

Solve five questions only

First Question

(20/100)

1. The period of a simple pendulum is measured in time units and is given by

$$T = km^a l^b g^c$$

Where (L) is the length of pendulum,(m) is the mass and (g) is the acceleration due to gravity. By dimensional analysis find the value of a,b and c.

2. Given three vectors: $\vec{A} = 3\hat{i} - \hat{k}$, $\vec{B} = \hat{i} - \hat{j}$ and $\vec{C} = 2\hat{i} + \hat{j}$, Find

a) $\vec{B} \cdot (\vec{A} \times \vec{C})$.

b) Find a vector \vec{D} such that $2\vec{A} - \vec{C} - \vec{D} = 0$

Second Question

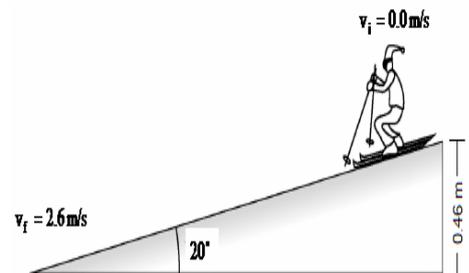
(20/100)

1. Define conservative and non-conservative force.

2. Children and sled with mass 50kg of slide down a hill with a height of 0.46m. If the sled starts from rest and has a speed of 2.6m/s at the bottom.

a) How much thermal energy is lost due to friction (i.e. what is the work that friction does)?

b) If the hill has an angle of 20° above the horizontal what was the frictional force.



Third Question

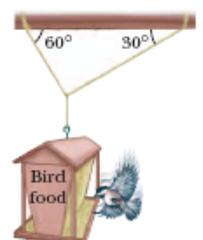
(20/100)

1. If you push on a heavy box that is at rest, you must exert some force to start its motion. However, once the box is sliding, you can apply a smaller force to maintain that motion. Why?

2. A 150-N bird feeder is supported by three cables as shown in Figure .

a) Find the tension in each cable.

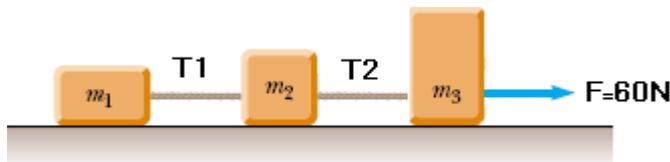
b) Suppose feeder is hung so that the tensions T_1 and T_2 are both equal to 80.0 N. Find the new angles they make with respect to the x axis.



Fourth Question

(20 /100)

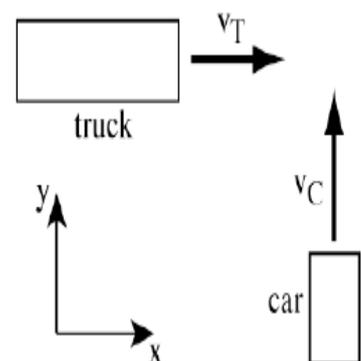
1. can the normal force F_n smaller than the weight w ? (Explain your answer)
2. Three block $m_1 = 10kg$, $m_2 = 20kg$, $m_3 = 30kg$ connected together with cords as a train. If the system is pulled with force $60N$. Find T_1 and T_2 .



Fifth Question

(20 /100)

1. Type of collision (Explain).
2. A truck with mass $m_T = 15000kg$ is traveling to the east at $v_T = 20m/s$. A car with mass $m_C = 900kg$ is traveling to the north at $v_C = 30m/s$ and collides with the truck. The road is slick with ice, so friction can be neglected. After the collision, the truck and the car stick to one another. Calculate the magnitude and direction of the final velocity of the (truck & car) as they continue traveling together after the collision.



Sixth Question

(20 /100)

1. Deduce work done by spring.
2. A Block $3kg$ put a vertically spring. This Block cause a reducing in the spring length by $5cm$. The same Block fall from height $4m$ over the spring. Find the compressed distance in the spring in this case.

End of Questions