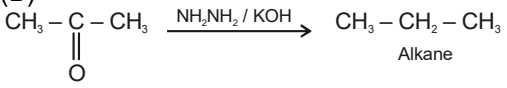
(B) H–C≡C–C≡C–H 4

(C)  2

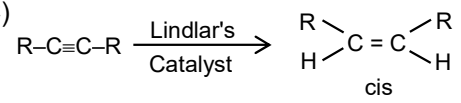
(D)  4

52. Which of the following .....

Sol. (A) $2R - X + 2Na \xrightarrow{\text{dry ether}} R - R + 2NaX$

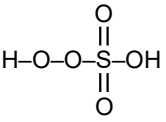
(B) 

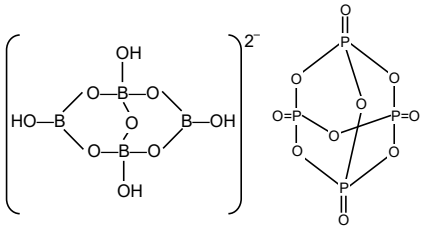
Carbonyl compound Alkane

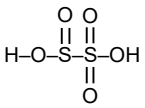
(C) 

cis

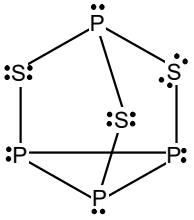
53. Select the incorrect .....

Sol. 

Borax 

$H_2S_2O_5$ (Pyrosulphurous acid) 

54. Which of the following .....

Sol. 

55. $Ca_2B_6O_{11} + Na_2CO_3$ .....

Sol. Compound [X] is $Na_2B_4O_7$.

(A) In anion of borax two boron is sp^3 hybridised and two boron are sp^2 hybridised.

(B) Aqueous solutions of [X] is alkaline.

(C) In the structure of [X] anion B–O–B bonds.

(D) [X] on heating with chromium salts in oxidizing flame gives green coloured bead.

56. Given is an equation of .....

Sol. $PV = RT - \frac{A}{V} + \frac{2B}{V^2}$

$P = \frac{RT}{V} - \frac{A}{V^2} + \frac{2B}{V^3}$

At critical point $\frac{dP}{dV} = 0$

$\frac{dP}{dV} = -\frac{RT}{V^2} + \frac{2A}{V^3} - \frac{6B}{V^4}$

$0 = \frac{1}{V^2}\left[-RT + \frac{2A}{V} - \frac{6B}{V^2}\right]$

$RTV^2 - 2AV + 6B = 0$

$D = 4A^2 - 4 \times RT \times 6B = 0$

$T_C = \frac{A^2}{6RB}$ $V_C = \frac{6B}{A}$ $P_C = \frac{A^3}{108B^2}$;

$Z = \frac{P_C V_C}{RT_C} \Rightarrow \frac{1}{Z} = 3$

57. A magnesium ribbon.....

Sol. $Mg + air \longrightarrow MgO + Mg_3N_2$

0.25 mol 0.1 0.05

$MgO + 2HCl \longrightarrow MgCl_2 + H_2O.$

0.10.2mol

$Mg_3N_2 + 8HCl \longrightarrow 3MgCl_2 + 2NH_4Cl.$

0.05 mol 0.4 mol 0.1 mol

NaOH

NH_3

0.1 mol

58. How many structural .....

Sol. 2-methylbutan-2-ol.

59. How many functional .....

Sol. Functional group present are : aldehyde, alcohol, primary amine, ketone, secondary amide, carboxylic acid and anhydride.

60. How many of the following .....

Sol. (I), (II), (III), (IV), (V), (VIII), (IX)

ANSWER KEY

PART : I MATHEMATICS

1.	(BC)	**2.**	(ABCD)	**3.**	(ABC)	**4.**	(ACD)	**5.**	(AB)	**6.**	(AB)	**7.**	(ABC)
8.	(AD)	**9.**	(AC)	**10.**	(BC)	**11.**	(CD)	**12.**	(ABCD)	**13.**	(BD)	**14.**	(AD)
15.	(ABC)	**16.**	(4)	**17.**	(4)	**18.**	(1)	**19.**	(7)	**20.**	(4)		

PART : II PHYSICS

21.	(CD)	**22.**	(AC)	**23.**	(AD)	**24.**	(ABCD)	**25.**	(BC)	**26.**	(ABD)	**27.**	(ABCD)
28.	(BC)	**29.**	(ABCD)	**30.**	(AB)	**31.**	(ABCD)	**32.**	(BC)	**33.**	(BCD)	**34.**	(AC)
35.	(ABCD)	**36.**	(3)	**37.**	(4)	**38.**	(8)	**39.**	(8)	**40.**	(3)		

PART : III CHEMISTRY

41.	(AB)	**42.**	(ABCD)	**43.**	(ABD)	**44.**	(ABC)	**45.**	(ABCD)	**46.**	(ACD)	**47.**	(AB)
48.	(ABD)	**49.**	(ABCD)	**50.**	(ABD)	**51.**	(BD)	**52.**	(ACD)	**53.**	(B)	**54.**	(ABCD)
55.	(BCD)	**56.**	(3)	**57.**	(6)	**58.**	(1)	**59.**	(7)	**60.**	(7)		