Physics

1. Evaluate $(999)^{1/3}$ upto four places of decimal.
2. Solve $(1001)^{1/3}$ upto six places of decimal.
3. Plot graph $y = x$
4. Plot graph $x^2 + y^2 = 9$
5. Integrate the following functions w.r.t.x and find within the limits x = 2 to 4.

   (i) x^3 (ii) $\sqrt{x}$
6. Define Newton's law of gravitation and write its properties.
7. Define 1 Astronomical Unit (AU) unit.
8. Write the S.I. units

   (i) Force (ii) Angle (iii) Linear Momentum (iv) Power
9. Calculate the angle of (a) 1^o (b) $1'$ (c) $1''$ in radian
10. Write the dimensional formula of

    (i) Speed (b) Universal constant of gravitation
11. Is it true that a body is at rest in a frame within which it has been fixed?
12. Under what condition can an object in motion be considered a point object?
13. A bullet fired vertically upwards falls at the same place after some time. What is the displacement of the bullet?
14. What is the nature of position-time graph for a uniform motion?
15. What does the slope of position-time graph indicate?
16. What is the nature of velocity-time graph for uniform motion?
17. Can a particle with zero acceleration speed up?
18. State the condition when the magnitude of velocity and speed of an object are equal.
19. What does the slope of velocity-time graph represent?
20. What does the area under vleocity-time graph represent?
21. Define the term inertia.
22. Define inertial mass of a body.
23. A piece of cork is floating on water. What is the net force acting on it?
24. What are the SI and CGS units of momentum?
25. Write the second law of motion in vector form.
26. Define limiting friction.
27. Write the relation between coefficient of friction and angle of friction?
28. Which is greatest out of static friction, limiting friction and kinetic friction?

29. Give an example of the use of friction.

30. Which of Newton's laws of motion is involved in rocket propulsion?

31. Define the following: (i) Light year (ii) Parsecond (iii) Astronomical unit.

32. What are the dimensional formulae of the following:

(a) Pressure (b) Power (c) Density (d) Angle

33. Define the following terms and write the SI units:

(a) Displacement, and (b) Instantaneous velocity.

34. Differentiate between average speed and instanteneous speed of an object.

35. Deduce the following relation : $v^2 - u^2 = 2as$, Where symbols have their usual meaning.

36. Show that the slope of displacement time graph is equal to the velocity of uniform motion.

37. A particle starts from origin with uniform acceleration. Its displacement after t seconds is given in metres by the relation $A = 5t^2 + 4t + 8$

Calculate the magnitude of its (i) initial velocity (ii) velocity at t = 4 s (iii) uniform acceleration (iv) displacement at t = 5 s.

38. What are dimensions of (i) Angle (ii) Stress

39. By the use of dimensions show that energy per unit volume is equal to the pressure.
40. Show that angular momentum has the same unit as the Planck's const. h. Given $E = h\upsilon$
41. Density ρ, acc. due to gravity g and frequency υ are the basic quantities. Find the dimension of force.
42. If force (F), length (L) and time (T) are choosen as fundamental quantities, then what would be the dimensional formula for density?
43. Find the dimensions of linear momentum and surface Tansion in terms of velocity υ, density ρ and frequency υ as the fundamental quantities.
44. In the expression $P = El^2m^{-5}G^{-2}$; E, m, l and G denote, energy, mass, angualr momentum and gravitational constatn resp. Show that P is a dimensionless quantity.
45. In given equaiton $\left(P + \frac{a}{v^2}\right)(v - b) = RT$. What are dimensions of a and b? Here P - Pressure, V - volume, T - temperature and R - gas constant.
46. Write the dimensions of a and b in the relation $P = \frac{b - x^2}{at}$; where P = power, x = distance, t = time.11.
47. Write the dimension of a/ b in the relations
$F = a\sqrt{x} + bt^2$, F - force, x - distance, t - time
48. Write the dimension of a, b, c, and d. Velocity is given by $v = a + bt + \frac{c}{d + t}$.
49. $V = a + bt + \frac{C}{d + t}$ Find dimensions of a/b , a.b.
50. $x = at^2 + bt^3$ - find dimensions of a and b
51. Convert one joule into erg. or Prove that 1 Joule = $10^7 ergs$.
52. Convert one dyne into newton. or Prove that 1 dyne = $10^{-5} N$
53. If the value of universal gravitational constant in SI is 6.6×10^{-11} $NM^2 Kg^{-2}$ then find its value in CGS system
54. The density of Hg is 13.6 g cm^{-3} in CGS system. Its SI value = ?
55. In SI units the value of stefans constant is $\sigma = 5.67 \times 10^{-8}$ J/s $m^{-2}K^{-4}$. Find its vlaue in CGS system.
56. If the units of force, energy and velocity are 20 N, 200 J and 5 ms^{-1}. Find the units of length, mass and time.
57. Obtain an expression for the centripetal force F acting on a partice of mass m moving with velocity υ in a circle of radius r. Take dimensionless constant K $E = Kmv^2r^2$

58. Check the correction of the formula.
$\upsilon^2 - u^2 = 2as$, where symbols have their usual meanings.
59. Check whether the following relation is correct or not.
$\frac{1}{2}m\upsilon^2 = mgh$
where m is mass, g = acc. due to gravity
h = height, υ = velocity.
60. Check the accuracy of the formula
$\upsilon = \frac{1}{2\pi}\sqrt{g/\ell}$
where υ = frequency
g = acc. due to gravity
ℓ = length
61. Check the accuracy of the formula $t = 2\pi\sqrt{\ell/g}$, where t is time period of simple pendulum, ℓ is length of pendulum, g is acc. due to gravity.
62. Check the correctness of the formula $F = \frac{m\upsilon^3}{r}$, where υ = velocity of the particle, m is mass of the particle, r is radius of the circular path, F is force.
63. The diameter of a wire as measured by a screw gauge was found to be 0.026 cm, 0.028 cm, 0.029m, 0.027 cm, 0.024 cm and 0.027 cm. Calculate
(i) mean value of diameter
(ii) mean absolute error
(iii) relative error
(iv) percentage error. Also express the result in terms of absolute error and percentage error.

64. If $A = (12.0 \pm 0.1)cm$ and $B = (8.5 \pm 0.5)cm$, find (i) A + B and (ii) A – B
65. The length and breadth of a rectangle are $5.7 \pm 0.1cm$, and $3.4 \pm 0.2cm$. Calculate area of the rectangle with error limits.
66. The voltage across a lamp is (6.0 $\pm$ 0.1) volt and the current passing through it is (4.0 $\pm$ 0.2) ampere. Find the power consumed.
67. Given that
$\vec{A} = A_x\hat{i} + A_y\hat{j} + A_z\hat{k}$
and $\vec{B} = B_x\hat{i} + B_y\hat{j} + B_z\hat{k}$.
Find $\vec{A} \times \vec{B}$.

68. Find the scalar and vector product of two vectors,
$\vec{a} = (3\hat{i} - 4\hat{j} + 5\hat{k})$ and $\vec{b} = (-2\hat{i} + \hat{j} + 3\hat{k})$

69. Find the work done in moving a particle along a vector $\vec{S} = (4\hat{i} - \hat{j} + 7\hat{k})$ if the applied force is $\vec{F} = (\hat{i} + 2\hat{j} - \hat{k})$ newton. $\vec{S}$ is in metre.

70. The angle between vectors $\vec{A}$ and $\vec{B}$ is 60°. What is the ratio of $\vec{A}\vec{B}$ and $|\vec{A} \times \vec{B}|$?

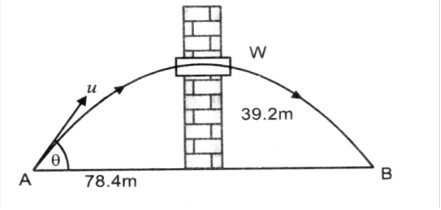
71. State parallelogram law of vector addition. Show that resultant of two vectors $\vec{A}$ and $\vec{B}$ inclined at an angle θ is
$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$

72. A man moving in rain holds his umbrella inclined to the vertical even though the rain drops are falling vertically

downwards. Why ?

73. Obtain expression for the area of a triangle in terms of the cross product of two vectors repre-senting the two sides of the triangle.
74. Show that two dimensional uniform velocity motion is equivalent to two one dimensional uniform velocity motion along two coordinate axes.
75. Define uniform acceleration. Show that in two- dimensional motion with uniform acceleration, each rectangular component of velocity is similar to that of uniformly accelerated motion along one dimension.
76. A boy stands at 78.4 m from a building and throws a ball which just enters a window 39.2 m above the ground. Calculate the velocity of projection of the ball.

FIGURE 2(d).20



77. A body is projected with a velocity of 40 ms^{-1}. After 2 s it just crosses a vertical pole of height 20.4 m. Find the angle of projection and horizontal range of projectile. ($g = 9.8\ ms^{-2}$).
78. From a point on the ground at a distance 15 m from the foot of a vertical wall, a ball is thrown at an angle of 45^o which just clears the top of the wall and afterwards strikes the ground at a distance 5 m on the other side. Find the height of the wall.
79. Can a particle accelerate if its speed is constant? Can it accelerate if its velocity is constant? Explain.
80. A ball is projected horizontally and at the same time another ball is dropped vertically from the top of a tower. (a) Will both the balls reach the ground at the same time? (b) Will both the balls strike the ground with same velocity?
81. A body of mass 5 kg is acted upon by two perpendicular forces of 8 N and 6 N. Give the magnitude and direction of the acceleration of the body.
82. A man weights 70 kg. He stands on a weighing machine in a lift, which is moving
(i) upwards with a nuiform speed of 10 ms^{-1}
(ii) downwards with a uniform acceleration of 5 ms^{-2}.
(iii) upowards with a uniform acceleration of 5 ms^{-2}.
83. A stream of water flowing horizontally with a speed of 15 ms^{-1} gushes out of a tube of cross-sectional area $10^{-2}\ m^2$, and hits at a vertical wall nearby. What is the force exerted on the wall by the impact of water, assuming it does not rebound?
84. A train runs along an unbanked circular track of radius 30 m at a speed of 54 kmh^{-1}. The mass of the train is 10^6 kg. Waht provides the centripetal force required for this purpose? The engine or the rails? The outer or the inner rail? Which rail will wear out faster, the outer or the inner rail? What is the angle of banking required to prevent wearing out of the rails?
85. Find the :
i) Path of projectile
ii) Time of flight
iii) Horizontal range
iv) Velocity of the object at any instant
When projectile given to horizontal projection
86. Find (i) Path of projectile (ii) Time of flight
(iii) Horizontal Range (iv) Velocity of object at any instant
87. Write the laws of limiting friction.
88. Define (i) Angle of contact (ii) Cofficient of friction.
89. Derive the expression for apperant weight of a man in lift when lift is moving in upper direction with acceleration $\vec{a}$.
90. What will be the acceleration of a body sliding down a rough inclined plane
91. What do you mean by motion in vertical circle and derive the expression for tension at highest and lowest point.
92. Derive an equation for the distance covered gby a uniformly accelerated body in nth second of its motion. A

body travels half its total path in the last second of its fall from rest, calculate the time of its fall.

93. Derive the following equations of motion for uniformly accelerated motion from velocity-time graph:

(a) $v = u + at$ (b) $s = ut + \frac{1}{2}at^2$ (c) $v^2 - u^2 = 2as$

94. Define relative velocity of one object w.r.t another object. Draw position-time graphs for two objects moving along a straight line; when their relative velocity is (i) zero and (ii) positive.

95. (a) Obtain an expression for the centripetal force required to make a body of mass m, moving with a velocity v around a circular path of radius r.
(b) Find an expression for velocity of recoil of gun.

96. What is meant by banking of roads? What is the need for banking a road? Obtain an expression for the maximum speed with which a vehicle can safely negotiate a curved road banked at an angle θ. The coefficient of friction between the wheels and the road is μ.

97. Derive an expression for velocity of a car on a banked circular road having coefficent of friction μ. Hence write the epxression for optimum velocity.

98. (a) Why are circular roads banked? Deduce an expression for the angle of banking.
(b) A 1000 kg car rounds a curve on a flat road of radius 50 m at a speed of 50 km h^{-1} (14 ms^{-1}). Will the car make the turn or will it skid if the coefficent of friction is 0.60? justify.

99. What are centripetal and centrifugal force? A body attached to a string of length l describes a vertical circle such that it is just able to cross the highest point. Find the minimum velocity at the bottom of the circle.

100. (1) A monkey of mass 40 kg climbs on a rope (figure) which can stand a maximum tension of 600 N. In which of the following cases will the rope break: the monkey

(a) climbs up with an acceleration of 6 m s^2

(b) climbs down with an acceleration of 6 m s^2

(c) climbs up with a uniform speed of 5 m s^{-1}

(d) falls down the rope nearly freely under gravity?

(Ignore the mass of the rope)

(2). The rear side a truck is open and a box of 40 kg mass is placed 5 m away from the open end as shown in figure. The coefficient of friction between the box and the surface below it is 0.15. On a straight road, the truck starts from rest and accelerates with 2 m s^{-2}. At what distance from the starting point does the box fall off the truck? (Ignore the size of the box)