PHYSICS

NCERT - FULL MARKS PHYSICS(TAMIL)

APPENDIX 1

Solved Example Unit 1

1. Find the dimensions of a and b in the formula $\left[P+\frac{a}{V^2}\right][V-b]=RT$ where P is pressure and V is the volume of the gas

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2. Show that $\left(P^{-5/6}\rho^{1/2}E^{1/3}\right)$ is of the dimension of time. Here P is the pressure, ρ is the density and E is the energy of a bubble)

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3. Find the dimensions of mass in terms of Energy, length and time

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4. A physical quantity Q is found to depend on quantities x,y,z obeying relation $Q = \frac{x^2 y^3}{z^1}$. The percentage errors in x, y and z are 2%, 3% and 1% respectively. Find the percentage error in

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5. The mass and volume of a body are found to be $4 \pm 0.3kg$ and $5 \pm .01m^3$ respectively.

Th en fi nd the maximum possible percentage error in density

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6. Using a Vernier Callipers, the length of a cylinder in diff erent measurements is found to be 2.36 cm, 2.27 cm, 2.26 cm, 2.28 cm, 2.31 cm, 2.28 cm and 2.29 cm. Find the mean value, absolute error, the relative error and the percentage error of the cylinder.

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7. The shadow of a pole standing on a level ground is found to be 45 m longer when the sun's altitude is 30° than when it was 60°. Determine the height of the pole. [Given $\sqrt{3} = 1.73$]

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8. Calculate the number of times a human heart beats in the life of 100 years old man. Time of one heart beat= 0.8s

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9. The parallax of a heavenly body measured from two points diametrically opposite on equator of earth is 2'. Calculate the distance of the heavenly body. [Given radius of the earth = 6400km] $\left[1^n = 4.85 \times 10^{-6} \text{rad}\right]$

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10. Convert a velocity of $72kmh^{-1}$ into ms^{-1} with the help of dimensional analysis.

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11. Check the correctness of the following equation using dimensional analysis. Make a comment on it. $S = ut + 1/4at^2$ where s is the displacement, u is the initial velocity, t is the time and a is the acceleration produced.

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12. Round - off the following numbers as indicated.

17.234 to 3 digits

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13. Round - off the following numbers as indicated.

3.996×10^5 to 3 digits

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14. Round - off the following numbers as indicated.

3.6925×10^{-3} to 2 digits

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15. Round - off the following numbers as indicated.

124783 to 5 digits

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16. Solve the following with regard to significant figures.

$\sqrt{4.5 - 3.31}$

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17. Solve the following with regard to significant figures.

$5.9 \times 10^5 - 2.3 \times 10^4$

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18. Solve the following with regard to significant figures.

7.18×4.3

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19. Solve the following with regard to significant figures.

6.5×0.136

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20. Arrive at Einstein's mass-energy relation by dimensional method $\left(E = mc^2\right)$

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21. The velocity of a body is given by the equation $v = b/t + ct^2 + dt^3$. Find the dimensional formula for b.

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22. The initial and final temperatures of a liquid in a container are observed to be $75.4 \pm 0.5^{\circ} C$ and $56.8 \pm 0.2^{\circ} C$. Find the fall in the temperature of the liquid.

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23. Two resistors of resistances $R_1 = 150 \pm 2\text{Ohm}$ and $R_2 = 220 \pm 6$ Ohm are connected in parallel combination. Calculate the equivalent resistance.

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24. A capacitor of capacitance C = $3.0 \pm 0.1 \mu F$ is charged to a voltage of $V = 18 \pm 0.4$ Volt. Calculate the charge Q(Use Q= CV)

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Solved Example Unit 2

1. Th e position vector for a particle is represented be $\overrightarrow{r} = 3t^2\hat{i} + 5t\hat{j} + 6\hat{k}$, find the

velocity and speed of the particle at t = 3 sec?

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2. A gun is fired from a place which is at distance 1.2 km from a hill. The echo of the sound is heard back at the same place of firing after 8 second. Find the speed of sound.

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3. A train 100 m long is moving with a speed of $60kmh^{-1}$. In how many seconds will it cross a bridge of 1 km long?

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4. Draw the resultant direction of the two unit vectors $\hat{i}+$ and $\hat{j}$. Use a 2-dimensional Cartesian co-ordinate system. Is $\hat{i}+\hat{j}$ a unit vector ?

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5. A swimmer moves across the Cauvery river of 750 m wide. The velocity of the swimmer relative to water $\left(\overrightarrow{v}_{sw}\right)$ is $1.5ms^{-1}$ and directed perpendicular to the water current. The velocity of water relative to the bank $\left(\overrightarrow{v}_{wb}\right)$ is $1ms^{-1}$. Calculate the velocity of the swimmer with respect to the bank of the river $\left(\overrightarrow{v}_{sb}\right)$.

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6. A swimmer moves across the Cauvery river of 750 m wide. The velocity of the swimmer relative to water $\left(\overrightarrow{v}_{sw}\right)$ is $1.5ms^{-1}$ and directed perpendicular to the water current. The velocity of water relative to the bank $\left(\overrightarrow{v}_{wb}\right)$ is $1ms^{-1}$. Calculate the time taken by the swimmer to cross the Cauvery river.

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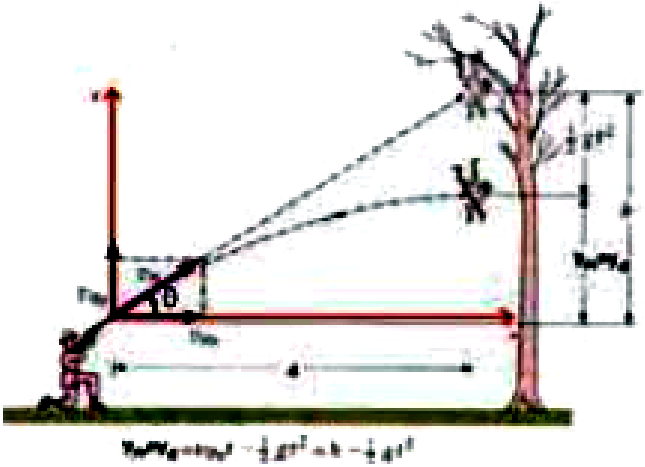
7. A monkey hangs on a tree. A hunter aims a gun at the monkey and fires the bullet with velocity v_0 which makes angle α_0 with horizontal direction. At the instant gun fires, monkey leaves the branch and falls straight down to escape from the bullet as shown in the figure. Will bullet hit the monkey or will the monkey escape the bullet? (ignore air

resistance)



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8. A three storey building of height 100m is located on Earth and a similar building is also located on Moon. If two people jump from the top of these buildings on Earth and Moon

simultaneously, when will they reach the ground and at what speed? $\left(g = 10ms^{-2}\right)$

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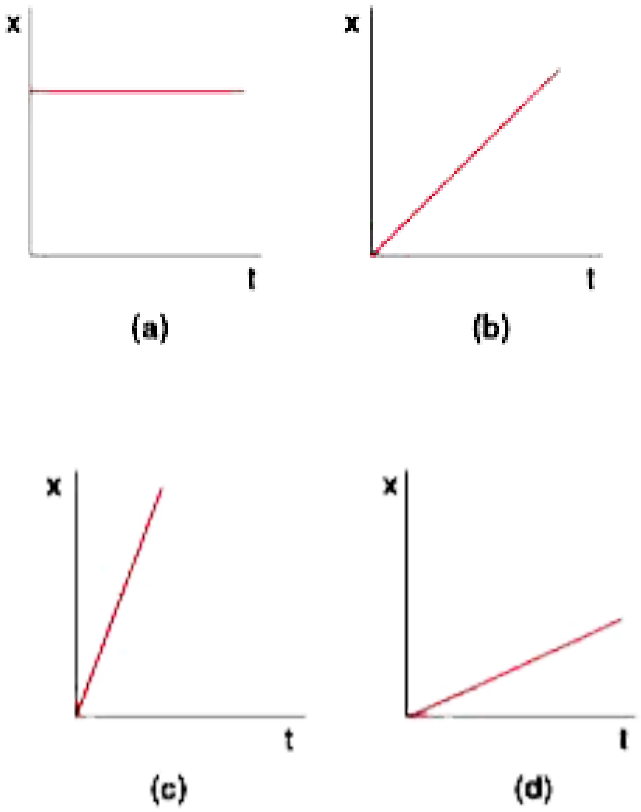
9. The following graphs represent position – time graphs. Arrange the graphs in ascending order of increasing speed



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Solved Example Unit 3

1. A body of mass 100 kg is moving with an acceleration of $50 cm s^{-2}$. Calculate the force experienced by it.

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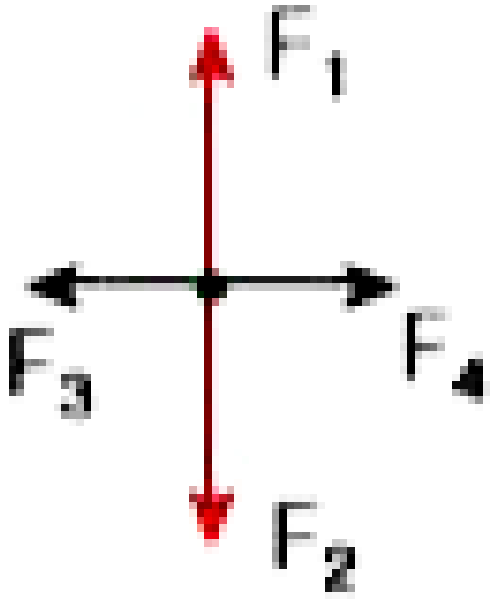
2. Identify the free body diagram that represents the particle accelerating in positive x direction in the following. The relative magnitude of forces should be indicated when

the free body diagram for mass m is drawn.



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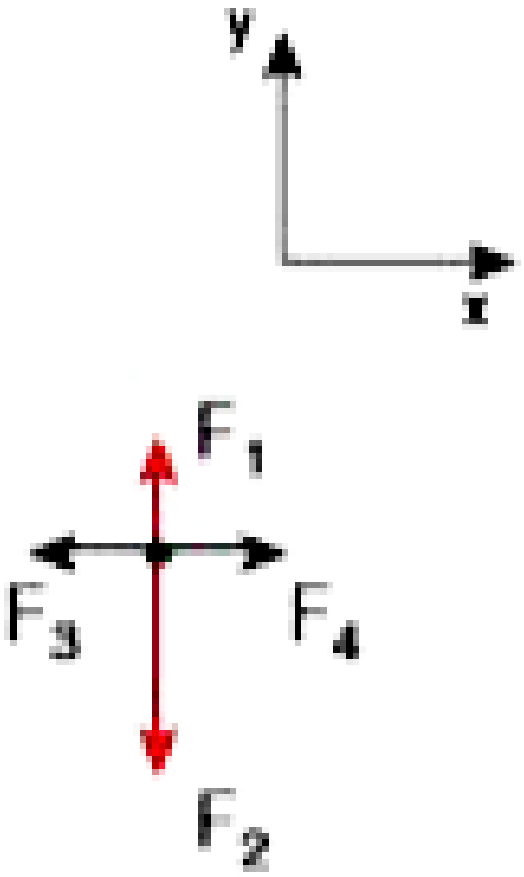
3. Identify the free body diagram that represents the particle accelerating in positive

x direction in the following. The relative magnitude of forces should be indicated when the free body diagram for mass m is drawn.



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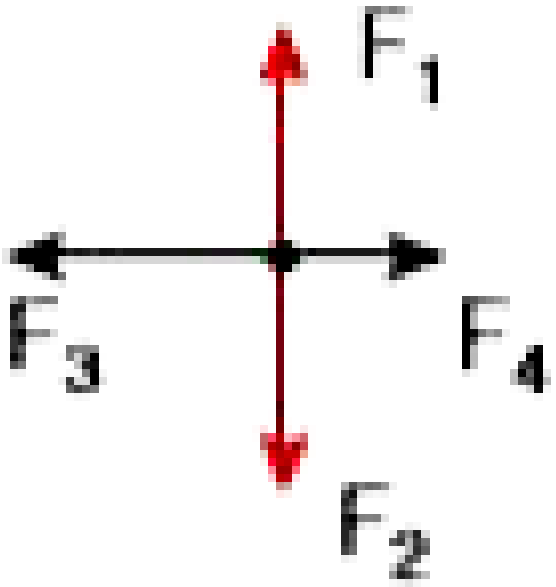

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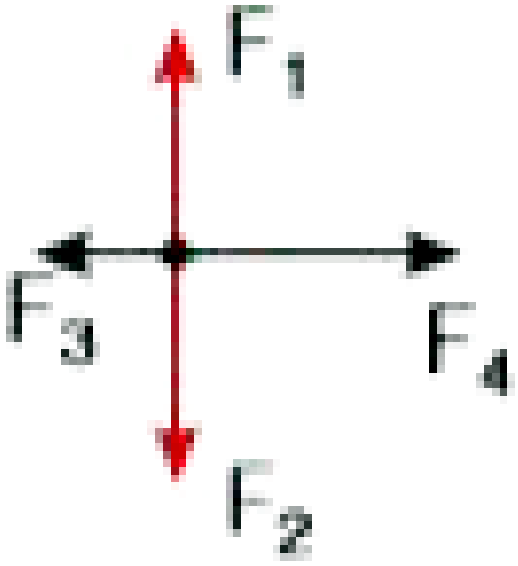
5. Identify the free body diagram that represents the particle accelerating in positive x direction in the following. The relative magnitude of forces should be indicated when

the free body diagram for mass m is drawn.



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6. A gun weighing 25 kg fires a bullet weighing 30 g with the speed of $200ms^{-1}$. What is the

speed of recoil of the gun.

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7. A wooden box is lying on an inclined plane. What is the coefficient of friction if the box starts sliding when the angle of inclination is 45°

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8. Two masses $m_1 = 5kg$ and $m_2 = 4kg$ tied to a string are hanging over a light frictionless pulley. What is the acceleration of each mass when left free to move? $\left(g = 10ms^{-2}\right)$

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9. A block of mass m is pushed momentarily along a horizontal surface with an initial velocity u. If μ_k is the coefficient of kinetic

friction between the object and surface, find the time at which the block comes to rest.

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10. Three blocks of masses 10 kg, 7 kg and 2 kg are placed in contact with each other on a frictionless table. A force of 50 N is applied on the heaviest mass. What is the acceleration of the system?

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11. The coefficient of friction between a block and plane is $\frac{1}{\sqrt{3}}$. If the inclination of the plane gradually increases, at what angle will the object begin to slide?

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12. Find the maximum speed at which a car can turn round a curve of 36 m radius on a level road. Given the coefficient of friction between the tyre and the road is 0.53.

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13. Calculate the centripetal acceleration of the Earth which orbits around the Sun. The Sun to Earth distance is appriximately 150 million km. (Assume the orbit of Earth to be circular)

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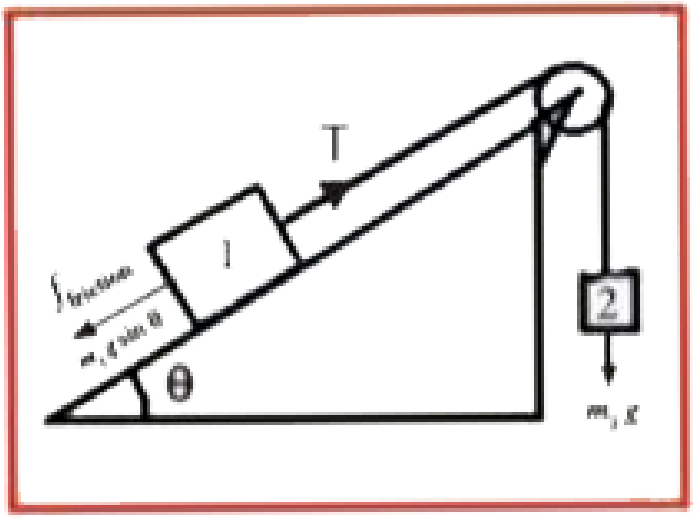
14. A block 1 of mass m_1 , constrained to move along a plane inclined at angle θ to the

horizontal, is connected via a massless inextensible string that passes over a massless pulley, to a second block 2 of mass m_2 . Assume the coefficient of static friction between the block and the inclined plane is μ_k and the coefficient of kinetic friction is μ_k



What is the relation between the masses of

block 1 and block 2 such that the system just starts to slip?

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15. Consider two objects of masses 5 kg and 20 kg which are initially at rest. A force 100 N is applied on the two objects for 5 second.

What is the momentum gained by each object after 5 s.

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16. Consider two objects of masses 5 kg and 20 kg which are initially at rest. A force 100 N is applied on the two objects for 5 second.

What is the speed gained by each object after 5 s.

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17. An object of mass 5 kg is initially at rest on the surface. The surface has coefficient kinetic friction $\mu_k = 0.6$. What initial velocity must be given to the object so that it travels 10 m

before coming to rest? When the object moves on the surface it will experience three forces.

Downward gravitational force (mg)

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18. An object of mass 5 kg is initially at rest on the surface. The surface has coefficient kinetic friction $\mu_k = 0.6$. What initial velocity must be given to the object so that it travels 10 m before coming to rest? When the object

moves on the surface it will experience three forces.

Upward normal force (N)

View Text Solution

19. An object of mass 5 kg is initially at rest on the surface. The surface has coefficient kinetic friction $\mu_k = 0.6$. What initial velocity must be given to the object so that it travels 10 m before coming to rest? When the object moves on the surface it will experience three

forces.

Frictional force opposite to the motion of the object.

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20. In the section 3.7.3 (Banking of road) we have not included the friction exerted by the road on the car. Suppose the coefficient of static friction between the car tyre and the surface of the road is , calculate the minimum speed with which the car can take safe turn?

When the car takes turn in the banked road, the following three forces act on the car.

The gravitational force mg acting downwards

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21. In the section 3.7.3 (Banking of road) we have not included the friction exerted by the road on the car. Suppose the coefficient of static friction between the car tyre and the surface of the road is , calculate the minimum speed with which the car can take safe turn?

When the car takes turn in the banked road, the following three forces act on the car.

The normal force N acting perpendicular to the surface of the road

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22. In the section 3.7.3 (Banking of road) we have not included the friction exerted by the road on the car. Suppose the coefficient of static friction between the car tyre and the surface of the road is , calculate the minimum

speed with which the car can take safe turn?

When the car takes turn in the banked road, the following three forces act on the car.

The static frictional force f acting on the car along the surface.

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Solved Example Unit 4

1. A force $\vec{F} = \hat{i} + 2\hat{j} + 3\hat{k}$ acts on a particle and displaces it through a distance

$\overrightarrow{S} = 4\hat{i} + 6\hat{j}$ Calculate the work done.

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2. A particle moves along X- axis from x=0 to x=8 under the influence of a force given by $F = 3x^2 - 4x + 5$. Find the work done in the process

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3. A body of mass 10kg at rest is subjected to a force of 16N. Find the kinetic energy at the end of 10 s.

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4. A body of mass 5kg is thrown up vertically with a kinetic energy of 1000 J. If acceleration due to gravity is $10ms^{-2}$, find the height at which the kinetic energy becomes half of the original value.

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5. Two bodies of mass 60 kg and 30 kg move in the same direction along straight line with velocity $40cms^{-1}$ and $30cms^{-1}$ respectively suffer one dimensional elastic collision. Find their velocities after collision.

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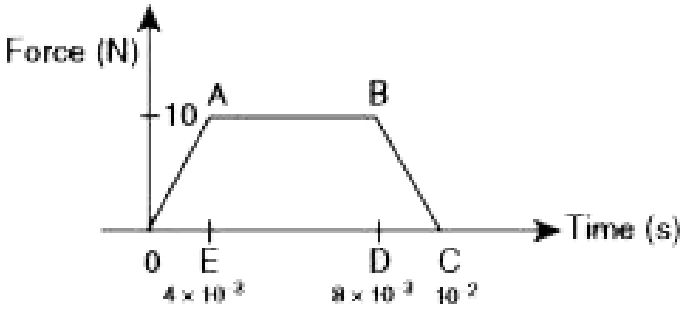
6. A particle of mass 70 g moving at $50cms^{-1}$ is acted upon by a variable force as shown in

the figure. What will be its speed once the force stops?



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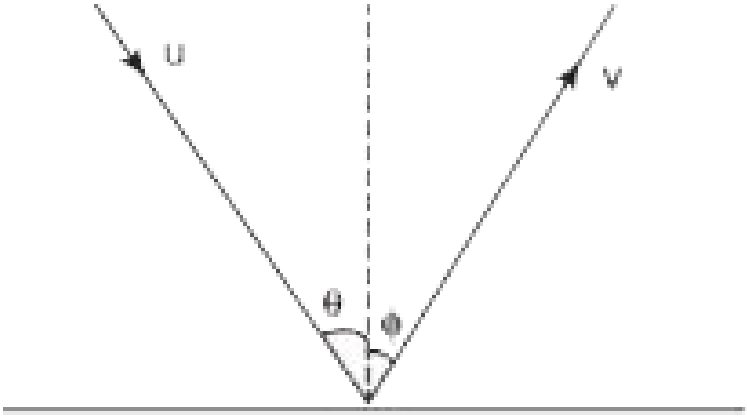
7. A particle strikes a horizontal frictionless floor with a speed u at an angle θ with the vertical and rebounds with the speed v at an angle ϕ with an vertical. The coefficient of

restitution between the particle and floor is e.

What is the magnitude of v?



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8. A particle of mass m is fixed to one end of a light spring of force constant k and un-stretched length l. It is rotated with an

angular velocity ω in horizontal circle. What will be the length increase in the spring?

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9. A gun fires 8 bullets per second into a target X. If the mass of each bullet is 3 g and its speed $600ms^{-1}$. Then, calculate the power delivered by the bullets

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Solved Example Unit 5

1. Three particles of masses $m_1 = 1kg, m_2 = 2kg$ and $m_3 = 3kg$ are placed at the corners of an equilateral triangle of side 1m as shown in Figure. Find the position of center of mass.

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2. An electron of mass $9 \times 10^{-31} kg$ revolves around a nucleus in a circular orbit of radius

0.53Å. What is the angular momentum of the electron? (Velocity of electron is, $v = 2.2 \times 10^6 ms^{-1}$)

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3. A solid sphere of mass 20 kg and radius 0.25 m rotates about an axis passing through the center. What is the angular momentum if the angular velocity is 5 rad s^{-1}.

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4. A solid cylinder when dropped from a height of 2 m acquires a velocity while reaching the ground. If the same cylinder is rolled down from the top of an inclined plane to reach the ground with same velocity, what must be the height of the inclined plane? Also compute the velocity.

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5. A small particle of mass m is projected with an initial velocity v at an angle θ with x axis in

X-Y plane as shown in Figure. Find the angular momentum of the particle.

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6. From a complete ring of mass M and radius R, a sector angle θ is removed. What is the moment of inertia of the incomplete ring about axis passing through the center of the ring and perpendicular to the plane of the ring?

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7. A massless right tangled triangle is suspended with its right angle corner. A mass of 100 kg is suspended from another corner B which subtends an angle 53°. Find the mass m that should be suspended from other corner C so that BC (hypotenuse) remains horizontal.

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8. If energy of 1000 J is spent in increasing the speed of a flywheel from 30 rpm to 720 rpm,

find the moment of inertia of the wheel

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9. Consider two cylinders with same radius and same mass. Let one of the cylinders be solid and another one be hollow. When subjected to same torque, which one among them gets more angular acceleration than the other?

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10. A thin horizontal circular disc is rotating about a vertical axis passing through its center. An insect goes from A to point B along its diameter as shown in Figure. Discuss how the angular speed of the circular disc changes?

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11. What is the shape of the graph between $\sqrt{E_{kr}}$ and L? (E_{kr} is the rotational kinetic

energy and L is angular momentum)

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12. What information can you get from the slope of the graph?

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13. You are given the graph of $\sqrt{E_{kr}}$ and L for two bodies A and B. Which one has more moment of inertia?

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14. Consider a thin uniform circular ring rolling down in an inclined plane without slipping. Compute the linear acceleration along the inclined plane if the angle of inclination is 45°.

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