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IN JEE MAIN AND ADVANCED

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Time : 3 hrs.

Max. Marks: 360

Topics covered in various subjects :

- Physics** : Work, Energy and Power, Rotational Motion, Gravitation, Properties of Solids and Liquids
- Chemistry** : Thermodynamics, Chemical Equilibrium, Redox Reactions; Hydrogen, s-Block Elements, Some p-Block Elements (Group -13 & 14)
- Mathematics** : Complex Numbers, Quadratic Equations, Mathematical Induction; Permutations and Combinations, Binomial Theorem & its Applications

Instructions:

- (i) Duration of Test is 3 hrs.
- (ii) The Test booklet consists of 90 questions. The maximum marks are 360.
- (iii) There are **three** parts in the question paper. Distribution of marks subjectwise in each part is as under for each correct response.
 - Part A – PHYSICS (120 marks)** – Questions No.1 to 30 consist **FOUR (4)** marks each for each correct response.
 - Part B – CHEMISTRY (120 marks)** – Questions No.31 to 60 consist **FOUR (4)** marks each for each correct response.
 - Part C – MATHEMATICS (120 marks)** – Questions No.61 to 90 consist **FOUR (4)** marks each for each correct response.
- (iv) One fourth ($\frac{1}{4}$) marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.
- (v) **Pattern of the Question: Section – I : Multiple Type Objective Questions** (Straight Single Choice Multiple Type Questions); **Section – II: Assertion – Reason Type Questions**; **Section – III: Comprehension Type Questions** : (One Comprehension Type Question should have 3 questions - Multiple Concept Questions); **Section – IV: Straight Objective Questions**: (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

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[PART - A : PHYSICS]

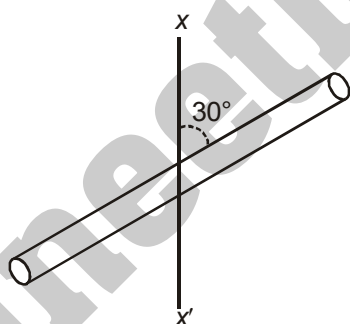
SECTION - I

Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions

This section contains 16 multiple choice questions numbered 1 to 16. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

- The moment of inertia of a body about a given axis depends upon
 - Mass distribution
 - Shape of the body
 - Distance between body and axis of rotation
 - All of these
- A body of mass m is moving with constant velocity on $x = \frac{2}{3}y$. Its angular momentum about origin
 - Increases
 - Decreases
 - Remains constant
 - Is zero
- When net external force acting on the system is zero, then
 - Angular momentum of system remains conserved
 - Linear momentum of system remains conserved
 - Torque on the system is zero
 - Both (1) & (2)
- A rod of length l and mass m is rotating with angular velocity ω about an axis xx' passing through its centre and inclined at an angle of 30° . Rotational kinetic energy of the rod is



- $\frac{ml^2\omega^2}{96}$
 - $\frac{ml^2\omega^2}{48}$
 - $\frac{ml^2\omega^2}{24}$
 - $\frac{ml^2\omega^2}{12}$
- A solid sphere and a hollow sphere of same diameter are rotating with same kinetic energy. A retarding torque τ stops the solid sphere after making x revolutions, then after how many revolutions will hollow sphere stop on applying same retarding torque τ ?

(1) $\frac{x}{2}$ (2) $2x$

(3) x (4) $\frac{x}{4}$

- A shell is fired to hit a target on the ground at distance R . But at the highest point of its motion shell explodes in two equal parts such that one piece retraces its path to point of projection on the ground. Then the distance from the point of projection where the second piece will strike the ground is

(1) $2R$ (2) $\frac{3}{2}R$

(3) R (4) $\frac{R}{2}$

- A ring has mass M and radius a . The distance from the centre of the ring on the axial line where force experienced by a point mass m will be maximum is

(1) $\frac{a}{\sqrt{2}}$ (2) $\frac{a}{2\sqrt{2}}$

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

- Kinetic energy needed to escape the body of mass m from a height R above the earth's surface is (R is the radius of earth)

(1) mgR (2) $\frac{mgR}{2}$

(3) $\frac{mgR}{4}$ (4) $\frac{3mgR}{4}$

- Which of the following is correct for a planet revolving around the sun?

- Planet revolves around the sun in elliptical orbit
- Angular momentum of the planet about the sun remains constant
- Work done by the gravitational force on the planet is zero only in some part of the orbit
- All of these

- Two planets A and B have same density but radius of A is half the radius of B . Escape speed from the surface of planet A is v . Escape speed from the surface of planet B will be

(1) $\frac{v}{\sqrt{2}}$ (2) $\sqrt{2}v$

(3) $\frac{v}{2}$ (4) $2v$

- For satellite motion which of following statement is correct?

Class (XII)

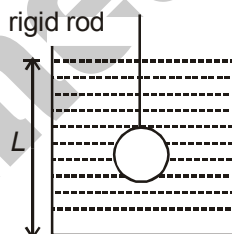
- (1) If the mechanical energy of the satellite is positive, then it escapes away from the gravitational field of the planet
- (2) When the height of the satellite is increased, its potential energy increases and kinetic energy decreases
- (3) Closed orbits are always elliptical and mechanical energy in the orbit is always negative
- (4) All of these
12. A particle is projected from the surface of earth with speed $\sqrt{\frac{5}{2}gR}$. The particle will follow (R = radius of earth)
- (1) Circular path (2) Parabolic path
- (3) Hyperbolic path (4) Elliptical path
13. A string is wrapped several times around a uniform solid cylinder of mass 2 kg and diameter 2 cm. The cylinder can rotate freely about its axis. The string is pulled by a force of 2 N. The acceleration of the string

- (1) 2 m/s^2 (2) $\frac{1}{2} \text{ m/s}^2$
- (3) 1 m/s^2 (4) $\frac{1}{4} \text{ m/s}^2$

14. Pressures inside two soap bubbles of radii r_1 and r_2 are P and $2P$ respectively. $\frac{r_1}{r_2}$ is

- (1) 2 (2) 0.5
- (3) Less than 2 (4) Greater than 2

15. A cylindrical container of length L is full to the brim with a liquid of density ρ . It is placed on a weight scale, the scale reading is w . A light ball of volume V and mass m is pushed gently down and held beneath the surface of the liquid with a rigid rod of negligible volume as shown in the figure. The reading of the scale when the ball is fully immersed is



- (1) $w + \rho Vg - mg$ (2) $w + mg - \rho Vg$
- (3) w (4) $w + \rho Vg$

16. In a U-tube the radii of two columns are respectively r_1 & r_2 and $r_2 > r_1$. When a liquid of density ρ and surface tension T is filled in it, then a level difference

of h is observed on two arms is (contact angle between container & liquid is zero)

- (1) $\frac{T(r_2 - r_1)}{2\rho g r_1 r_2}$ (2) $\frac{T(r_2 - r_1)}{\rho g r_1 r_2}$
- (3) $\frac{2T(r_2 - r_1)}{\rho g r_1 r_2}$ (4) $\frac{2T(r_2 + r_1)}{\rho g r_1 r_2}$

SECTION - II

Assertion – Reason Type Questions

Directions : Questions number 17 to 21 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

17. Statement-1 : Internal forces can change the momentum of individual particles of the system.

and

Statement-2 : The momentum of the system as a whole is not affected by the internal forces.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
- (2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

18. Statement-1 : If no external torque acts on a particle about a point, its angular speed about the point must be constant.

and

Statement-2 : In absence of external torque about a point, angular momentum of the system about the point is conserved.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is NOT a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

19. Statement-1 : The acceleration due to gravity on earth

Class (XII)

goes on decreasing as we go from poles to the equator.

and

Statement-2 : Acceleration due to gravity is a vector quantity.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

20. Statement-1 : The unit of stress is same as that of pressure.

and

Statement-2 : Stress has the same meaning as pressure.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

21. Statement-1 : The centre of mass and centre of gravity always coincide.

and

Statement-2 : Centre of mass depends on the distribution of mass but the centre of gravity depends on the distribution of mass as well as the variation of acceleration due to gravity.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

SECTION - III

Comprehension Type Questions

Directions : Question No. 22 to 24 are based on the following paragraph.

Two satellites S_1 and S_2 revolve round a planet in coplanar circular orbits in the same sense. Their periods of revolution are 8 hour and 27 hour respectively. The radius of the orbit of S_1 is 10^5 km.

22. The radius of the orbit of S_2 is

(1) 2.25×10^5 km (2) 4×10^5 km

(3) 3×10^5 km (4) 9×10^5 km

23. Linear speed of S_2 is

(1) $\frac{\pi}{3} \times 10^5$ km/h (2) $\frac{\pi}{2} \times 10^5$ km/h

(3) $\frac{\pi}{6} \times 10^5$ km/h (4) $\frac{\pi}{4} \times 10^5$ km/h

24. Angular speed of S_2 as observed by astronaut in S_1 , when the satellites are closest, is

(1) $\frac{\pi}{8}$ rad/s (2) $\frac{\pi}{12}$ rad/s

(3) $\frac{\pi}{15}$ rad/h (4) $\frac{\pi}{15}$ rad/s

SECTION - IV

Straight Objective Questions

Directions : Question No. 25 to 30 are based on the following Multiple concept questions and/or difficulty/lengthy calculations & application based questions.

25. A projectile of mass 6 kg explodes at highest point of its path. It breaks into three parts of 1 kg, 2 kg and 3 kg. 1 kg part retraces its path, 2 kg comes to rest. The range of the projectile was 180 m if no explosion would have taken place. The distance of 3 kg part from the point of projection when it finally lands on the ground is

(1) 180 m (2) 300 m

(3) 75 m (4) 150 m

26. A large open container of negligible mass and uniform cross-sectional area A has a small hole of

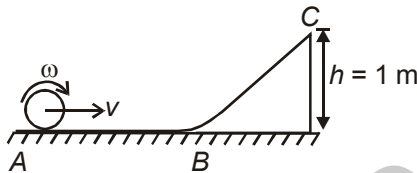
cross-sectional area $\frac{A}{400}$ in its side wall near the bottom. The container is kept on a smooth horizontal floor and contains a liquid of density ρ and mass m_0 . Assuming liquid starts flowing out horizontally through the hole at $t = 0$, calculate the approx acceleration of the container, when 50% of the liquid has drained out

- (1) $\frac{g}{50}$ (2) $\frac{g}{200}$
 (3) $\frac{g}{150}$ (4) $\frac{g}{100}$

27. A capillary tube of radius r is lowered into a liquid of surface tension T and density ρ . The potential energy acquired by the liquid in the capillary is (angle of contact = zero)

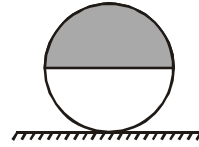
- (1) $\frac{\pi T^2}{2\rho g}$ (2) $\frac{2\pi T^2}{\rho g}$
 (3) $\frac{\sqrt{2}\pi T^2}{\rho g}$ (4) $\frac{\pi T^2}{\rho g}$

28. A small sphere of mass 1 kg is rolling without slipping with linear speed $v = \sqrt{\frac{200}{7}}$ m/s. It leaves the curved surface (on which it rolls without slipping) at point C. Translational kinetic energy at point C is



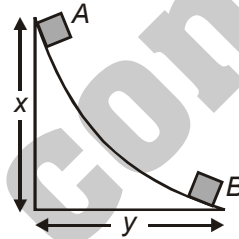
- (1) 4 J (2) $\frac{50}{7}$ J
 (3) 8 J (4) $\frac{20}{7}$ J

29. Kinetic energy of upper half (shaded) of a uniform hemispherical shell of mass m rolling without slipping with its centre moving with speed v is



- (1) $\frac{1}{3}mv^2$ (2) $\frac{2}{3}mv^2$
 (3) $\frac{1}{2}mv^2$ (4) mv^2

30. A small block of mass m is released from the point A on a rough circular. It slides down and reaches the point B. The co-efficient of kinetic friction between the block and surface is μ . The velocity when it will reach at the bottom will be



- (1) $\sqrt{2g\left(\frac{y}{\mu} - x\right)}$
 (2) $\sqrt{2g(x - \mu y)}$
 (3) $\sqrt{g(y - \mu x)}$
 (4) $\sqrt{g\left(\frac{1}{\mu}y - x\right)}$

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[PART - B : CHEMISTRY]

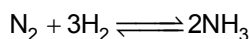
SECTION - I

Straight Single Choice Multiple Type Questions /
Application Based Single Choice Questions

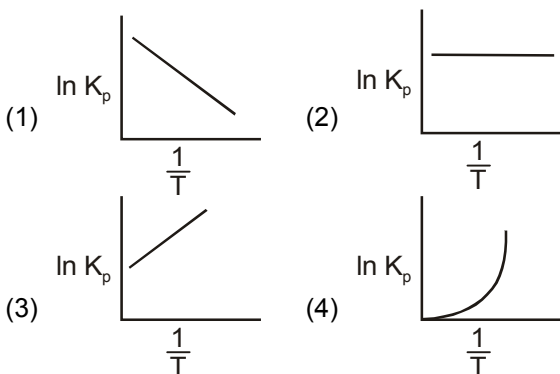
This section contains 16 multiple choice questions numbered 31 to 46. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

31. For the following reaction



The correct graph is



32. At temperature 400 K, PCl_5 is 50% dissociated at an equilibrium pressure of 4 atm. At what pressure it would dissociate to the extent of 80% at same temperature?

- (1) 0.50 atm (2) 0.60 atm
(3) 2.80 atm (4) 0.75 atm

33. Which of the alkali metal forms hydrated halide?

- (1) Li (2) Na
(3) K (4) All of these

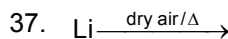
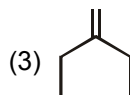
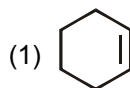
34. Which of the salt is hydrolysed in water?

- (1) NaCl
(2) KNO_3
(3) Na_2SO_4
(4) AgCN

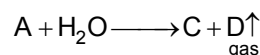
35. Which of the silicate have general formula $[\text{Si}_4\text{O}_{11}]^{-6}$?

- (1) Pyroxene silicate
(2) Soro silicate
(3) Amphiphole
(4) 2-Dimensional silicate

36. A compound having formula C_6H_{10} gives two type product on reductive ozonolysis. One out of them is HCHO. The compound may be



Product will be:



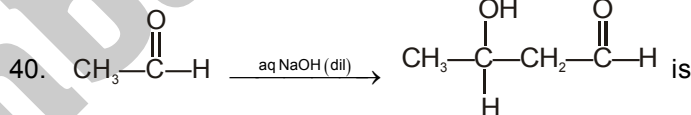
- (1) Li_2O_2 (2) $\text{Li}_2\text{O} + \text{LiOH}$
(3) $\text{Li}_2\text{O}_2 + \text{LiH}$ (4) $\text{Li}_2\text{O} + \text{Li}_3\text{N}$

38. Most stable carbanion is:

- (1) $(\text{CH}_3)_3\text{C}^\ominus$ (2) $^\ominus\text{CH}_2 - \text{CH} = \text{CH}_2$
(3) $\text{CH}_3\text{CH}_2\text{CH}_2^\ominus$ (4) $(\text{CH}_3)\text{CH}^\ominus$

39. Various oxidation states of Pb in Pb_3O_4 are

- (1) +8/3 (2) +2
(3) +4 (4) +2 & +4



the example of

- (1) Cannizaro reaction
(2) Beckmann's rearrangement
(3) Aldol condensation
(4) Tollen's Test

41. At equilibrium

- (1) $\Delta G^\ominus = 0$ (2) $\Delta H^\ominus = 0$
(3) $\Delta S^\ominus = 0$ (4) $\Delta G = 0$

42. In which of the following boron is present in two states of hybridisation

- (1) $\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$ (2) $\text{B}_3\text{N}_3\text{H}_6$
(3) B_2O_3 (4) B_2H_6

43. Which does no form hydrides:

- (1) gr-3 (2) gr-4
(3) group 7, 8, 9 (4) gr-12

44. At room temperature

- (1) para hydrogen is major
(2) Ortho & para are equimolar

Class (XII)

- (3) Atomic hydrogen is major
(4) Ortho hydrogen is major
45. Oxidation state of 'Cl' in CaOCl_2 is:
(1) +1, -1 (2) 0
(3) -1 (4) +1/2
46. Oxidation state of 'Cr' in K_3CrO_8
(1) -3 (2) +6
(3) +5 (4) +7

SECTION - II**Assertion – Reason Type Questions**

Directions : Questions number 47 to 51 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

47. Statement-1 : Na is weakest reducing agent amongst alkali metal in aqueous medium.

and

Statement-2 : Ionisation energy of sodium is lower than lithium.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True
48. Statement-1 : Due to change in volume of container equilibrium is disturbed.

and

Statement-2 : Due to change in volume, K_c changes.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True
49. Statement-1 : At equilibrium, ΔG is minimum.

and

Statement-2 : Temperature pressure volume like macroscopic does not changes at equilibrium.

- (1) Statement-1 is True, Statement-2 is True;

Statement-2 is a correct explanation for Statement-1

- (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True
50. Statement-1 : In NH_4CN degree of hydrolysis is independent from concentration.

and

Statement-2 : NH_4CN is a salt of weak acid and weak base.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True
51. Statement-1 : Diborane contain 3C – 2e bond.

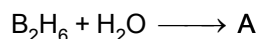
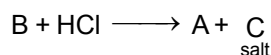
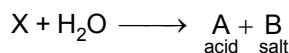
and

Statement-2 : B is sp^3 hybridised in B_2H_6 .

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
(3) Statement-1 is True, Statement-2 is False
(4) Statement-1 is False, Statement-2 is True

SECTION - III**Comprehension Type Questions**

Directions : Question No. 52 to 54 are based on the following paragraph.



52. The compound X will be

- (1) B_4H_{10} (2) $\text{Na}_2[\text{B}_4\text{O}_5(\text{OH})_4] \cdot 8\text{H}_2\text{O}$
(3) NaBO_2 (4) B_2O_3

Class (XII)

53. X can be used as
 (1) Acid (2) Base
 (3) Buffer (4) Neutral
54. How many sp^3 hybridised B atom are present in X?
 (1) Zero (2) 4
 (3) 2 (4) 1

SECTION - IV

Straight Objective Question

Directions : Question No. 55 to 60 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

55. Which of the compound gives homolytic cleavage with B_2H_6 ?
 (1) NH_3 (2) $CH_3 - NH_2$
 (3) $(CH_3)_3N$ (4) $CH_3 - CH_2 - NH_2$
56. Which compound have aromatic character?
 (1) Borazine
 (2) Orthosilicate
 (3) Diamond
 (4) All of these

57. The carbide which gives alkane on hydrolysis?
 (1) Al_4C_3
 (2) Mg_2C_3
 (3) CaC_2
 (4) All of these
58. pH of the 0.1 M NaHS solution does not depend on
 (1) pK_{a_1} of H_2S (2) pK_{a_2} of H_2S
 (3) Conc. of HS^- (4) All of these
59. The compound which does not contain peroxy linkage
 (1) BaO_2 (2) PbO_2
 (3) Na_2O_2 (4) H_2SO_5
60. $K_2Cr_2O_7 + H_2O_2 \xrightarrow{(30\%)} \text{Product}$
 Equivalent weight of $K_2Cr_2O_7$ in this reaction is
 (1) $\frac{M}{1}$ (2) $\frac{M}{2}$
 (3) $\frac{M}{6}$ (4) $\frac{M}{7}$

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[PART - C : MATHEMATICS]

SECTION - I

Straight Single Choice Multiple Type Questions

This section contains 16 multiple choice questions numbered 61 to 76. Each question has 4 choices (1), (2), (3) and (4), out of which **ONLY ONE** is correct.

Choose the correct answer :

61. The number of common root(s) between the equations $x^3 + 2x^2 + 2x + 1 = 0$ and $1 + x^{130} + x^{1998} = 0$ is
 (1) Zero (2) One
 (3) Two (4) Three
62. If z satisfies the condition $|z^2 - 4| = 2|z|$, then the greatest value of $|z|$ is
 (1) $2 + \sqrt{5}$
 (2) $1 + \sqrt{5}$
 (3) $\sqrt{5} - 1$
 (4) $\sqrt{5} + 2$
63. If the complex number $\left(\frac{z_1}{z_2}\right)$ is a purely imaginary number, then the value of $\left|\frac{2z_1 + 3z_2}{2z_1 - 3z_2}\right|$ will be
 (1) 1
 (2) 2
 (3) 3
 (4) Dependent on $|z_1|$ and $|z_2|$
64. If z satisfies $|z - 3 - 4i| = 5$ and the maximum value of $|z - i|$ is $(a\sqrt{2} + b)$, then the value of b^a is equal to
 (1) 125 (2) 729
 (3) 1 (4) 32
65. The number of possible six digit numbers in which digits are in ascending order is
 (1) 48 (2) 84
 (3) 120 (4) 126
66. The coefficient of x^{53} in the expansion of $\sum_{j=0}^{100} {}^{100}C_j (x-3)^{100-j} 2^j$ is
 (1) ${}^{100}C_{47}$ (2) ${}^{100}C_{53}$
- (3) ${}^{-100}C_{53}$ (4) ${}^{-100}C_{100}$
67. The coefficient of x^{14} in the expansion of $(x+a)^4 (x+b)^5 (x+c)^6$ is $k_1 a + k_2 b + k_3 c$ where k_1, k_2, k_3 are constants, then the numerical value of $k_1 k_2 k_3$ will be
 (1) 120 (2) 64
 (3) 125 (4) 60
68. If the third term in the expansion of $(x + x^{\log_{10} x})^5$ is equal to 10^6 , then the value of x must be
 (1) 100 (2) $10^{-5/2}$
 (3) $10^{-3/2}$ (4) $10^{-1/2}$
69. The number of integral values of a for which the quadratic equation $(x-a)(x-10) - 1 = 0$ has integral roots is
 (1) Zero (2) One
 (3) Two (4) Infinitely many
70. The number of real roots of the equation $\frac{1}{x-1} + \frac{2}{x-2} + \frac{3}{x-3} = 1$ is
 (1) Zero (2) One
 (3) Two (4) Three
71. If $2a + 3b + 6c = 0$, then at least one root of the equation $ax^2 + bx + c = 0$ will lie in the interval
 (1) (1, 1.5) (2) (0, 1)
 (3) (1, 2) (4) (2, 3)
72. The number of positive odd integral solutions of the equation $x_1 + x_2 + x_3 + x_4 + x_5 = 25$, is
 (1) 1001 (2) 1003
 (3) 999 (4) 1005
73. There are five coplanar parallel lines. 4 points are marked on each of the lines. The maximum number of triangles with vertices at these points is
 (1) 1320 (2) 1020
 (3) 1120 (4) 1220
74. The number of ways in which 8 different balls can be put in two boxes of different sizes so that no box, remains empty is
 (1) 254
 (2) 252
 (3) 256

(4) 248

75. The equation formed by increasing each root of $2x^2 + 8x + 3 = 0$ by 3 is $2ax^2 + bx + c = 0$, then the value of $b^2 + c^2$ is equal to

- (1) $25a^2$
 (2) $12a^2$
 (3) $10a^2$
 (4) $30a^2$

76. The equations $7x^2 + 11x + 15 = 0$ and $ax^2 + bx + c = 0$ have a common root, then a, b, c are in

- (1) A.P.
 (2) G.P.
 (3) H.P.
 (4) A.G.P. with common ratio of G.P. greater than unity

SECTION - II

Assertion & Reasoning Type Questions

Directions : Questions number 77 to 81 are Assertion-Reason type questions. Each of these questions contains two statements. Statement-1 (Assertion) and Statement-2 (Reason). Each of these questions also has four alternative choices, only one of which is the correct answer. You have to select the correct choice.

77. Statement-1 : If z satisfies the relation $|z - z_1| + |z - z_2| = \text{constant}$, where z_1 and z_2 are two complex constants, then the locus of z will always be an ellipse.

and

Statement-2 : The sum of the distances of any point taken on the boundary of ellipse from its two foci is always constant, but the value of this constant is always greater than the distance between its foci.

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1
 (2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1
 (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

78. Statement-1 : The value of $(1 + 0.0001)^{10000}$ is less than 2.

and

Statement-2 : $2 \leq \left(1 + \frac{1}{n}\right)^n < 3, n \in N.$

- (1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for

Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

79. Statement-1 : If the quadratic equation $ax^2 + bx + c = 0$, has all of its roots imaginary (where $a, b, c \in R$ and $c > 0$), then the numerical value of $a + b + c$ will be positive.

and

Statement-2 : In quadratic equation $ax^2 + bx + c = 0$, the numerical value of $(a + b + c)$ is always positive.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

80. Statement-1 : The coefficient of x^3 in the expansion of $(1 - x + x^2)^5$ is -30 .

and

Statement-2 : In the expansion of $(1 - x + x^2)^5$, the coefficient of x^k is always equal to $10k$.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

(3) Statement-1 is True, Statement-2 is False

(4) Statement-1 is False, Statement-2 is True

81. Statement-1 : The value of ${}^{50}C_4 + \sum_{r=1}^6 {}^{56-r}C_3$ is ${}^{55}C_4$.

and

Statement-2 : ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r, r \geq 0, n > r, a$ natural number.

(1) Statement-1 is True, Statement-2 is True; Statement-2 is a correct explanation for Statement-1

(2) Statement-1 is True, Statement-2 is True; Statement-2 is **NOT** a correct explanation for Statement-1

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- (3) Statement-1 is True, Statement-2 is False
 (4) Statement-1 is False, Statement-2 is True

SECTION - III**Comprehension Type Questions**

Directions : Question No. 82 to 84 are based on the following paragraph.

In Gaussian plane, the distance between two complex numbers z_1 and z_2 is given by $|z_1 - z_2|$

82. If z satisfies the relation $|z + i| = |z - 2|$, then the locus of z will be

- (1) Circle
 (2) Straight line
 (3) Ellipse
 (4) Hyperbola

83. If z satisfies the relation

$$|z + 1|^2 + |z - 1|^2 = 1, \text{ then } z \text{ represents}$$

- (1) Ellipse (2) Circle
 (3) Pair of straight lines (4) No locus

84. The area of the region shaded by the complex number z if z satisfies the conditions

$$3 \leq |z - 2 + 3i| \leq 5 \text{ and } -\frac{\pi}{4} \leq \arg(z - 2 + 3i) \leq \frac{\pi}{4} \text{ will be}$$

- (1) 8π (2) 16π
 (3) 4π (4) 2π

SECTION - IV**Straight Objective Type Questions**

Directions : Question No. 85 to 90 are based on (Straight Single Choice - Multiple Concept Questions and/or Difficulty/Lengthy calculations & Application based questions)

85. If the roots of the equation $z^6 = 64$ are represented on the complex plane, then the area of the figure formed by joining these points will be

- (1) $6\sqrt{3}$ (2) $3\sqrt{3}$
 (3) $2\sqrt{3}$ (4) $4\sqrt{3}$

86. If $(1 + x)^{10} = a_0 + a_1x + a_2x^2 + \dots + a_{10}x^{10}$, then the numerical value of

$$(a_0 - a_2 + a_4 - a_6 + a_8 - a_{10})^2 + (a_1 - a_3 + a_5 - a_7 + a_9)^2 \text{ is equal to}$$

- (1) 3^{10} (2) 2^{10}
 (3) 2^9 (4) 3^9

87. If $\frac{1}{4-3i}$ is a root of the equation $ax^2 + bx + 1 = 0$, where a, b are real numbers, then $a + b$ is equal to

- (1) 17 (2) 33
 (3) 9 (4) -17

88. If the sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to the sum of the squares of

their reciprocals, then the value of $\frac{b^2}{ac} + \frac{bc}{a^2}$ is equal to

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

89. If the letters of the word 'SCHOOL' be arranged as in a dictionary, then the rank of the word 'SCHOOL' will be

- (1) 301 (2) 302
 (3) 303 (4) 304

90. Consider a 5×5 graph paper, the total number of right angled isosceles triangles whose vertices are integral points of this graph and whose sides forming right angle are parallel to x axis & y axis is

- (1) 110 (2) 333
 (3) 220 (4) 440

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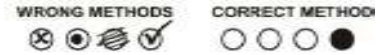
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INSTRUCTIONS FOR FILLING THE SHEET

1. Please fill the Question Paper Code in above Box.
2. This sheet should not be folded or crushed.
3. Use only blue/black ball point pen to fill the circles.
4. Use of pencil is strictly prohibited.
5. Circles should be darkened completely and properly.
6. Cutting and erasing on this sheet is not allowed.
7. Do not make any stray marks on the sheet.
8. Do not use marker or white fluid on the sheet.



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2.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	17.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	32.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	47.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	62.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	77.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	18.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	33.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	48.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	63.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	78.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	19.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	34.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	49.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	64.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	79.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
5.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	20.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	35.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	50.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	65.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	80.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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7.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	22.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	37.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	52.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	67.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	82.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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11.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	26.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	41.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	56.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	71.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	86.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	27.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	42.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	57.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	72.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	87.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
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15.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	30.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	45.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	60.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	75.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	90.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>