TEST ID **00018403**

AIEEE

PART TEST - 1

[Time : 3 Hours] *[Max Marks : 432]*

☞ ***INSTRUCTIONS***

A. General :

(i) The Test Booklet consists of **90** questions**.** The maximum marks are **432.**

(ii) There are three sections in this paper consisting of Mathematics , Physics & Chemistry having 30 questions each.

Part A – CHEMISTRY (144 marks) –Question No. 1 to 24 consist **FOUR (4)** marks each and Question No. 25 to 30 consist **EIGHT (8)** marks each for each correct response.

Part B – MATHEMATICS (144 marks) – Question No. 31 to 32 and 39 to 60 consist **FOUR (4)** marks each and Question No. 33 to 38 consist **EIGHT (8)** marks each for each correct response.

Part C – PHYSICS (144 marks) – Questions No.61 to 84 consist **FOUR (4)** marks each and Question No. 85 to 90 consist **EIGHT (8)** marks each for each correct response

(iii) Candidates will be awarded marks as stated above in instruction No. (ii) for correct response of each question 1/4 (one fourth) 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.

(iv) Mark only one correct answer out of four alternatives.

(v) Use Blue/Black Ball Point Pen only for writing particulars/ or any marking.

(vi) Use of calculator is not allowed.

(vii) Darken the circles in the space provided only.

(viii) Use of white fluid or any other material which damages the answer sheet, is not permitted.

B. Filling the OMR SHEET :

Please read carefully the instructions printed on the OMR SHEET before marking your response.

PART A: CHEMISTRY

1. The molecular weight of haemoglobin is about 65,000 g/mol. Haemoglobin contains 0.35% Fe by mass. How many iron atoms are there in a haemoglobin molecule?

   (a) 1 (b) 2

   (c) 3 (d) 4

2. Gastric juice contains about 3.0g of HCl per litre. If a person produces about 2.5 litre of gastric juice per day, how many antacid tablets each containing 400 mg of $Al(OH)_3$ are needed to neutralise all the HCl produced in one day.

   (a) 10 (b) 14.8

   (c) 13.5 (d) 16

3. Two oxides of certain metal were separately heated in a current of hydrogen until constant weights were obtained. The water produced in each oxide was carefully collected and weighted. It was found that 1 g of each oxide gave 0.1254g and 0.2263 g of water respectively. The given data supports the law of

   (a) Reciprocal proportions

   (b) Multiple proportions

   (c) Conservation of mass

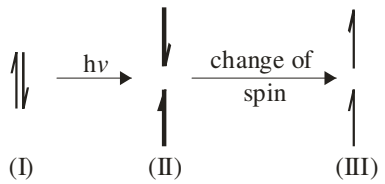
   (d) Law of gaseous volume

4. 'x' gram of $KClO_3$ is thermally decomposed at NTP giving as much oxygen, which is sufficient for combustion of 3.12 g of acetylene gas. What is the value of x? (Given molecular mass of $KClO_3$ = 122.5)

   (a) 12.25 g (b) 24.5 g

   (c) 49 g (d) 2.25 g

5. The spin multiplicity for the orbital electron is 2s + 1 where s is total electron spin. The spin multiplicity for stage (I), (II) and (III).



   are respectively

   (a) 1, 1, 1 (b) 1, 2, 3

   (c) 1, 1, 3 (d) 1, 3, 1

6. The wave number of the first line in the Balmer series of hydrogen atom is 15200 cm^{-1}. What is the wave number of the first line in the Balmer series of Be^{3+}?

   (a) $2.432 \times 10^5\ cm^{-1}$ (b) $15200\ cm^{-1}$

   (c) $4 \times 15200\ cm^{-1}$ (d) $2 \times 15200\ cm^{-1}$

7. A photon of 400 nm is absorbed by a gas and re-emits two photons. One re-emitted photon has wavelength 500 nm the other photon has wave length of

   (a) 2000Å (b) 200Å

   (c) 5000Å (d) 20000Å

8. If uncertainty in the measurements of position and velocity of electron are equal, then minimum uncertainty in its velocity will be

   (a) $\frac{1}{2m}\sqrt{\frac{h}{\pi}}$ (b) $\frac{1}{2}\sqrt{\frac{h}{\pi m}}$

   (c) $\sqrt{\frac{h}{2\pi m}}$ (d) $\frac{\sqrt{h}}{2\pi m}$

9. An electron diffraction experiment was performed with a beam of electrons accelerated by a potential difference of 10.0 KV. What is the wavelength of electron beam. (1 KV = 1000 eV for electrons).

   (a) 0.246Å (b) 1.23Å

   (c) 0.062Å (d) 0.123Å

10. Arrange in increasing order of O – O bond length in the following compounds O_2, $O_2[SbF_6]$, $Rb[O_2]$ using ground state configuration of dioxygen in these compounds.

    (a) $O_2\ [SbF_6] . < O_2 < Rb[O_2]$

    (b) $O_2 < Rb[O_2] < O_2\ [SbF_6]$

    (c) $O_2\ [SbF_6] . < Rb[O_2] < O_2$

    (d) $O_2 < O_2\ [SbF_6] < Rb[O_2]$

11. The bond order for CO^+ is,

(a) 3 (b) 2.5

(c) 3.5 (d) 2

12. Select correct statement(s).

(a) Acidic strength of HBr > HCl but reverse is true for their reducing property.

(b) Basic strength of PH_3 > AsH_3 but reverse is true for their bond angle.

(c) Dipole moment of CH_3Cl > CH_3F but reverse is true for their HCH bond angle.

(d) Ka_1 of fumaric acid is higher than maleic acid but reverse is true for their Ka_2.

13. The hybrid state of B-atom in boron-hydride is sp^2, while in its dimer it has sp^3 hybrid state because

(a) one of the empty orbitals of boron takes part in hybridisation

(b) overlapping between s and p-orbitals of H and B forms a p bond

(c) B_2H_6 is an electron rich compound

(d) B_2H_6 is less stable than BH_3

14. Arrange NO_2, NO_2^+ and NO_2^- in order of decreasing bond angle?

(a) $NO_2^+ > NO_2 > NO_2^-$

(b) $NO_2^- > NO_2^+ > NO_2$

(c) $NO_2^- > NO_2 > NO_2^+$

(d) $NO_2 > NO_2^- > NO_2^+$

15. A 4 : 1 molar mixture of He and CH_4 is contained in a vessel at 20 bar pressure. Due to a hole in the vessel the gas mixture leaks out. The composition of the mixture effusing out initially is

(a) 8 : 1 (b) 1 : 8

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

16. A vessel has nitrogen gas and water vapour at a total pressure of 1 atm. The partial pressure of water vapour is 0.3 atm. When the contents of this vessel are transformed to another vessel having one third of the capacity of original vessel, completely at the same temperature, the total pressure of the system in the new vessel is

(a) 3.0 atm (b) 1 atm

(c) 3.33 atm (d) 2.4 atm

17. The behaviour of a real gas is usually depicted by plotting compressibility factor Z versus P at a constant temperature. At high temperature and high pressure, Z is usually more than one. This fact can be explained by vander Waals equations when

(a) The constant a is negligible and not b.

(b) The constant b is negligible and not a.

(c) Both the constants a and b are negligible.

(d) Both the constant a and b are not negligible.

18. For two gases, A and B with molecular weights M_A and M_B, it is observed that at a certain temperature, T, the mean speed of A is equal to the root mean square speed of B. Thus the mean speed of A can be made equal to the mean speed of B, if

(a) A is at temperature T and B at T′, T > T′

(b) A is lowered to a temperature $T_2 = \frac{8}{3\pi}T$ while B is at T

(c) Both A and B are raised to a higher temperature

(d) Both A and B are placed at lower temperature

19. 4.00g of substance A, dissolved in 100g H_2O depressed the f.pt. of water by 0.1°C. While 4g of another substance B which is a binary electrolyte depressed the f.pt by 0.2°C. What is the relation between molecular weights of the two substances is

(a) $M_A = 4M_B$ (b) $M_A = M_B$

(c) $M_A = 0.5M_B$ (d) $M_A = 2M_B$

20. Which of the following statement is/are correct?

(a) Ionic hydrides have low melting points.

(b) Ionic hydrides have high melting points

(c) Ionic hydrides conduct electricity in the solid state

(d) Ionic hydrides are good conductors of electricity in the solid state

21. The first ionisation energy of Ar is less than that of Ne. An explanation of this fact is that

(a) The effective nuclear charge experienced by a valence electron in Ar is much smaller than in Ne.

(b) The effective nuclear charge experienced by a valence electron in Ar is much smaller than in Ne.

(c) The atomic radius of Ar is larger than that of Ne.

(d) The atomic radius of Ar is smaller

22. Which of the following sets of elements have almost same atomic radii.

(a) Fe, Co, Ni, Cu (b) He, Ne, Ar, Xe

(c) Be, Mg, Ca, Sr (d) Cl, Br, I

23. Which of the following has least Ionic radii

(a) N^{3-} (b) Mg^{2+}

(c) Na^{2+} (d) Al^{3+}

24. Select the correct statement from the following?

(a) Covalent hydrides are formed by s-block elements.

(b) The stability of covalent hydrides decreases in a period from left to right

(c) Co-valent hydrides have low melting and boiling points

(d) Co-valent compounds are good conductor of electricity.

25. Nitric acid can be produced from NH_3 in three steps process

(I) $4NH_3\ (g) + 5O_2\ (g) \longrightarrow 4NO\ (g) + 6H_2O\ (g)$

(II) $2NO\ (g) + O_2\ (g) \longrightarrow 2NO_2\ (g)$

(III) $3NO_2\ (g) + H_2O\ (l) \longrightarrow 2HNO_3\ (aq) + NO\ (g)$

% yield of Ist, IInd and IIIrd are respectively 50%, 60% and 80% respectively then what volume of $NH_3(g)$ at 1 atm and 0°C is required to produce 1575 g of HNO_3

(a) 156.25 (b) 350 L

(c) 3500 L (d) 35 L

26. A jar contains a gas and a few drops of water at TK temperature. The pressure in the jar is 830 mm of Hg. The temperature of the jar is reduced by 1%. The vapour pressures of water at two temperatures are 30 and 25 mm of Hg. Calculate the new pressure in jar

(a) 817 mm of Hg (b) 792 mm of Hg

(c) 830 mm of Hg (d) 724 mm of Hg

27. The energy of a I, II and III energy levels of a certain atom are E, $\frac{4E}{3}$ and 2E respectively. A photon of wavelength λ is emitted during a transition from III to I. What will be the wavelength of emission for transition II to I?

(a) $\frac{\lambda}{2}$ (b) λ

(c) 2λ (d) 3λ

28. 60g of urea is dissolved in 1100g solution. To keep $\Delta T/K_f$ as 1 mol/kg, water separated in the form of ice is:

(a) 40g (b) 60g

(c) 100g (d) 200g

29. Which of the following statement(s) is/are correct?

(I) The removal of one electron from $Na^+(g)$ ion requires more energy than that from $Mg^+(g)$

(II) The extent of hydration of Na^+ ion is more than that of K^+ ion.

(III) Ionic radii follows the order for three elements (X, Y, Z) of same period belonging to group 1, 2 and 3 (i.e. I A, II A and III A) in the periodic table is $X^+ > Y^{2+} > Z^{3+}$.

(IV) With the increasing electronegativity (which increases with increasing positive charge), the basic strength of any elemental oxide decreases.

(a) (I) and (II) are correct

(b) (I) and (III) are correct

(c) (I), (II) and (III) are correct

(d) (I), (II), (III) and (IV) are correct

30. The energy level of 4s–orbital is less than 3d–orbital because

(a) 4s–orbital is more near to nucleus than 3d–orbital.

(b) 4s–orbital penetrates more into the nucleus than 3d–orbital.

(c) 4s–orbital can have only two electrons whereas 3d can have 10 electrons

(d) 4s–orbital is spherical and 3d–orbital is double dumb bell.

PART B: MATHEMATICS

31. For what values of 'a' ; $a\cos\theta + 5\sin\theta \le 7$ for all real values of θ is satisfied

(a) $[-2\sqrt{6}, 2\sqrt{6}]$ (b) $[2\sqrt{6}, \infty)$

(c) $(-\infty, -2\sqrt{6}]$ (d) none of these

32. If $\sin\alpha\cos\beta = -\frac{1}{2}$ then for real values of α and β, the expression $\cos\alpha\sin\beta$ will lie in

(a) $\left[-\frac{1}{4}, \frac{1}{4}\right]$ (b) $\left[-\frac{1}{2}, \frac{1}{2}\right]$

(c) $\left[-\frac{1}{8}, \frac{1}{8}\right]$ (d) none of these

33. The number of right angled triangles having integral sides and hypotenuse 65 unit is

(a) Three (b) Two

(c) Four (d) Six

34. Let $0^o < \theta < 45^o$ and $t_1 = (\tan\theta)^{\tan\theta}$, $t_2 = (\tan\theta)^{\cot\theta}$, $t_3 = (\cot\theta)^{\tan\theta}$, and $t_4 = (\cot\theta)^{\cot\theta}$ then

(a) $t_1 > t_2 > t_3 > t_4$ (b) $t_2 < t_1 < t_3 < t_4$

(c) $t_1 > t_2 > t_4 > t_3$ (d) $t_1 < t_2 < t_4 < t_3$

35. The value of $\cos^4\frac{\pi}{24} - \sin^4\frac{\pi}{24}$ will be

(a) $\frac{\sqrt{2}+\sqrt{6}}{4}$ (b) $\frac{\sqrt{2}+\sqrt{6}}{3}$

(c) $\frac{\sqrt{2}-\sqrt{6}}{2}$ (d) none of these

36. An observer finds that the angular elevation of a tower is A, on advancing 3 m towards the tower the elevation is 45^o, and on advancing 2m nearer, the elevation is 90^o – A, the height of the tower is

(a) 1m (b) 6m

(c) 5m (d) 8m

37. In a triangle ABC; tan(A/2) = 5/6, tan(B/2) = $\frac{20}{37}$, then the sides a, b and c are in

(a) G.P. (b) H.P.

(c) A.P. (d) none of these

38. In a ΔABC, A – B = 120^o, and R = 8r then cosC will be

(a) $\frac{1}{8}$ (b) $\frac{3}{8}$

(c) $\frac{7}{8}$ (d) none of these

39. The value of $\sin10^o.\sin50^o.\sin70^o$ will be

(a) $\frac{1}{8}$ (b) $\frac{1}{4}$

(c) $\frac{1}{2}$ (d) none of these

40. If $(1 + \tan1^o) . (1 + \tan2^o) . (1 + \tan3^o) \ldots\ldots (1 + \tan44^o) = 2^n$, then n will be

(a) 44 (b) 22

(c) 11 (d) none of these

41. In a ΔABC, $\cos A = \cos B . \cos C$ then $\cot B . \cot C$ will be

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

(c) $\frac{\sqrt{3}}{2}$ (d) none of these

42. A solution (x, y) of $x^2 + 2x \sin xy + 1 = 0$ is

(a) (–1, 0) (b) (1, 0)

(c) $\left(1, \frac{3\pi}{2}\right)$ (d) $\left(-1, -\frac{3\pi}{2}\right)$

43. The least positive value of θ for which $\cos3\theta + \sin5\theta = 0$ is

(a) $\frac{3\pi}{4}$ (b) $\frac{3\pi}{16}$

(c) $\frac{3\pi}{8}$ (d) none of these

44. The number of positive values of $\tan(x/2)$ for which $3 \sin x + 4 \cos x = 5$ is

(a) 2 (b) 3

(c) 1 (d) none of these

45. The minimum positive value of 'α' for which $32 \tan^8\theta = 2 \cos^2\alpha - 3 \cos\alpha$ and $3 \cos2\theta = 1$ is

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

(c) $\frac{4\pi}{3}$ (d) none of these

46. The value of $\sum_{n=1}^{\infty} \tan^{-1}\left(\frac{1}{n^2 + n + 1}\right)$ is

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

(c) $\frac{\pi}{3}$ (d) none of these

47. In a ΔABC, $\cos^2A + \cos^2B + \cos^2C = 1$ then triangle ABC will be

(a) equilateral triangle

(b) right angled triangle

(c) sides of Δ are in A.P.

(d) none of these

48. The value of x for which $4 \sin^{-1}x + \cos^{-1}x = \pi$ will be

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

(c) $\frac{1}{2}$ (d) none of these

49. The value of

$$\tan^{-1}\left(\frac{1}{\sqrt{3}}\right) + \cos^{-1}\left(-\frac{\sqrt{3}}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$$

will be

(a) $-\frac{\pi}{6}$ (b) $\frac{5\pi}{6}$

(c) $\frac{\pi}{3}$ (d) none of these

50. The value of

$$\sin(2\tan^{-1}(1/3)) + \cos(\tan^{-1}2\sqrt{2}) \text{ is}$$

(a) $\frac{13}{15}$ (b) $\frac{11}{15}$

(c) $\frac{14}{15}$ (d) none of these

51. The summation of

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

$$\tan^{-1}\frac{1}{1+4(5)}+.....+\tan^{-1}\frac{1}{1+n(n+1)}$$

will be

(a) $\tan^{-1}\frac{n}{n+2}$ (b) $\tan^{-1}\frac{n}{n+1}$

(c) $\tan^{-1}\frac{n+1}{n+2}$ (d) $\tan^{-1}\frac{n-1}{n+2}$

52. Two angles of a triangle are $\sin^{-1}\left(\frac{1}{\sqrt{5}}\right)$ and $\sin^{-1}\left(\frac{1}{\sqrt{10}}\right)$, then third angle will be

(a) $\frac{\pi}{6}$ (b) $\frac{\pi}{4}$

(c) $\frac{\pi}{3}$ (d) $\frac{5\pi}{6}$

53. If in any triangle $r = r_1 - r_2 - r_3$, having as usual notations, then triangle will be

(a) isosceles (b) equilateral

(c) right angled (d) none of these

54. In a triangle, if the sum of two sides is x and their product is y such that $y = (x - z)(x + z)$, where z = third side, then triangle is

(a) Right angled (b) Obtuse angled

(c) Equilateral (d) None of these

55. The expression

$\sqrt{\sin^4\theta+4\cos^2\theta}-\sqrt{\cos^4\theta+4\sin^2\theta}$ for all real values of θ will be equal to

(a) $\cos\theta$ (b) $\cos2\theta$

(c) $\sin\theta$ (d) $\sin2\theta$

56. The expression $(4\cos^2 9^o - 3)(4\cos^2 27^o - 3)$ will be equal to

(a) $\cot 9^o$ (b) $\sin 9^o$

(c) $\cos 9^o$ (d) $\tan 9^o$

57. A tower subtends an angle α at a point A on the ground, and the angle of depression of its foot from a point B just above A and at a distance b from A is β. The height of the tower is

(a) $b\tan\alpha\cot\beta$ (b) $b\tan\alpha\tan\beta$

(c) $b\cot\alpha\cot\beta$ (d) $b\cot\alpha\tan\beta$

58. If $\tan^{-1}\frac{\sqrt{1+t^2}-\sqrt{1-t^2}}{\sqrt{1+t^2}+\sqrt{1-t^2}}=\theta$ then t^2 will be

(a) $\cos 2\theta$ (b) $\sin 2\theta$

(c) $\sin\theta$ (d) $\cos\theta$

59. In a ΔABC, $\frac{a}{b}=2+\sqrt{3}$ and $\angle C = 60^o$ then $\angle A$ will be

(a) 15^o (b) 105^o

(c) 75^o (d) none of these

60. The equation $3\sin^2 x + 10\cos x - 6 = 0$ is satisfied for $n \in I$, if

(a) $x = n\pi + \cos^{-1}(1/3)$

(b) $x = 2n\pi \pm \cos^{-1}(1/3)$

(c) $x = n\pi - \cos^{-1}(1/3)$

(d) none of these

PART C: PHYSICS

61. If the energy, $E = G^p h^q c^r$, where G is the universal gravitational constant, h is the Planck's constant and c is the velocity of light, then the values of p, q and r are, respectively

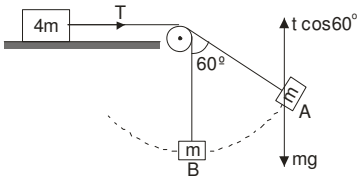
(a) $\frac{-1}{2}, \frac{1}{2}$ and $\frac{5}{2}$

(b) $\frac{1}{2}, \frac{-1}{2}$ and $\frac{-5}{2}$

(c) $\frac{-1}{2}, \frac{1}{2}$ and $\frac{3}{2}$

(d) $\frac{1}{2}, \frac{-1}{2}$ and $\frac{-3}{2}$

62. In the system shown in the figure the mass *m* moves in a circular arc of angular amplitude 60º and mass 4 m is stationary. Then choose the incorrect statement.



(a) the minimum value of coefficient of friction between the mass 4 m and the surface of the table is 0.25.

(b) the work done by gravitational force on the block *m* is positive when it moves from *A* to *B*.

(c) the power delivered by the tension when *m* moves from *A* to *B* is zero.

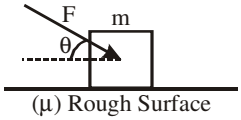
(d) the kinetic energy of *m* in position *B* equals the work done by gravitational force on the block when it moves from position *A* to position *B*.

63. One centimeter on the main scale of a vernier calipers is divided into 10 equal parts. If 10 divisions of vernier coincide with 8 small division of the main scale, the least count of calipers is

(a) 0.01 cm (b) 0.02 cm

(c) 0.05 cm (d) 0.005 cm.

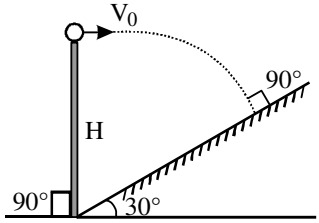
64. Find minimum value of the angle θ so that block of mass m does not move on rough surface. The coefficient of static friction between the block and surface whatever may be the value of applied force F.



(a) $\tan^{-1}(\mu)$ (b) $\frac{1}{2}\tan^{-1}(\mu)$

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

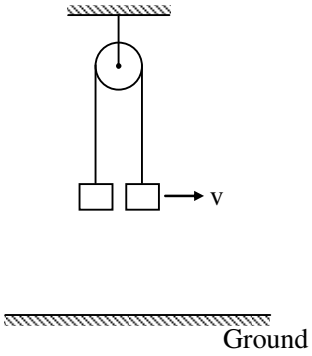
65. In the given figure, the angle of inclination of the inclined plane is 30°. Find the horizontal velocity V_0 so that the particle hits the inclined plane perpendicularly.



(a) $V_0 = \sqrt{\frac{2gH}{5}}$ (b) $V_0 = \sqrt{\frac{2gH}{7}}$

(c) $V_0 = \sqrt{\frac{gH}{5}}$ (d) $V_0 = \sqrt{\frac{gH}{7}}$

66. Two equal masses hang on either side of a pulley at the same height from the ground. The mass on the right is given a horizontal speed. After some time



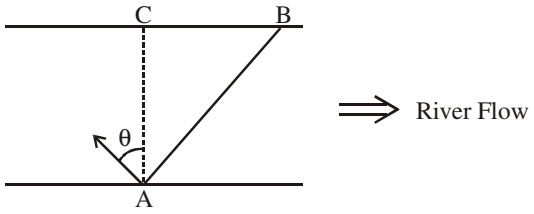
(a) The mass on the left will be nearer to ground

(b) The mass on the right will be nearer to ground

(c) Both the masses will be at equal distance from the ground.

(d) Nothing can be said regarding their positions.

67. Width of a river is 60 m. A swimmer wants to cross the river such that he reaches from A to B directly. Point B is 45 m ahead of line AC (perpendicular to river). Assume speed of river and speed of swimmer as equal. Swimmer must try to swim at angle θ with line AC. Value of θ is (assume that $\sin 37° = \frac{3}{5}$)



(a) 37º (b) 53º

(c) 30º (d) 16º

68. If retardation produced by air resistance to the projectile is one tenth of acceleration due to gravity, the time to return from the maximum height

(a) increases by 9%

(b) decreases by 9%

(c) increases by 11%

(d) decreases by 11%

69. The position of a particle moving along x–axis is given by $x = 3t^2 - t^3$ where x is in m and t is in s. consider the following statements :

(i) Displacement of the particle after 4 is 16 m.

(ii) Distance traveled by the particle upto 4 s is 24 m.

(iii) Displacement of the particle after 4 s is –16 m.

(iv) Distance covered by the particle upto 4 s is 22 m.

Select the correct alternative

(a) statements (i) and (ii) only are correct.

(b) statement (ii) and (iii) only are correct.

(c) statements (i) and (iii) only are correct.

(d) none of these

70. A rubber bead of mass 5 gm falls from a height of 100 cm and rebounds to half the height. The impulse imparted by floor is approximately

(a) 38 N-s (b) 3.8 N-s

(c) 0.038 N-s (d) 0.38 N-s

71. A bowler throws a ball horizontally along east direction with speed of 144 km/hr. The batsman hits the ball such that it deviates from its initial direction of motion by 74º north of east direction, without changing its speed. If mass of the ball is 1/3 kg and time of contact between bat and ball is 0.02 s. Average force applied by batsman on ball is

(a) 800 N, 53º East of North

(b) 800 N, 53º North of East

(c) 800 N, 53º North of West

(d) 800 N, 53º West of North.

72. A formula is given as

$$P = \frac{b}{a}\sqrt{1 + \frac{k.\theta.t^3}{m.a}}$$

where P = pressure

k = Boltzmann's constant;

θ = Temperature; t = Time

'a' and 'b' are constants. Dimensional formula of 'b' is same as

(a) Moment of inertia

(b) Linear momentum

(c) Angular momentum

(d) Torque.

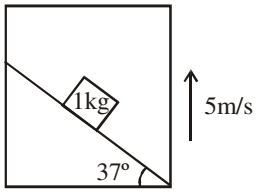
73. A block of 1 kg is kept on a rough surface of an elevator moving up with constant velocity of 5 m/s. In 10 seconds work done by normal reaction (the block does not slide on the inclined surface)

(i) from ground frame is 320 J

(ii) is equal to work done by friction force in elevator frame

(iii) is equal to work done by friction in ground frame

Of the three statements given above, the ones that are true is given by the choice



(a) (i) (b) (ii), (iii)

(c) (i), (ii) (d) only (iii)

74. Read the following statements

(i) 12300 has only 3 significant digits

(ii) 1.2300×10^4 has only 5 significant digits

(iii) 0.012300×10^6 has only 3 significant digits

(iv) all trailing zeroes are non significant digits

Correct statements are

(a) (i), (ii) (b) (iii), (iv)

(c) only (iv) (d) (i) and (iv).

75. A small spherical ball is suspended through a string of length l. The whole arrangement is placed in a vehicle which is moving with velocity v. Now suddenly the vehicle stops and ball starts moving along a circular path. If tension in the string at the highest point is twice the weight of the ball then

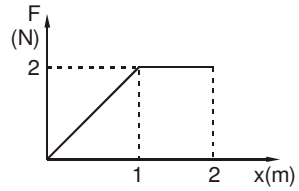
(a) $v = \sqrt{5gl}$

(b) $v = \sqrt{10gl}$

(c) velocity of the ball at highest point is $\sqrt{gl}$

(d) velocity of the ball at the highest point is $\sqrt{3gl}$

76. The force acting on a particle of mass 1 kg, starting from rest from the origin, is shown in the figure. The velocity of the particle at $x = 2$ m is



(a) $2\sqrt{2}$ m/s (b) $\sqrt{6}$ m/s

(c) 2 m/s (d) $\sqrt{3}$ m/s

77. Six particles are placed on the corners of a regular hexagon of side 4 m. Each starts from rest with a constant speed of 10 m/s such that direction of motion of each is always pointing towards the next in order. They finally converge. The distance covered by each particle before they converge is

(a) 4 m (b) 8 m

(b) 12 m (d) 16 m

78. Several particles are projected from a point in various direction but with same initial speed 'v_o'. At any subsequent time 't'.

(a) All of them lie on a paraboloid

(b) All of them lie on a sphere

(c) All of them lie in one plane

(d) All of them lie along a straight line

79. Two particles each of mass m are moving on x-axis and y-axis with velocities 4 m/s and 6m/s respectively. Velocity of their centre of mass is

(a) $\sqrt{13}\,m/s$ (b) $\sqrt{5}\,m/s$

(c) $\sqrt{52}\,m/s$ (d) $10\,m/s$

80. An elastic cord of elastic constant k and length L is hung from point A having a massless block at the other end. A smooth ring of mass M falls from point A, the maximum elongation of cord is

(a) $\frac{Mg}{k}\left[1+\sqrt{\frac{1+2kL}{Mg}}\right]$

(b) $\frac{Mg}{k}\sqrt{\left[1-\frac{2kL}{Mg}\right]}$

(c) $\frac{2Mg}{k}$

(d) $\frac{2Mg}{k}\sqrt{\left[1+\frac{2kL}{Mg}\right]}$

81. An athlete's coach told his team that muscle times speed equals power. What dimensions does he view for "muscle"?

(a) $ML\,T^2$ (b) $ML^2\,T^{-2}$

(c) $ML\,T^{-2}$ (d) L

82. Choose the wrong statement

(a) Zero velocity of a particle does not necessarily mean that its acceleration is zero.

(b) Zero acceleration of a particle does not necessarily mean that its velocity is zero.

(c) If speed of a particle is constant, its acceleration must be zero.

(d) none of these

83. You lift a suitcase from the floor and keep it on a table. The work done by you on the suitcase does not depend on

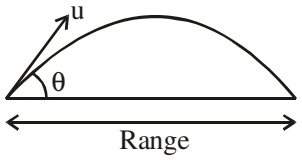
(a) the path taken by the suitcase

(b) the tame taken by you in doing so

(c) your weight

(d) all of these

84. A particle is projected in vertical plane from horizontal surface, with speed of projection u and angle of projection θ above the horizontal.



STATEMENT – 1

The horizontal range must be the farthest displacement of the particle from point of projection along the horizontal.

because

STATEMENT – 2

The projectile is farthest distance from the point of projection, when its instantaneous velocity vector and position vector (w.r.t. point of projection) are mutually perpendicular.

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

(b) Statement – 1 is True, Statement – 2 is True; Statement – 2 is NOT a correct explanation for Statement – 1.

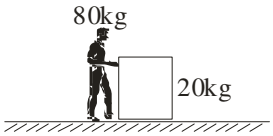
(c) Statement – 1 is True, Statement – 2 is False.

(d) Statement – 1 is False, Statement – 2 is True.

85. A man of mass 80 kg pushes a box of mass 20 kg horizontally. The man moves the box with a constant acceleration of 2 m/s^2 but his foot does not slip on the ground. There is no friction between the box and the ground, whereas there is sufficient friction between the man's foot and the ground to prevent him from slipping.

STATEMENT – 1

The force applied by the man on the box is equal and opposite to the force applied by the box on the man.



because

STATEMENT – 2

Friction force applied by the ground on the man is 200 N.

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

(b) Statement – 1 is True, Statement – 2 is True; Statement – 2 is NOT a correct explanation for Statement – 1.

(c) Statement – 1 is True, Statement – 2 is False.

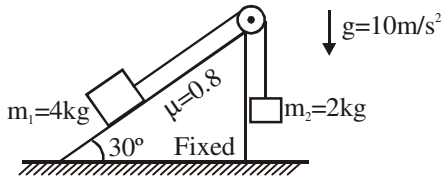
(d) Statement – 1 is False, Statement – 2 is True.

86. A body falling freely from a given height *H* hits an inclined plane in its path at a height *h*. As a result of this impact the direction of the velocity of the body becomes horizontal. Then the value of (*h*/*H*) the body will take maximum time to reach the ground is

(a) $\frac{1}{2}$ (b) $\frac{1}{8}$

(c) $\frac{3}{8}$ (d) $\frac{5}{12}$

87. Two blocks of masses m_1 and m_2 are connected through a massless inextensible string. Block of mass m_1 is placed at the fixed rigid inclined surface while the block of mass m_2 is hanging at the other end of the string, which is passing through a fixed massless frictionless pulley shown in figure. The coefficient of static friction between the block and the inclined plane is 0.8. The system of masses m_1 and m_2 is released from rest.



(a) the tension in the string is 20 N after releasing the system

(b) the contact force by the inclined surface on the block is along normal to the inclined surface

(c) the magnitude of contact force by the inclined surface on the block m_1 is $20\sqrt{3}$N

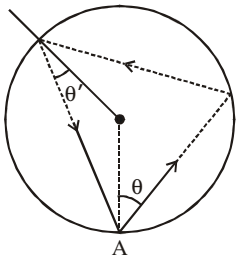
(d) All are correct

88. The potential energy of a particle is determined by the expression $U = \alpha (x^2 + y^2)$, where α is a positive constant. The particle begins to move from a point with the coordinates (3, 3) (m), only under the action of potential field force. Then its kinetic energy T at the instant when the particle is at a point with the coordinates (1, 1) (m) is

(a) 8 α (b) 24 α

(c) 16 α (d) zero

89. A smooth hoop lies on a smooth horizontal table and is fixed. A particle is projected on the table from a point A on the inner circumference of the hoop at angle θ with radius vector. If e be the coefficient of restitution and the particle returns to the point of projection after two successive impacts. The final angle θ' made by velocity vector with radius of hoop is



(a) $\tan\theta' = \frac{e^2}{(1+e^2)}\tan\theta$

(b) $\tan\theta' = e^2\tan\theta$

(c) $\tan\theta' = \frac{\tan\theta}{e^2}$

(d) $\tan\theta' = \frac{\tan\theta}{e}$

90. Choose the correct statement (s) of the following :

(a) force acting on a particle for equal time intervals can produce the same change in momentum but different change in kinetic energy

(b) force acting on a particle for equal time intervals can produce different change in momentum but same change in kinetic energy

(c) force acting on a particle for equal displacements can produce different change in kinetic energy but same change in momentum

(d) None of these