

Section-A

Each question carries one mark (30 x 1 = 10 Marks)

1. One $\mu\text{m} = \underline{\hspace{1cm}}$ nm
 a) 0.001 b) 1000 c) 0.01 d) 100
2. How many nano seconds does it take light to travel 1.0 m in vacuum.
 a) 3.33 b) 0.33 c) 33.3 d) 333
3. The velocity (m/s) of the particle is given in terms of time (t) is given by the equation
 $V = at + \frac{b}{t+c}$. Using the principle of homogeneity, the dimensional formulas of a, b, c respectively are
 a) L^2, T, LT^{-2} b) LT^{-2}, LT, L c) LT^{-2}, L, T d) L, LT, T^2
4. The acceleration of a vertically projected body at the maximum height is
 (a) Zero (b) $>g$ (c) g (d) $<g$
5. Area under the v-t graph of straight line motion is
 a) Change in velocity b) Instantaneous acceleration
 c) Change in position d) none
6. A stone is dropped from the same height when another stone is thrown horizontally. They will hit the ground
 a) Simultaneously b) Depends on the observer
 c) One after the other d) None
7. A motor cycle driver triples its velocity when he is taking a turn. The centripetal acceleration will be
 a) 4 times b) 9 times c) 1/4 times d) 1/9 times
8. The SI unit of measuring the change in momentum of a moving body is
 a) N.s b) kg.m/s c) both a&b d) $\text{N m}^2/\text{kg}^2$
9. Momentum is conserved
 a) in an elastic collision of two balls b) in an inelastic collision of two balls
 c) in the absence of an external force d) in all of the above cases
10. The combination of rotational motion and the translational motion of a rigid body is known as _____
 a) Frictional motion b) Axis motion
 c) Angular motion d) Rolling motion
11. A stone is thrown vertically upward with a speed 10 m/s from a tower of 75m. Find the time taken by the stone to reach the ground and speed of the stone when it hits the ground.
 A) 5 s, 30 m/s b) 5s, 35 m/s c) 5s, 25 m/s d) 5s, 40 m/s
12. A vector \vec{A} has magnitude of 30 units and makes 30° with +X axis in counter clockwise direction and vector \vec{B} has magnitude of $10\sqrt{2}$ units and makes 45° with negative X axis in clockwise direction. If $\vec{R} = \vec{A} + \vec{B}$. Find the magnitude of \vec{R} an angle made by \vec{R} with +X axis
 a) 30 units , 32.6 degrees b) 25 units , 32.6 degrees
 c) 30 units , 57.4 degrees d) 30 units , 45 degrees
13. The resistance $R = V/I$ where $V = (200 \pm 5)$ V and $I = (16 \pm 0.4)$ A. Find the percentage error in R
 a) 4% b) 5% c) 7% d) 6%

14. A circular racetrack of radius 200 m is banked at an angle of 10° . What is the optimum speed of the race car to avoid wear and tear on its tyres?
 (a) 18.59 m/s (b) 20.25 m/s (c) 19.15 m/s (d) 17.12 m/s
15. 3000 liters of water is to be filled in a tank at a height of 20 m. If the time taken by a motor to fill the water is 50 minute find the power of the motor (density of water = 1000 kg/m^3)
 (a) 150 W (b) 126 W (c) 165 W (d) 196 W
16. Which of the following set of quantities have the same Dimensional formula?
 P. Force and Energy R. Impulse and momentum
 Q. Work and Energy S. Distance and displacement
 Now choose from the following
 a) Only P b) P, Q and R c) Q, R and S d) Both P and S.
17. A block of mass 5 kg initially at rest at the origin is acted on by a force along the positive X-direction represented by $F = (20 + 5x) \text{ N}$. calculate the work done by the force during the displacement of the block from $x=0$ to $x=4 \text{ m}$.
 a) 100 J b) 120 J c) 80 J d) 60 J
18. Which of the following statements are correct for system of particles?
 P. In translational motion linear velocity is same.
 Q. In rotational motion angular velocity is same.
 R. Rolling motion means rotation about a fixed axis
 S. Internal forces do effect the motion of center of mass
 Now choose from the following
 a) P, Q b) P, R c) P, S d) Q, R
19. When the projectile is at the highest point of its trajectory, the direction of its velocity and acceleration are
 a) Parallel to each other b) anti parallel to each other
 c) Perpendicular to each other d) Inclined to each other at 45°
20. What is the mass of a cart that has an acceleration of 5 ms^{-2} when a net force of 2000 N is applied to it?
 a. 10,000 kg b. 2000 kg
 c. 1000 kg d. 400 kg
21. Which of the following groups are vector quantities?
 a) Velocity, displacement, energy c) Momentum, displacement, weight
 b) Momentum, work, acceleration d) Momentum, force, power
22. A block of mass 2 kg rests on a rough inclined plane making an angle of 30° with the horizontal. The coefficient of static friction between the block and the plane is 0.7. The frictional force on the block is
 (a) 9.8 N (b) $0.7 \times 9.8 \times \sqrt{3} \text{ N}$
 (c) $9.8 \times \sqrt{3} \text{ N}$ (d) $0.7 \times 9.8 \text{ N}$
23. The horizontal and vertical displacement of the projectile at time t are $x=36t$, $y=48t-4.9t^2$ where x and y are in meters and t in second. Initial velocity of the projectile in ms^{-1}
 a) 60 ms^{-1} b) 30 ms^{-1}
 c) 90 ms^{-1} d) 100 m/s
24. The work done by the centripetal force for a body moving in a circular path
 a) Negative b) Positive
 c) Zero d) none of these
25. A body of mass 100 kg falls from a height of 10 m. Its increase in kinetic energy is
 a) 9800 J b) 1000 J
 c) 5000 J d) 3000 J
26. No work is done if
 a) Force and displacement are perpendicular b) Displacement is zero
 c) Force is zero d) All of the these
27. A body starts from rest and travels for t second with uniform acceleration of 2 m/s^2 . If the displacement made by it is 16 m, the time of travel t is

- a) 3 s
c) 5s
b) 4s
d) 6s
28. If for two vectors A and B, $A \cdot B = 0$ (dot product) the vectors
a) are parallel to each other
b) act at an angle of 60
c) are perpendicular to each other
d) act at an angle of 30 degrees
29. A 6 kg object is subject to three forces $F_1 = 20i + 30j$ N, $F_2 = 8i - 50j$ N and $F_3 = 2i + 2j$ N. Find the acceleration of object
a) $5i + 3j$
b) $5i - 3j$
c) $3i + 5j$
d) $3i - 5j$
30. Shape of the x-t curve for accelerated motion of a particle is?
a) Straight line parallel to time axis
b) Straight line having positive slope
c) Parabola
d) Straight line parallel to position axis

Section-B

Attempt any of the three following (3 x 10M =30 Marks)

- 1a) Count the significant figures from the following numbers (5M)
i) 7.095 ii) 0.0060 iii) 2.70×10^2 iv) 5.55505 v) 9400
- b) A physical quantity X related to four measurable quantities a,b,c and d as follows
 $X = a^4 b^{-2} c^{3/2} d^{-1}$. The percentage error in the measurement of a,b,c and d are 1%,3%,2% and 4 % respectively.
What is the percentage error in X. (5M)
- 2 a) Derive kinematic equations for uniformly accelerated motion. (5M)
- b) A bullet with a speed of 360 kmh^{-1} strikes a tree and penetrates 5.0 cm before stopping .What is the magnitude of its retardation. (5M)
- 3a) Show that the path of the projectile is parabola. Obtain expression for the range of the projectile. (5M)
- b) An object is launched from a cliff 20 m above the ground at an an angle of 30° above the horizontal with a speed of 30 ms^{-1} .How far horizontally does the object travel before landing on the ground.($g=10 \text{ ms}^{-2}$) (5M)
- 4 a) Discuss the types of friction and write the expressions of these frictional forces. (5M)
- b) What is the acceleration of the block and trolley system as shown in below figure, If the coefficient of kinetic friction between the trolley and surface is 0.05? What is tension the string?(Take $g=10 \text{ ms}^{-2}$ and neglect the mass of the string) (5M)

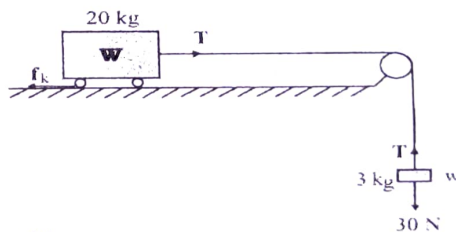


Figure 4(b)

- 5a) Derive an expression for maximum velocity on a banked road. (5M)
- b) A ball is freely dropped from the certain height h_1 it collides the floor with speed 10 ms^{-1} and rebounds to height of h_2 is 4m. Calculate the coefficient of restitution. (5M)
- 6a) State and prove Work energy theorem. (5M)
- b) To simulate the car accidents, auto manufacturers study the collisions of moving cars with mounted springs of different spring constants. Consider a typical simulation with a car of mass 800 kg moving with a speed 18.0 km/h on a smooth road and colliding with a horizontally mounted spring of the spring constant $1.11 \times 10^3 \text{ Nm}^{-1}$.What is the maximum compression of the spring? (5M)