Sky Tutorials
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IIT-JEE | NEET | Foundation

JEE

Time: 3 Hours **M.M. 300**

ALL INDIA SKY TEST SERIES

TARGET BATCH – IIT - JEE

Date : 01/10 /2023

SYLLABUS

PHYSICS	CHEMISTRY	MATHEMATICS
Previous + Centre of Mass	Thermodynamics, Equilibrium, Bonding, GOC, Isomerism	Previous + Function

Please read the instructions carefully. You are allotted **5** minutes specifically for this purpose.

INSTRUCTIONS:

1. This Question paper is divided in to three parts Physics, Chemistry and Mathematics each part is further divided into two sections.
   Section –A Contains 20 Questions Section B contains 10 questions. Please ensure that the Questions paper you have received contains **ALL THE QUESTIONS** in each Part.
2. **In Section A all the 20 Questions are compulsory and Section B Contain 10 Question, out of these 10 Questions**, candidates can choose to attempt any 5 Questions.
   Each Question has four choices (A), (B), (C), (D) out of which **only one is correct & Carry 4 marks each 1 mark** will be deducted for each wrong answer.

GENERAL INSTRUCTION

1. Use only **blue/black pen (avoid gel pen)** for darkening the bubble.
2. Indicate the correct answer for each question by filling appropriate bubble in your **OMR** answer sheet.
3. The answer sheet will be checked through computer hence, the answer of the question must be marked by –shading the circles against the question by dark **blue/black pen**
4. Blank papers, Clipboards, Log tables, Slide Rule, Calculator, Cellular Phones Papers and Electronic Gadgets in any form are **not** allowed to be carried inside the examination hall.

Name of the candidate:_____

Signature of the candidate: _____**Signature of the invigilator:**_____

PHYSICS

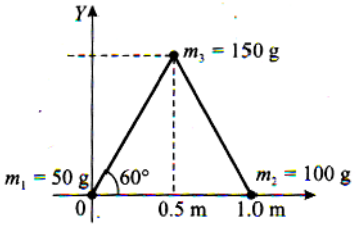
SECTION - A

Single Choice Question

1. Distance of the centre of mass of a solid uniform cone from its vertex is z_0. If the radius of its base is R and its height is h then z_0 is equal to

(a) $\frac{h^2}{4R}$ (b) $\frac{3h}{4}$ (c) $\frac{5h}{8}$ (d) $\frac{3h^2}{8R}$

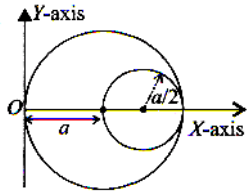
2. Three particles of masses 50 g, 100 g and 150 g are placed at the vertices of an equilateral triangle of side 1 m (as shown in the figure). The (x, y) coordinates of the centre of mass will be



(a) $\left(\frac{7}{12}m, \frac{\sqrt{3}}{8}m\right)$ (b) $\left(\frac{\sqrt{3}}{4}m, \frac{5}{12}m\right)$

(c) $\left(\frac{7}{12}m, \frac{\sqrt{3}}{4}m\right)$ (d) $\left(\frac{\sqrt{3}}{8}m, \frac{7}{12}m\right)$

3. A circular hole of radius $\left(\frac{a}{2}\right)$ is cut out of a circular disc of radius 'a' as shown in figure. The centroid of the remaining circular portion with respect to point 'O' will be



(a) $\frac{1}{6}a$ (b) $\frac{10}{11}a$ (c) $\frac{5}{6}a$ (d) $\frac{2}{3}a$

4. Two bodies of mass 1 kg and 3 kg have position vectors $\hat{i}+2\hat{j}+\hat{k}$ and $-3\hat{i}-2\hat{j}+\hat{k}$ respectively. The magnitude of position vector of centre of mass of this system will be similar to the magnitude of vector

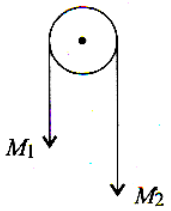
(a) $\hat{i}-2\hat{j}+\hat{k}$ (b) $-3\hat{i}-2\hat{j}+\hat{k}$

(c) $-2\hat{j}+2\hat{k}$ (d) $-2\hat{i}-\hat{j}+2\hat{k}$

5. Two blocks of masses 10 kg and 30 kg are placed on the same straight line with coordinates (0, 0) cm and (x, 0) cm respectively. The block of 10 kg is moved on the same line through a distance of 6 cm towards the other block. The distance through which the block of 30 kg must be moved to keep the position of centre of mass of the system unchanged is

(a) 4 cm towards the 10 kg block
(b) 2 cm away from the 10 kg block
(c) 2 cm towards the 10 kg block
(d) 4 cm away from the 10 kg block

6. Two masses M_1 and M_2 are tied together at the two ends of light inextensible string that passes over a frictionless pulley. When the mass M_2 is twice that of M_1, the acceleration of the system is a_1. When the mass M_2 is thrice that of M_1, acceleration of the system is a_2. The ratio $\frac{a_1}{a_2}$ will be



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

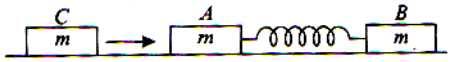
7. A wedge of mass M = 4m lies on a frictionless plane. A particle of mass m approaches the wedge with speed v. There is no friction between the particle and the plane or between the particle and the wedge. The maximum height climbed by the particle on the wedge is given by

(a) $\frac{2v^2}{7g}$ (b) $\frac{v^2}{g}$ (c) $\frac{2v^2}{5g}$ (d) $\frac{v^2}{2g}$

8. A man (mass = 50 kg) and his son (mass = 20 kg) are standing on a frictionless surface facing each other. The man pushes his son so that he starts moving at a speed of 0.70 ms^{-1} with respect to the man. The speed of the man with respect to the surface is

(a) 0.20 ms^{-1} (b) 0.14 ms^{-1}
(c) 0.47 ms^{-1} (d) 0.28 ms^{-1}

9. Two identical blocks A and B each of mass m resting on the smooth horizontal floor are connected by a light spring of natural length L and spring constant K. A third block C of mass m moving with a speed v along the line joining A and B collides with A. The maximum compression in the spring is (Assume elastic collision)



(a) $v\sqrt{\frac{m}{2K}}$ (b) $\sqrt{\frac{mv}{2K}}$ (c) $\sqrt{\frac{mv}{K}}$ (d) $\sqrt{\frac{m}{2K}}$

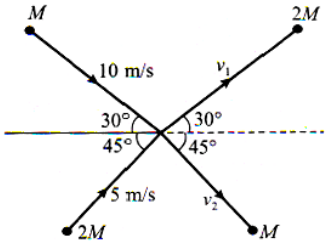
10. A body of mass M at rest explodes into three pieces, in the ratio of masses 1 : 1 : 2. Two smaller pieces fly off perpendicular to each other with velocities of 30 ms^{-1} and 40 ms^{-1} respectively. The velocity of the third piece will be

(a) 15 ms^{-1} (b) 25 ms^{-1} (c) 35 ms^{-1} (d) 50 ms^{-1}

11. A body of mass 2 kg makes an elastic collision with a second body at rest and continues to move in the original direction but with one fourth of its original speed. What is the mass of the second body ?

(a) 1.8 kg (b) 1.2 kg (c) 1.5 kg (d) 1.0 kg

12. Two particles, of masses M and 2M, moving as shown, with speed of 10 m/s and 5 m/s, collide elastically at the origin. After the collision, they move along the indicated directions with speed v_1 and v_2, respectively. The values of v_1 and v_2 are nearly



(a) 3.2 m/s and 6.3 m/s
(b) 3.2 m/s and 12.6 m/s
(c) 6.5 m/s and 6.3 m/s
(d) 6.5 m/s and 3.2 m/s

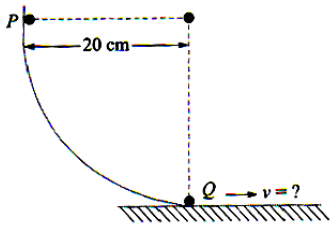
13. Two particles of equal mass m have respective initial velocities $u\hat{i}$ and $u\left(\frac{\hat{i}+\hat{j}}{2}\right)$. They collide completely inelastically. The energy lost in the process is

(a) $\frac{3}{4}mu^2$ (b) $\frac{1}{8}mu^2$ (c) $\sqrt{\frac{2}{3}}mu^2$ (d) $\frac{1}{3}mu^2$

14. An object of mass m_1 collides with another object of mass m_2, which is at rest. After the collision the objects move with equal speed in opposite direction. The ratio of the masses m_2 : m_1 is

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

15. As per the given figure, a small ball P slides down the quadrant of circle and hits the other ball Q of equal mass which is initially at rest. Neglecting the effect of friction and assume the collision to be elastic, the velocity of ball Q after collision will be (g = 10 m/s^2)

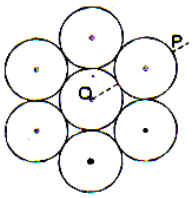


(a) 0 (b) 0.25 m/s (c) 2 m/s (d) 4 m/s

16. A fly wheel is accelerated uniformly from rest and rotates through 5 rad in the first second. The angle rotated by the fly wheel in the next second, will be

(a) 7.5 rad (b) 15 rad (c) 20 rad (d) 30 rad

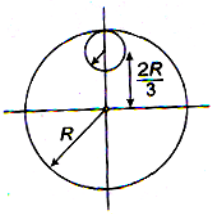
17. Seven identical circular planar disks, each of mass M and radius R are welded symmetrically as shown. The moment of inertia of the arrangement about the axis normal to the plane and passing through the point P is



(a) $\frac{181}{2}MR^2$ (b) $\frac{19}{2}MR^2$

(c) $\frac{55}{2}MR^2$ (d) $\frac{73}{2}MR^2$

18. From a uniform circular disc of radius R and mass 9 M, a small disc of radius R/3 is removed shown in the figure. The moment of inertia of the remaining disc about an axis perpendicular to the plane of the disc and passing through centre of disc is :



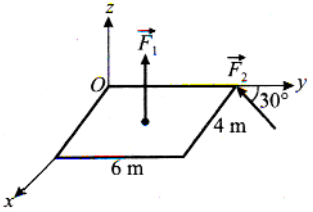
(a) $\frac{37}{9}MR^2$ (b) $4\,MR^2$

(c) $\frac{40}{9}MR^2$ (d) $10\,MR^2$

19. The radius of gyration of a uniform rod of length *l*, about an axis passing through a point $\frac{l}{4}$ away from the centre of the rod, and perpendicular to it, is

(a) $\frac{1}{8}l$ (b) $\sqrt{\frac{7}{48}}l$ (c) $\sqrt{\frac{3}{8}}l$ (d) $\frac{1}{4}l$

20. A slab is subjected to two forces $\vec{F}_1$ and $\vec{F}_2$ of same magnitude F as shown in the figure. Force F_2 is in XY-plane while force F_1 acts along z-axis at the point $(2\hat{i}+3\hat{j})$. The moment to these forces about point O will be



(a) $\left(3\hat{i}-2\hat{j}-3\hat{k}\right)F$ (b) $\left(3\hat{i}+2\hat{j}+3\hat{k}\right)F$

(c) $\left(3\hat{i}+2\hat{j}-3\hat{k}\right)F$ (d) $\left(3\hat{i}-2\hat{j}+3\hat{k}\right)F$

SECTION -B

21. Moment of Inertia (M.I.) of four bodies having same mass 'M' and radius '2R' are as follows

$I_1 = M.I.$ of solid sphere about its diameter

$I_2 = M.I.$ of solid cylinder about its axis

$I_3 = M.I.$ of solid circular about its diameter

$I_4 = M.I.$ of thin circular ring about its diameter

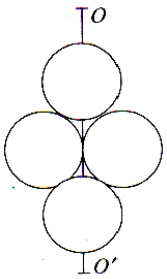
If $2(I_2+I_3)+I_4 = xI_1$, then value of x will be _____.

22. The moment of inertia of a uniform thin rod about a perpendicular axis passing through one end is I_1. The same rod is bent into a ring and its moment of inertia about a diameter is I_2. If $\frac{I_1}{I_2}$ is $\frac{x\pi^2}{3}$, then the value of x will be _____.

23. The radius of gyration of a cylindrical rod about an axis of rotation perpendicular to its length and passing through the centre will be _____ m.

Given , the length of the rod is $10\sqrt{3}$ m.

24. Four identical discs each of mass 'M' and diameter *'a'* are arranged in a small plane as shown in figure. If the moment of inertia of the system about OO′ is $\frac{x}{4}Ma^2$. Then the value of x will be _____.



25. Two bodies of the same mass are moving with the same speed, but in different directions in a plane. They have a completely inelastic collision and move together thereafter with a final speed which is half of their initial speed. The angle between the initial velocities of the two bodies (in degree) is 2θ. Find θ. **Ans. 60**

26. A ball with a speed of 9 m/s collides with another identical ball at rest. After the collision, the direction of each ball make an angle of 30^0 with the original direction. What is the ratio of velocities of the ball after collision.

27. A body of mass 5 kg is moving with a momentum 10 kg ms^{-1} . Now a force of 2 N acts on the body in the direction of its motion for 5 s. The increase in the Kinetic energy of the body is _____J.

28. The position of the centre of mass of a uniform semi-circular wire of radius 'R' placed in x-y plane with its center at the origin and the line joining its ends as x-axis by $\left(0, \frac{xR}{\pi}\right)$. Then, the value of |x| is _____.

29. The distance of centre of mass from end A of a one dimensional rod (AB) having mass density $\rho = \rho_0\left(1-\frac{x^2}{L^2}\right)$ kg/m and length L (in meter) is $\frac{3L}{\alpha}$ m. The value of α is _____ (where x is the distance from end A)

30. A stone tied to a string of length L is whirled in a vertical circle with the other end of the string at the centre. At a certain instant of time, the stone is at its lowest position and has a speed u. The magnitude of change in its velocity it reaches a position where the string is horizontal, is $\sqrt{x(u^2-gL)}$. The value of x is …. .

CHEMISTRY

SECTION - A

Single Choice Question

31. Among the following, the set of parameters that represent path functions, is :
(A) q + w (B) q (C) w (d) H - TS
(a) (B) and (C) (b) (B), (C) and (D)
(c) (A) and (D) (d) (A), (B) and (C)

32. An ideal gas expands in volume from 1×10^{-3} to $1\times10^{-2}\,m^3$ at 300 K against a constant pressure of $1\times10^{5}\,Nm^{-2}$. The work done is
(a) 270 kJ (b) –900 kJ (c) –900 J (d) 900 kJ

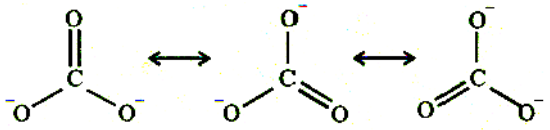
33. The heat required to raise the temperature of body by 1 K is called
(a) specific heat (b) thermal capacity
(c) water equivalent (d) none of these

34. Given
(A) $2CO(g) + O_2(g) \rightarrow 2CO_2(g)\ \Delta H_1^{\theta} = -x\,kJ\,mol^{-1}$
(B) $C(graphite) + O_2(g) \rightarrow CO_2(g)\ \Delta H_2^{\theta} = -y\,kJ\,mol^{-1}$
The ΔH^{θ} for the reaction
$C(graphite) + \frac{1}{2}O_2(g) \rightarrow CO(g)$ is
(a) $\frac{x-2y}{2}$ (b) $\frac{x+2y}{2}$ (c) $\frac{2x-y}{2}$ (d) 2y – *x*

35. For which of the following reactions, ΔH is equal to ΔU?
(a) $N_2(g)+3H_2(g)\rightarrow 2NH_3(g)$
(b) $2HI(g)\rightarrow H_2(g)+I_2(g)$
(c) $2SO_2(g)+O_2(g)\rightarrow 2SO_3(g)$
(d) $2NO_2(g)\rightarrow N_2O_4(g)$

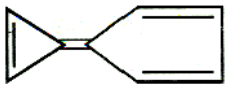
36. $(\Delta H-\Delta U)$ for the formation of carbon monoxide (CO) from its elements at 298 K is
(R = 8.314 $JK^{-1}\,mol^{-1}$)
(a) $-2477.57\,J\,mol^{-1}$ (b) $2477.57\,J\,mol^{-1}$
(c) $-1238.78\,J\,mol^{-1}$ (d) $1238.78\,J\,mol^{-1}$

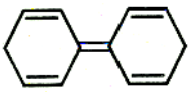
37. Resonance in carbonate ion (CO_3^{2-}) is



Which of the following is true?
(a) It is possible to identify each structure individually by some physical or chemical method.
(b) All these structures are in dynamic equilibrium with each other.
(c) CO_3^{2-} has a single structure i.e., resonance hybrid of the above three structures.
(d) Each structure exists for equal amount of time.

38. Among the following compounds, the one which shows highest dipole moment is

(a)  (b) 

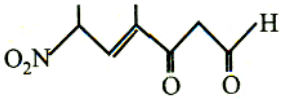
(c)  (d) 

39. Given below are two statements :
Statement-I : SO_2 and H_2O both possess V-shaped structure.
Statement – II: The bond angle of SO_2 is less than that of H_2O
In the light of the above statements, choose the most appropriate answer from the options given below:
(a) Both Statement I and Statement II are correct
(b) Statement I is correct but Statement II is incorrect
(c) Both Statement I and Statement II are incorrect
(d) Statement I is incorrect but Statement II is correct

40. For OF_2 molecule consider the following:
(A) Number of lone pairs on oxygen is 2.
(B) FOF angle is less than 104.5^0.
(C) Oxidation state of O is -2.
(D) Molecule is bent 'V' shaped.
(E) Molecular geometry is linear.
Correct options are:
(a) C, D, E only (b) B, E, A only
(c) A, C, D only (d) A, B, D only

41. Consider the ions/molecule $O_2^+, O_2, O_2^-, O_2^{2-}$
For increasing bond order the correct option is :
(a) $O_2^{2-}<O_2^-<O_2<O_2^+$ (b) $O_2^-<O_2^{2-}<O_2<O_2^+$
(c) $O_2^-<O_2^{2-}<O_2^+<O_2$ (d) $O_2^-<O_2^+<O_2^{2-}<O_2$

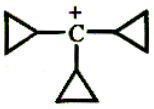
42. The correct IUPAC name of the following compound is :



(a) 4-methyl-2-nitro-5-oxohept-3-enal
(b) 4-methyl-5-oxo-2-nitrohept-3-enal
(c) 4-methyl-6-nitro-3-oxohept-4-enal
(d) 6-formyl-4-methyl -2-nitrohex-3-enal

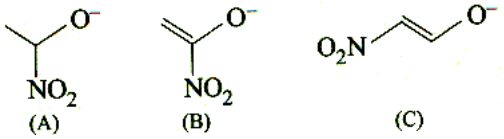
43. The decreasing order of hydride affinity for following carbocations is:

A. $CH_2=CH-\overset{+}{C}(CH_3)-CH_3$ B. $C_6H_5-\overset{+}{C}(C_6H_5)-C_6H_5$

C. $H_3C-\overset{+}{C}(CH_3)-CH_3$ D. 

Choose the correct answer from the options given below :
(a) A, C, B, D (b) C, A, B, D
(c) C, A, D, B (d) A, C, D, B

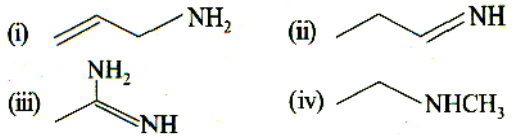
44. The correct order of stability for the following alkoxides is :



(A) (B) (C)

(a) (B)> (A) > (C) (b) (C) > (B) > (A)
(c) (C) > (A) > (B) (d) (B) > (C) > (A)

45. The increasing order of basicity of the following compounds is



(a) (i) < (ii) < (iii) < (iv) (b) (ii) < (i) < (iii) < (iv)
(c) (ii) < (i) < (iv) < (iii) (d) (iv) < (ii) < (i) < (iii)

46. Consider the acidity of the carboxylic acids :
(1) PhCOOH
(2) $o-NO_2C_6H_4COOH$
(3) $p-NO_2C_6H_4COOH$
(4) $m-NO_2C_6H_4COOH$
Which of the following order is correct?
(a) 2 > 4 > 1 > 3 (b) 2 > 4 > 3 > 1
(c) 1 > 2 > 3 > 4 (d) 2 > 3 > 4 > 1

47. 20 mL of 0.1 M NH_4OH is mixed with 40 mL of 0.05M HCl. The pH of the mixture is nearest to :
(Given : K_b (NH_4OH) = 1×10^{-5}, log 2 = 0.30, log 3 = 0.48, log 5 = 0.69, log 7 = 0.84, log 11 = 1.04)
(a) 3.2 (b) 4.2 (c) 5.2 (d) 6.2

48. The K_{sp} for bismuth sulphide (Bi_2S_3) is 1.08×10^{-73}. The solubility of Bi_2S_3 in mol L^{-1} at 298 K is
(a) 1.0×10^{-15} (b) 2.7×10^{-12}
(c) 3.2×10^{-10} (d) 4.2×10^{-8}

49. If K_{sp} of CaF_2 at 25^0C is 1.7×10^{-10}, the combination amongst the following which gives a precipitate of CaF_2 is
(a) $1\times10^{-2}M\,Ca^{2+}$ and $1\times10^{-3}M\,F^-$
(b) $1\times10^{-4}M\,Ca^{2+}$ and $1\times10^{-4}M\,F^-$
(c) $1\times10^{-2}M\,Ca^{2+}$ and $1\times10^{-5}M\,F^-$
(d) $1\times10^{-3}M\,Ca^{2+}$ and $1\times10^{-5}M\,F^-$

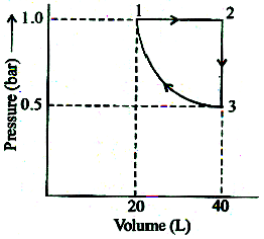
50. For the reaction,
$2SO_2(g)+O_2(g)\rightleftharpoons 2SO_3(g)$,
$\Delta H=-57.2\,kJ\,mol^{-1}$ and $K_c=1.7\times10^{16}$
Which of the following statement is **INCORRECT**?
(a) The equilibrium constant is large suggestive of reaction going to completion and so no catalysts is required.
(b) The equilibrium will shift in forward direction as the pressure increases.
(c) The equilibrium constant decreases as the temperature increases.
(d) The addition of inert gas at constant volume will not affect the equilibrium constant.

SECTION - B

Integer Type Questions

51. The total number of intensive properties from the following is _____
Volume, Molar heat capacity, Molarity, E^0 cell, Gibbs free energy change, Molar mass, Mole.

52. One mole of an ideal monoatomic gas is subjected to changes as shown in the graph. The magnitude of the work done (by the system or on the system) is. $x\times10\,J$ then value of x (nearest integer) is.



Given : log 2 = 0.3, In 10 = 2.3

53. $A_2+B_2\rightarrow 2AB \quad \Delta H_f^0=-200\,kJ\,mol^{-1}$
AB, A_2 and B_2 are diatomic molecule. If the bond enthalpies of A_2, B_2 and AB are in the ratio 1 : 0.5 : 1, then the bond enthalpy of A_2 is x kJmol^{-1} then value of $\frac{x}{100}$ is

54. For a chemical reaction $A+B \rightleftharpoons C+D$ $(\Delta_r H^0 = 80 kJ mol^{-1})$ the entropy change $\Delta_r S^0$ depends on the temperature T (in K) as $\Delta_r S^0 = 2T(JK^{-1}mol^{-1})$. Minimum temperature at which it will become spontaneous is $a \times 10^2$ K. then the value of a (Integer) is

55. The number of bent-shaped molecule/s from the following is _____
$N_3^-, NO_2^-, I_3^-, O_3, SO_2$

56. (i) $X(g) \rightleftharpoons Y(g)+Z(g)$ $K_{P_1}=3$

(ii) $A(g) \rightleftharpoons 2B(g)$ $K_{P_2}=1$

If the degree of dissociation and initial concentration of both the reactants X(g) and A(g) are equal, then the ratio of the total pressure at equilibrium $\left(\frac{P_1}{P_2}\right)$ is equal to x : 1.

The value of x is _____ (Nearest integer)

57. If the pKa of lactic acid is 5, then the pH of 0.005 M calcium lactate solution at 25^0C is _____ $\times 10^{-1}$ (Nearest integer)

Lactic acid $CH_3-\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}-COOH$

58. The number of structure isomers for C_6H_{14} is :

59. Among these how many statement are correct
(i) U and H each depends only temp.
(ii) $C_{p_1m} - C_{v_1m} = R$
(iii) dU = CvdT for any process.
(iv) Change in entropy of endothermic Reaction is always positive.

60. In the following reactions, the total number of oxygen atoms in X and Y is _____
$Na_2O + H_2O \rightarrow 2X$
$Cl_2O_7 + H_2O \rightarrow 2Y$

MATHEMATICS

SECTION - A

Single Choice Question

61. Let p, q $\in$ Q. If $2-\sqrt{3}$ is a root of the quadratic equation $x^2+px+q=0$. Then
(a) $q^2+4p+14=0$ (b) $q^2-4p-12=0$
(c) $p^2-4p-12=0$ (d) $p^2-4q+12=0$

62. Let α and β be the roots of $x^2-6x-2=0$. If $a_n=\alpha^n-\beta^n$ for $n \geq 1$, then the value of $\frac{a_{10}-2a_8}{3a_9}$ is :
(a) 2 (b) 1 (c) 4 (d) 3

63. The number of real solutions of the equation $3\left(x^2+\frac{1}{x^2}\right)-2\left(x+\frac{1}{x}\right)+5=0$, is
(a) 4 (b) 3 (c) 2 (d) 0

64. Let $S=\{x : x \in R$ and $(\sqrt{3}+\sqrt{2})^{x^2-4}+(\sqrt{3}-\sqrt{2})^{x^2-4}\}=10$. Then n(S) is equal to
(a) 2 (b) 4 (c) 0 (d) 6

65. If α and β are the roots of the equation $x^2-2x+2=0$, then the least value of n for which $\left(\frac{\alpha}{\beta}\right)^n = 1$ is
(a) 3 (b) 4 (c) 2 (d) 5

66. Let α and β be two roots of the equation $x^2+2x+2=0$. Then $\alpha^{15}+\beta^{15}$ is equal to
(a) 512 (b) –512 (c) –256 (d) 256

67. Let $z=\left(\frac{\sqrt{3}}{2}+\frac{i}{2}\right)^5+\left(\frac{\sqrt{3}}{2}-\frac{i}{2}\right)^5$. If R(z) and I(z), respectively, denote the real and imaginary parts of z, then
(a) R(z) > 0 and I(z) > 0 (b) R (z) < 0 and I(z) > 0
(c) R(z) = -3 (d) I(z) = 0

68. If the sum of the series $20+19\frac{3}{5}+19\frac{1}{5}+18\frac{4}{5}+.....$ upto n^{th} term is 488 and then n^{th} term is negative, then
(a) n^{th} term is $-4\frac{2}{5}$ (b) n = 41
(c) nth term is -4 (d) n = 60

69. Let S_n denote the sum of first n-terms of an arithmetic progression. If S_{10} = 530, S_5 = 140, then $S_{20}-S_6$ is equal to
(a) 1862 (b) 1852 (c) 1842 (d) 1872

70. Let $S=2+\frac{6}{7}+\frac{12}{7^2}+\frac{20}{7^3}+\frac{30}{7^4}+.....$ Then 4*S* is equal to
(a) $\left(\frac{7}{3}\right)^2$ (b) $\left(\frac{7^3}{3^2}\right)$ (c) $\left(\frac{7}{3}\right)^3$ (d) $\frac{7^2}{3^3}$

71. If α and β be the coefficients of x^4 and x^2 respectively in the expansion of $\left(x+\sqrt{x^2-1}\right)^6+\left(x-\sqrt{x^2-1}\right)^6$, then
(a) $\alpha-\beta=-132$ (b) $\alpha+\beta=-30$
(c) $\alpha-\beta=60$ (d) $\alpha+\beta=60$

72. Fractional part of the number $\frac{4^{2022}}{15}$ is equal to

(a) $\frac{4}{15}$ (b) $\frac{1}{15}$ (c) $\frac{8}{15}$ (d) $\frac{14}{15}$

73. Let two points be A(1, -1) and B(0, 2). If a point $P(x', y')$ be such that the area of $\Delta PAB = 5$ sq. units and it lies on the line, $3x + y - 4\lambda = 0$, then a value of λ is

(a) 4 (b) 1 (c) 3 (d) –3

74. If the length of the chord of the circle, $x^2 + y^2 = r^2 (r > 0)$ along the line, $y - 2x = 3$ is r, then r^2 is equal to

(a) $\frac{9}{5}$ (b) $\frac{12}{5}$ (c) 12 (d) $\frac{24}{5}$

75. Consider a circle C which touches the y-axis at (0, 6) and cuts off an intercept $6\sqrt{5}$ on the x-axis. Then the radius of the circle C is equal to

(a) 8 (b) $\sqrt{82}$ (c) $\sqrt{53}$ (d) 9

76. The slope of the line touching both the parabolas $y^2 = 4x$ and $x^2 = -32$ is

(a) 1/2 (b) 3/2 (c) 1/8 (d) 2/3

77. If the common tangent to the parabolas, $y^2 = 4x$ and $x^2 = 4y$ also touches the circle, $x^2 + y^2 = c^2$, then c is equal to

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

78. Let the eccentricity of the hyperbola $H: \frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ be $\sqrt{\frac{5}{2}}$ and length of its latus rectum be $6\sqrt{2}$. If y = 2x + c is a tangent to the hyperbola H, then the value of c^2 is equal to

(a) 18 (b) 20 (c) 24 (d) 32

79. Let A be a 3×3 invertible matrix.
If $|\text{adj } (24 \text{ A})| = |\text{Adj } (3 \text{ adj } (2A))|$, then $|A|^2$ is equal to

(a) 6^6 (b) 2^{12} (c) 2^6 (d) 1

80. Let x, y, z > 1 and $A = \begin{bmatrix} 1 & \log_x y & \log_x z \\ \log_y x & 2 & \log_y z \\ \log_z x & \log_z y & 3 \end{bmatrix}$.
Then $|\text{adj } (\text{adj } A^2)|$ is equal to

(a) 4^8 (b) 2^8 (c) 2^4 (d) 6^4

SECTION - B

Integer Type Questions

81. Let $f: R \to R$ be a function defined by $f(x) = \frac{2e^{2x}}{e^{2x} + e}$. Then $f\left(\frac{1}{100}\right) + f\left(\frac{2}{100}\right) + f\left(\frac{3}{100}\right) + ... + f\left(\frac{99}{100}\right)$ is equal to _____.

82. The locus of the point of intersection of the lines $(\sqrt{3})kx + ky - 4\sqrt{3} = 0$ and $\sqrt{3}x - y - 4(\sqrt{3})k = 0$ is conic, whose eccentricity is _____ .

83. If m is the slop of a common tangent to the curves $\frac{x^2}{16} + \frac{y^2}{9} = 1$ and $x^2 + y^2 = 12$, then $12m^2$ is equal to .

84. Let L be a tangent line to the parabola $y^2 = 4x - 20$ at (6, 2). If L is also a tangent to the ellipse $\frac{x^2}{2} + \frac{y^2}{b} = 1$, then the value of b is equal to :

85. Let a common tangent to the curves $y^2 = 4x$ and $(x - 4)^2 + y^2 = 16$ touch the curves at the points P and Q. Then $(PQ)^2$ is equal to _____.

86. Points P (-3, 2), Q(9, 10) and $R(\alpha, 4)$ lie on a circle C with PR as its diameter. The tangents to C at the points Q and R intersect at the point S. If S lies on the line $2x - ky = 1$, then k is equal to _____.

87. Let $A(1,0), B(6,2)$ and $C\left(\frac{3}{2}, 6\right)$ be the vertices of a triangle ABC. If P is a point inside the triangle ABC such that the triangle APC, APB and BPC have equal areas, then the length of the line segment PQ, where Q is the point $\left(-\frac{7}{6}, -\frac{1}{3}\right)$, is _____ .

88. The coefficient of x^{18} in the expansion of $\left(x^4 - \frac{1}{x^3}\right)^{15}$ is 455 K then the value of K is

89. The coefficient of x^7 in $(1 - x + 2x^3)^{10}$ is 80 K then the value of K is

90. If the value of real number a > 0 for which $x^2 - 5ax + 1 = 0$ and $x^2 - ax - 5 = 0$ have a common real root is $\frac{3}{\sqrt{2\beta}}$ then β is equal to _____.