

JEE Main

CLASS XI

Physics : Physical World, Units and Measurements, Motion in a Straight Line, Motion in a Plane, Laws of Motion

Chemistry : Some Basic Concepts of Chemistry, Structure of Atom, Classification of Elements and Periodicity in Properties, Chemical Bonding and Molecular Structure

Mathematics : Sets, Relations and Functions, Trigonometric Functions, Principles of Mathematical Inductions

PART TEST - 1

Instructions:

- I. The JEE Main Chapterwise Test Paper consists of one paper containing 60 objective questions (four options with single correct answer) and 30 numerical value type questions from the above mentioned chapters of Physics, Chemistry and Mathematics.
- II. The duration of paper would be 3 hours (180 minutes).
- III. There will be total 90 questions : Physics - 30, Chemistry - 30, Mathematics - 30.
- IV. Each question will carry 4 marks. For each correct response the applicant will be awarded four marks. For each incorrect answer there will be deduction of one mark.
- V. There will be no negative marking for unattended questions. More than one answer of single question will also be considered as incorrect response and will be negatively marked.

Max. Marks : 300

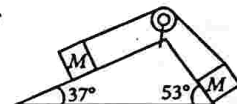
Time : 180 minutes

PHYSICS

Section-A (Multiple Choice Questions)

1. The equation of state of a gas is given by $\left(P + \frac{a}{V^3}\right)(V - b^2) = cT$, where P , V , T are pressure, volume and temperature respectively, and a , b , c are constants. The dimensions of a and b are respectively
(a) $[ML^8T^{-2}]$ and $[L^{3/2}]$ (b) $[ML^5T^{-2}]$ and $[L^3]$
(c) $[ML^5T^{-2}]$ and $[L^6]$ (d) $[ML^6T^{-2}]$ and $[L^{3/2}]$
2. A car moves a distance of 200 km. It covers first half of the distance at speed 60 km h^{-1} and the second half at speed v . If the average speed is 40 km h^{-1} , the value of v is
(a) 30 km h^{-1} (b) 13 km h^{-1}
(c) 60 km h^{-1} (d) 40 km h^{-1}
3. Resultant of two vectors \vec{A} and \vec{B} is of magnitude P . If \vec{B} is reversed, then resultant is of magnitude Q . What is the value of $(P^2 + Q^2)$?
(a) $2(A^2 + B^2)$ (b) $2(A^2 - B^2)$
(c) $A^2 - B^2$ (d) $A^2 + B^2$

4. The acceleration of system of two bodies over the wedge as shown in figure is



- (a) 1 m s^{-2} (b) 2 m s^{-2}
(c) 0.5 m s^{-2} (d) 10 m s^{-2}

5. The frequency of vibration f of a mass m suspended from a spring of spring constant k is given by relation of the type $f = cm^x k^y$, where c is a dimensionless constant. The values of x and y are
(a) $1/2, 1/2$ (b) $-1/2, -1/2$
(c) $1/2, -1/2$ (d) $-1/2, 1/2$
6. In the following equation, x , t and F represent respectively, displacement, time and force.

$$F = a + bt + \frac{1}{c + d \cdot x} + A \sin(\omega t + \phi)$$

The dimensional formula for $A \cdot d$ is

- (a) $[T^{-1}]$ (b) $[L^{-1}]$ (c) $[M^{-1}]$ (d) $[TL^{-1}]$

7. The position vector of a particle is $\vec{r} = (a \cos \omega t)\hat{i} + (a \sin \omega t)\hat{j}$. The velocity of the particle is

- (a) directed towards the origin
- (b) directed away from the origin
- (c) parallel to the position vector
- (d) perpendicular to the position vector.

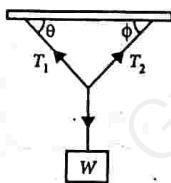
8. An object moving with a speed of 6.25 m s^{-1} is decelerated at a rate given by $\frac{dv}{dt} = -2.5\sqrt{v}$ where v is the instantaneous speed. The time taken by the object to come to rest would be

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

9. In an experiment, refractive index of glass was observed to be 1.45, 1.56, 1.54, 1.44, 1.54 and 1.53. The percentage error in reading is

- (a) $\pm 2.1\%$
- (b) $\pm 3.1\%$
- (c) $\pm 4\%$
- (d) $\pm 5\%$

10. A weight W hangs from a rope that is tied to two other ropes that are fastened to the ceiling as shown in figure. The upper ropes make angles θ and ϕ with the horizontal. Now, the values of T_1 and T_2 are

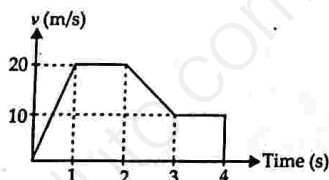


- (a) $\frac{W \sin \phi}{\sin(\theta + \phi)}, \frac{W \sin \theta}{\sin(\theta + \phi)}$
- (b) $\frac{W \sin \phi}{\cos(\theta + \phi)}, \frac{W \sin \theta}{\cos(\theta + \phi)}$
- (c) $\frac{W \cos \phi}{\sin(\theta + \phi)}, \frac{W \cos \theta}{\sin(\theta + \phi)}$
- (d) $\frac{W \cos \phi}{\tan(\theta + \phi)}, \frac{W \cos \theta}{\tan(\theta + \phi)}$

11. A body is moving in a circular path of radius 1 m and speed 1 m/s (anti-clockwise). Initially particle is at the 30° South of East. (Take centre as origin, x -axis along East and y -axis along North). The position vector at $t = \pi$ s is

- (a) $\frac{\sqrt{3}\hat{i} + \hat{j}}{2}$
- (b) $\frac{-\sqrt{3}\hat{i} + \hat{j}}{2}$
- (c) $\frac{\hat{j} - \sqrt{3}\hat{i}}{2}$
- (d) $\frac{\hat{i} - \sqrt{3}\hat{j}}{2}$

12. From the adjoining graph, the distance traversed by the particle in 4 s is

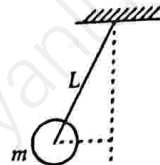


- (a) 60 m
- (b) 25 m
- (c) 55 m
- (d) 30 m

13. An aircraft is flying at a height of 3400 m above the ground. If the angle subtended at a ground observation point by the aircraft positions 10 s apart is 30° , then the speed of the aircraft is

- (a) 19.63 m s^{-1}
- (b) 1963 m s^{-1}
- (c) 108 m s^{-1}
- (d) 196.3 m s^{-1}

14. A ball of mass (m) 0.5 kg is attached to the end of a string having length $L = 0.5 \text{ m}$. The ball is rotated on a horizontal circular path about the vertical axis. The maximum tension that the string can bear is 324 N. The maximum possible value of angular velocity of ball (in radian/s) is

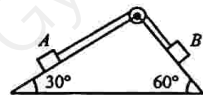


- (a) 9
- (b) 18
- (c) 27
- (d) 36

15. On a two-lane road, car A is travelling with a speed of 36 km h^{-1} . Two cars B and C approach car A in opposite directions, with a speed of 54 km h^{-1} . At a certain instant, when the distance of AB is equal to AC, both being 1 km, B decides to overtake A before C does. The minimum required acceleration of car B to avoid an accident is

- (a) 1 m/s^2
- (b) 1.5 m/s^2
- (c) 2 m/s^2
- (d) 3 m/s^2

16. Two blocks A and B of masses 10 kg and 12 kg respectively are kept on a rough wedge of inclination 30° and 60°



respectively. The coefficient of friction between the block A and wedge is 0.6 while that between B and the wedge is 0.3. The blocks are connected by a light inextensible thread. The wedge is fixed with respect to ground.

The acceleration of block A is

- (a) $\frac{(3\sqrt{3} - 6.8)g}{22}$, up the plane
- (b) $\frac{(3\sqrt{3} - 6.8)g}{22}$, down the plane
- (c) $\frac{(3\sqrt{3})}{22}g$, down the plane
- (d) Zero

17. The upper half of an inclined plane with inclination ϕ is perfectly smooth while the lower half is rough. A body starting from rest at the top will again come to rest at the bottom if the coefficient of friction for the lower half is given by

- (a) $2 \tan \phi$
- (b) $\tan \phi$
- (c) $2 \sin \phi$
- (d) $2 \cos \phi$

18. A police car moving on a highway at 30 km/h fires a bullet on a speeding car of thieves at 150 km/h . If the muzzle speed of bullet is 150 m/s , calculate the speed with which the bullet strikes the car of the thieves.

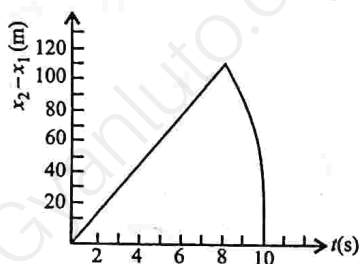
- (a) 95 m/s
- (b) 105 m/s
- (c) 117 m/s
- (d) 192 m/s

19. A train takes t s to perform a journey. It travels for $\left(\frac{t}{n}\right)$ s with uniform acceleration, then for $(n-3)\frac{t}{n}$

s with uniform speed v and finally it comes to rest with uniform retardation. The average of the speed of the train is

- (a) $(3n-2)\frac{v}{2n}$ (b) $(2n-3)\frac{v}{2n}$
 (c) $(3n-2)\frac{v}{3n}$ (d) $(2n-3)\frac{v}{3n}$

20. Two stones are thrown up simultaneously from the edge of a cliff 200 m high with initial speeds of 15 m s^{-1} and 30 m s^{-1} . Taking $g = 10\text{ m s}^{-2}$, the graph of relative position of the second stone with respect to the first has been shown. The equation of the curved part is



- (a) $100 + 15t - t^2$ (b) $200 + 30t - 5t^2$
 (c) $200 - 15t + 5t^2$ (d) $100 - 30t + 5t^2$

Section-B (Numerical Value Type)

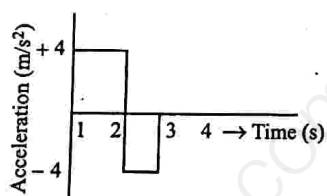
Attempt any 5 questions out of 10

21. A physical quantity P is related to four observables a, b, c, d as follows:

$$P = \frac{a^3 b^2}{\sqrt{c \cdot d}}$$

The percentage errors in the measurement of a, b, c and d are 1%, 3%, 4% and 2% respectively. The percentage error in the quantity P is _____.

22. A particle starts from rest at $t = 0$ and moves in a straight line with an acceleration as shown. The velocity (in m s^{-1}) of the particle at $t = 3\text{ s}$ is _____.



23. An aeroplane is flying horizontally with a velocity of 600 km/h at a height of 1960 m . When it is vertically above a point A on the ground a bomb is released from it. The bomb strikes the ground at point. The distance AB travelled by the bomb B (in km) is _____.
24. A tube of length L is filled completely with an incompressible liquid of mass M and closed at both ends. The tube is rotated in a horizontal plane about one of its ends with a uniform angular velocity ω . The

force exerted by the liquid at the other end is $nM\omega^2 L$. The value of n is _____.

25. A calorie is a unit of heat or energy and it equals about 4.2 J where $1\text{ J} = 1\text{ kg m}^2\text{ s}^{-2}$. Suppose we employ a system of units in which the unit of mass equals $\alpha\text{ kg}$, the unit of length equals $\beta\text{ m}$, the unit of time is $\gamma\text{ s}$, then the magnitude of calorie in the new units is $4.2\alpha^x \cdot \beta^y \cdot \gamma^z$. The value of z is _____.

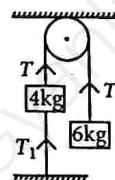
26. At the instant the traffic light turns green a car starts with a constant acceleration 2 m/s^2 . At the same instant a truck, travelling with a constant speed of 10 m/s , overtakes and passes the car. The distance (in m) beyond the starting point when the car overtakes truck is _____.

27. If the velocity of a body related to displacement x is given by $v = \sqrt{5000 + 24x}\text{ m/s}$, then the acceleration of the body is _____ m/s^2 .

28. A heavy uniform chain lies on horizontal table top. If the coefficient of friction between the chain and the table surface is 0.25 , then find the maximum fraction of the length of the chain that can hang over one edge of the table (in percentage) is _____.

29. A physical quantity P is related to four observables a, b, c and d as $P = \frac{a^2 b^3}{C\sqrt{d}}$, The percentage errors of measurement in a, b, c and d are 1%, 3%, 2% and 4% respectively. The percentage error in P is _____%.

30. Two blocks of mass 4 kg and 6 kg are attached to the ends of a string passing over a pulley. The 4 kg mass is attached to the table by another string. The tension in this string T_1 is _____ N .

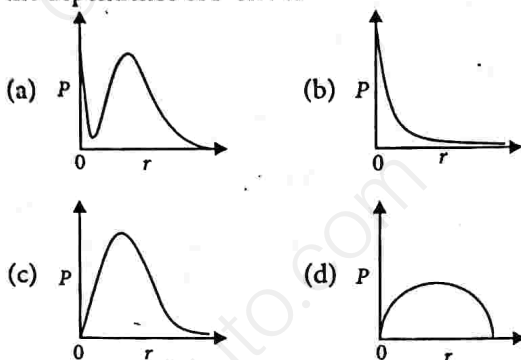


CHEMISTRY

Section-A (Multiple Choice Questions)

31. In the reaction,
 $2\text{Al}_{(s)} + 6\text{HCl}_{(aq)} \rightarrow 2\text{Al}^{3+}_{(aq)} + 6\text{Cl}^{-}_{(aq)} + 3\text{H}_{2(g)}$
- (a) 11.2 L of $\text{H}_{2(g)}$ at STP is produced for every mole of $\text{HCl}_{(aq)}$ consumed
- (b) 3 L of $\text{HCl}_{(aq)}$ is consumed for every 3 L of $\text{H}_{2(g)}$ produced
- (c) 33.6 L of $\text{H}_{2(g)}$ is produced regardless of temperature and pressure for every mole of Al that reacts
- (d) 67.2 L of $\text{H}_{2(g)}$ at STP is produced for every mole of Al that reacts.
32. P is the probability of finding the $1s$ electron of hydrogen atom in a spherical shell of infinitesimal thickness dr , at a distance r from the nucleus. The

volume of this shell is $4\pi r^2 dr$. The qualitative sketch of the dependence of P on r is

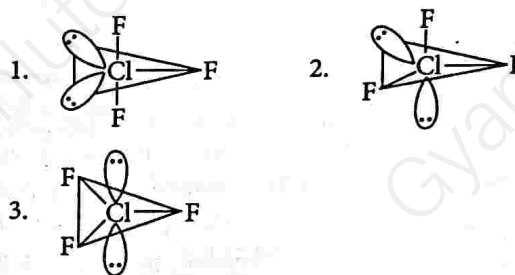


33. $A + 2B + 3C \rightleftharpoons AB_2C_3$
Reaction of 6.0 g of A, 6.0×10^{23} atoms of B, and 0.036 mol of C yields 4.8 g of compound AB_2C_3 . If the atomic mass of A and C are 60 and 80 amu, respectively, then atomic mass of B is (Avogadro no. = 6×10^{23})
(a) 70 amu (b) 60 amu
(c) 50 amu (d) 40 amu
34. The hybridisation of atomic orbitals of nitrogen in NO_2^+ , NO_3^- and NH_4^+ are
(a) sp , sp^3 and sp^2 respectively
(b) sp , sp^2 and sp^3 respectively
(c) sp^2 , sp and sp^3 respectively
(d) sp^2 , sp^3 and sp respectively.
35. The ions O^{2-} , F^- , Na^+ , Mg^{2+} and Al^{3+} are isoelectronic. Their ionic radii show
(a) a significant increase from O^{2-} to Al^{3+}
(b) a significant decrease from O^{2-} to Al^{3+}
(c) an increase from O^{2-} to F^- and then decrease from Na^+ to Al^{3+}
(d) a decrease from O^{2-} to F^- and then increase from Na^+ to Al^{3+} .
36. Energy of an electron in the ground state of the hydrogen atom is -2.18×10^{-18} J. The ionisation enthalpy of atomic hydrogen is
(a) 4.314×10^6 J mol $^{-1}$ (b) 2.52×10^{-6} J mol $^{-1}$
(c) 1.313×10^6 J mol $^{-1}$ (d) 2.33×10^5 J mol $^{-1}$
37. When 80 mL of 0.20 M HCl is mixed with 120 mL of 0.15 M KOH, the resulting solution is the same as a solution of
(a) 0.16 M KCl and 0.02 M HCl
(b) 0.08 M KCl and 0.08 M KOH
(c) 0.08 M KCl and 0.01 M KOH
(d) 0.08 M KCl and 0.01 M HCl.
38. Out of N_2O , SO_2 , I_3^+ , I_3^- , H_2O , NO_2^- , N_3^- , the linear species are
(a) NO_2^- , I_3^+ , H_2O (b) N_2O , I_3^+ , N_3^-
(c) N_2O , I_3^- , N_3^- (d) N_3^- , I_3^- , NO_2^-

39. An electron in a hydrogen like atom makes transition from a state in which its de-Broglie wavelength is λ_1 to a state where its de Broglie wavelength is λ_2 then wavelength of photon (λ) generated will be

(a) $\lambda = \lambda_1 - \lambda_2$ (b) $\lambda = \frac{4mc}{h} \left\{ \frac{\lambda_1^2 \lambda_2^2}{\lambda_1^2 - \lambda_2^2} \right\}$
(c) $\lambda = \sqrt{\frac{\lambda_1^2 \lambda_2^2}{\lambda_1^2 - \lambda_2^2}}$ (d) $\lambda = \frac{2mc}{h} \left\{ \frac{\lambda_1^2 \lambda_2^2}{\lambda_1^2 - \lambda_2^2} \right\}$

40. Which geometry of ClF_3 is more stable ?



- (a) All are equally stable (b) 1
(c) 3 (d) 2

41. Which of the following are isostructural pairs?

- A. SO_4^{2-} and CrO_4^{2-} B. $SiCl_4$ and $TiCl_4$
C. NH_3 and NO_3^- D. BCl_3 and $BrCl_3$
(a) C and D only (b) B and C only
(c) A and C only (d) A and B only

42. Photoelectric emission is observed from a metal surface with incident frequencies ν_1 and ν_2 , where $\nu_1 > \nu_2$. If the kinetic energies of the photoelectrons emitted in the two cases are in the ratio 2 : 1, then the threshold frequency ν_0 of the metal is

(a) $\nu_1 - \nu_2$ (b) $\frac{\nu_1 - \nu_2}{h}$
(c) $2\nu_1 - \nu_2$ (d) $2\nu_2 - \nu_1$

43. 12 g carbon combines with 64 g sulphur to form CS_2 . 12 g carbon also combines with 32 g oxygen to form CO_2 . 10 g sulphur combines with 10 g oxygen to form SO_2 . These data illustrate the

- (a) law of conservation of mass
(b) law of definite proportions
(c) law of reciprocal proportions
(d) law of gaseous volumes.

44. In an atom, an electron is moving with a speed of 600 m/s with an accuracy of 0.005%. Certainty with which the position of an electron can be located is ($h = 6.6 \times 10^{-34}$ kg m 2 s $^{-1}$; mass of electron,

$e_m = 9.1 \times 10^{-31}$ kg)
(a) 1.52×10^{-4} m (b) 5.10×10^{-3} m
(c) 1.92×10^{-3} m (d) 3.84×10^{-3} m

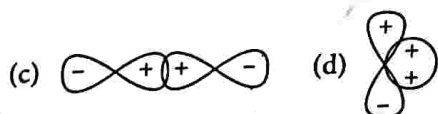
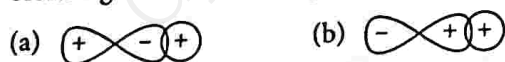
45. Consider the following sets of quantum numbers,

	n	l	m	s
(A)	3	0	0	+1/2
(B)	2	2	1	+1/2
(C)	4	3	-2	-1/2
(D)	1	0	-1	-1/2
(E)	3	2	3	+1/2

Which of the following sets of quantum numbers is not possible?

- (a) A, B, C and D (b) B, D and E
 (c) A and C (d) B, C and D
46. sp^3d^2 hybridisation is not displayed by
 (a) SF_6 (b) PF_5
 (c) $[CrF_6]^{3-}$ (d) BrF_5
47. A balanced equation for combustion of methane is given below: $CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$
 Which of the following statements is not correct on the basis of the above chemical equation?
 (a) One mole of CH_4 reacts with 2 moles of oxygen to give one mole of CO_2 and 2 moles of water.
 (b) One molecule of CH_4 reacts with 2 molecules of oxygen to give one molecule of CO_2 and 2 molecules of water.
 (c) 22.4 L of methane reacts with 44.8 L of oxygen to give 44.8 L of CO_2 and 22.4 L of water.
 (d) 16 g of methane reacts with 64 g of O_2 to give 44 g of CO_2 and 36 g of water.

48. In which of the following does the overlap of two orbitals give a non-bonding interaction?



49. Assertion : In the bonding molecular orbital of H_2 , electron density is increased between the nuclei.

Reason : The bonding molecular orbital is $\psi_A + \psi_B$, which shows destructive interference of the combining electron waves.

- (a) Assertion and reason are correct and reason is the correct explanation for the assertion.
 (b) Assertion and reason are correct but reason is not the correct explanation for the assertion.
 (c) Assertion is correct but reason is incorrect.
 (d) Assertion is incorrect but reason is correct.

50. Match the column-I with column-II and choose the correct option.

Column-I (Elements)		Column-II (Group numbers)	
(A)	An element whose fourth shell contains two p -electrons	(p)	8 th group
(B)	An element whose valence shell contains one unpaired p -electron	(q)	12 th group
(C)	An element which receives last electron in $(n-1)$ d -subshell	(r)	14 th group
(D)	An element with the ground state electronic configuration $[Ar]4s^23d^{10}$	(s)	17 th group

- A B C D
 (a) p q, r s q
 (b) r p, q q s
 (c) r s p, q q
 (d) q p p, s r

Section-B: (Numerical Value Type)

Attempt any 5 questions out of 10

51. The density of water and ethanol at room temperature are 1.0 g/mL and 0.789 g/mL respectively. Same number of molecules are present in 100 mL of water will be contained by ethanol at _____ mL of volume.
52. A 100 watt bulb emits monochromatic light of wavelength 400 nm. If the number of photons emitted by the bulb is $x \times 10^{20}$ per second, then approximate value of x is _____.
53. An element 'X' has its electronic configuration of 'K' shell is $(n-5)s^2$ and it has total number of electrons in its outermost, penultimate and anti-penultimate shell are 2, 8 and 25 respectively. Then the total number of unpaired electrons in element 'X' in its ground state is _____.
54. Consider the following molecules : $PCl_5, BrF_3, ICl_2, XeF_5, NO_3^-, XeO_2F_2, PCl_4^+, CH_3^+$
 The value of $\frac{a+b}{c}$ is _____.
 Where,
 a = No. of species having sp^3d hybridisation,
 b = No. of species which are planar,
 c = No. of species which are non-planar.
55. Weight of lime (CaO) that can be prepared by heating 100 kg of limestone ($CaCO_3$) of 95% purity is _____ kg.

56. The dissociation energy of H_2 is $430.53 \text{ kJ mol}^{-1}$. If hydrogen is dissociated by illumination with radiation of wavelength 253.7 nm , the percentage of the radiant energy which will be converted into kinetic energy approximately is _____ %.
57. Among the following, the total number of elements which have only single oxidation state (other than zero) in their corresponding stable compounds is _____. Cs, Ba, F, Zn, Be, Al, Sr, Tl, Pb.
58. If HCl is assumed to be completely polar then the expected value of dipole moment is 6.12 D but its experimental value is found to be 1.03 D . The percentage ionic character in HCl is approximately _____ %.
59. 10.30 mg of O_2 is dissolved into a litre of sea water of density 1.03 g/mL . The concentration of O_2 is _____ ppm.
60. In a collection of H-atom, all the electrons jump from $n = 5$ to ground level finally (directly or indirectly), without emitting any line in Balmer series. The number of possible different radiation is _____.

MATHEMATICS

Section-A (Multiple Choice Questions)

61. If $A = \{x : \cos x > -1/2, 0 \leq x \leq \pi\}$ and $B = \{x : \sin x > \frac{1}{\sqrt{2}}, \pi/3 \leq x \leq \pi\}$, then
- (a) $A \cap B = \left[\frac{-\pi}{3}, \frac{-2\pi}{3} \right]$ (b) $A \cap B = \left[\frac{\pi}{3}, \frac{2\pi}{3} \right]$
 (c) $A \cup B = \left[-\frac{5\pi}{6}, \frac{5\pi}{6} \right]$ (d) $A \cap B = \left[-\frac{\pi}{2}, \frac{\pi}{3} \right]$
62. By the principle of mathematical induction : $1 + 3 + 7 + 13 \dots$ upto n terms =
- (a) $\frac{n(n^2 + 2)}{3}$ (b) $\frac{n(n^2 - 1)}{3}$
 (c) $n(n^2 + 2)$ (d) None of these
63. If $A = \{(x, y) : x^2 + y^2 = 25; x, y \in \mathbb{R}\}$ and $B = \{(x, y) : x^2 + 16y^2 = 144; x, y \in \mathbb{R}\}$ then $A \cap B$ contains
- (a) one point (b) two points
 (c) three points (d) four points
64. If $\sin x - \cos x = a$, then
- (i) $\sin^4 x + \cos^4 x = \frac{1}{2}[2 - (1 - a^2)^2]$
 (ii) $|\sin x + \cos x| = \sqrt{2 - a^2}$
- Which of the following is correct?
- (a) Both (i) and (ii) (b) only (i)
 (c) only (ii) (d) Neither (i) nor (ii)

65. The function $f(x) = \frac{1}{\sqrt{(x^8 + 1)x(x^3 - 1) + 1}}$ is defined for
- (a) $x^8 \in (-\infty, -1)$ (b) $x \in (1, \infty)$
 (c) $x \in (-1, 1)$ (d) $x \in (-\infty, \infty)$
66. If $\theta = \frac{\pi}{4n}$, then value of $\tan \theta \tan 2\theta \dots \tan (2n - 1)\theta$ equals
- (a) -1 (b) 1 (c) 0 (d) 2
67. If $\theta_1, \theta_2, \theta_3, \theta_4$ are smallest positive angles in ascending order which have their sines equal to a positive number m , then $5 \sin \frac{\theta_1}{2} + 4 \sin \frac{\theta_2}{2} + 3 \sin \frac{\theta_3}{2} + 2 \sin \frac{\theta_4}{2} =$
- (a) $2\sqrt{m}$ (b) $2\sqrt{m + 2}$
 (c) $2\sqrt{1 - m}$ (d) $2\sqrt{1 + m}$
68. Domain of $f(x) = \log_2 \log_2 \log_2 \dots \log_2 x$ (n times) is
- (a) $(2^{n-1}, \infty)$ (b) $(2^n, \infty)$
 (c) $(2^{n+1}, \infty)$ (d) None of these

69. The solution of the system of equations $x + y = \frac{\pi}{2}$, $\sin x + \sin y = \sqrt{2}$ is $\{x, y\}$, then ($\forall k \in I$)
- (a) $x = 2k\pi + \frac{\pi}{4}, y = \frac{\pi}{4} - 2k\pi$
 (b) $x = 2k\pi - \frac{\pi}{2}, y = \frac{\pi}{2} + x$
 (c) $x = 2k\pi + \frac{\pi}{3}, y = \frac{\pi}{3} - 2k\pi$
 (d) $x = k\pi + \frac{\pi}{4}, y = \frac{\pi}{4} - k\pi$
70. If sets A and B are defined as $A = \{(x, y) : y = e^x, x \in \mathbb{R}\}$ and $B = \{(x, y) : y = \log_e x, x \in \mathbb{R}\}$, then
- (a) $B \subset A$ (b) $A \subset B$
 (c) $A \cap B = \phi$ (d) $A \cup B = A$
71. For positive integer m , $m^5 + 4m$ is always divisible by
- (a) 3 (b) 7 (c) 5 (d) 6
72. In triangle ABC , $\frac{\sin A + \sin B - \sin C}{\sin A + \sin B + \sin C}$ is equal to
- (a) $\tan \frac{A}{2} \cot \frac{B}{2}$ (b) $\cot \frac{A}{2} \tan \frac{B}{2}$
 (c) $\cot \frac{A}{2} \cot \frac{B}{2}$ (d) $\tan \frac{A}{2} \tan \frac{B}{2}$
73. Find the range of $f(x) = [x^2] - [x]^2, \forall 0 \leq x \leq 2$, where $[\cdot]$ denotes integral part function (greatest integer function).

- (a) {0, 4} (b) {0, 1, 2}
 (c) {1, 2} (d) {0, 1}

74. $\cos 12^\circ \cos 24^\circ \cos 36^\circ \cos 48^\circ \cos 72^\circ \cos 96^\circ$ equals

- (a) $-\frac{1}{2^6}$ (b) $\frac{1}{2^8}$ (c) $\frac{1}{2^7}$ (d) $-\frac{1}{2^7}$

75. On its annual sports day, a school awarded 35 medals in athletics, 15 in judo and 18 in swimming. If these medals goes to a total of 58 students and only three of them got medals in all the three sports. The number of students who received medals in exactly two of the three sports are

- (a) 9 (b) 4 (c) 5 (d) 7

76. If $U = \{x : x \in N \text{ and } 2 \leq x \leq 12\}$, $A = \{x : x \text{ is an even prime}\}$, $B = \{x : x \text{ is a factor of } 24\}$, then which of the following is not true?

- (a) $A - B$ is an empty set (b) $A - B = B \cap A'$
 (c) $A' - B' = B - A$ (d) $(A \cap B)' = A' \cup B'$

77. The range of the function $f(x) = \tan \sqrt{\frac{\pi^2}{9} - x^2}$ is

- (a) [0, 3] (b) $[0, \sqrt{3}]$
 (c) $[-3, \sqrt{3}]$ (d) $[\sqrt{3}, 3]$

78. There is a group of 265 persons who like either singing or dancing or painting. In this group 200 like singing, 110 like dancing and 55 like painting. If 60 persons like both singing and dancing, 30 like both singing and painting and 10 like all three activities, then the number of persons who like only dancing and painting is

- (a) 10 (b) 20 (c) 30 (d) 40

79. The equation $e^{\sin x} - e^{-\sin x} - 7 = 0$ has

- (a) one real root
 (b) two real roots
 (c) more than two real roots
 (d) no real roots

80. Consider the two sets : $A = \{m \in R : \text{both the roots of } x^2 - (m+1)x + m + 4 = 0 \text{ are real}\}$ and $B = [-3, 5]$.

Which of the following is not true?

- (a) $A - B = (-\infty, -3) \cup (5, \infty)$
 (b) $A \cap B = \{-3\}$
 (c) $B - A = (-3, 5)$
 (d) $A \cup B = R$

Section-B (Numerical Value Type)

Attempt any 5 questions out of 10

81. The number of values of x in $[0, 2\pi]$ such that $1 + \sin^4 2x = \cos^2 6x$, is _____.

82. Out of 800 boys in a school, 224 played cricket, 240 played hockey and 336 played basketball. Of the total, 64 played both basketball and hockey; 80 played cricket and basketball and 40 played cricket and hockey; 24 played all the three games. The number of boys who did not play any game is _____.

83. If $x = \frac{\sin^2 p}{\cos^2 p}$, $y = \frac{\cos^2 p}{\sin^2 p}$ and $\sin p - \cos p = \frac{1}{2}$ and if

the value of $x + y$ is $\frac{n}{9}$, then find n is _____.

84. Let Z denotes the set of all integers where

$A = \{(a, b) : a^2 + 3b^2 = 28, a, b \in Z\}$ and
 $B = \{(a, b) : a > b, a, b \in Z\}$, then the number of elements in $A \cap B$ is _____.

85. If $\sec x + \tan x = \frac{22}{7}$ and $\operatorname{cosec} x + \cot x = \frac{m}{n}$, where m and n are coprime positive integers, then the last digit of m is _____.

86. The greatest positive integer, which divides $(n+2)(n+3)(n+4)(n+5)(n+6)$ for all $n \in N$, is _____.

87. The period of the function $f(x) = (-1)^{[x]}$ where $[.] = \text{G.I.F}$ is _____.

88. Let $\theta = \frac{\pi}{2008}$ and N be the smallest integer n such that

$2 \sum_{r=1}^n \sin r\theta \cdot \cos r^2\theta$ is an integer. The sum of the digits of N is _____.

89. If n is a positive integer, then $5^{2n+2} - 24n - 25$ is divisible by _____.

90. If the range of $y = \frac{1}{2 + \sin 3x + \cos 3x}$ is

$y \in \left[\frac{1}{n+\sqrt{n}}, \frac{1}{n-\sqrt{n}} \right]$, then the value of n is _____.

SPACE FOR ROUGH WORK