Pre-Health Post-Baccalaureate Program
PHY2053 Study Guide & Practice Problems

Topics Covered:

Centripetal Acceleration
Newton's Laws
Free Body Diagrams

Created by Isaac Loy

Centripetal Acceleration

→ In circular motion, $\vec{v}$ is always tangent to the circle

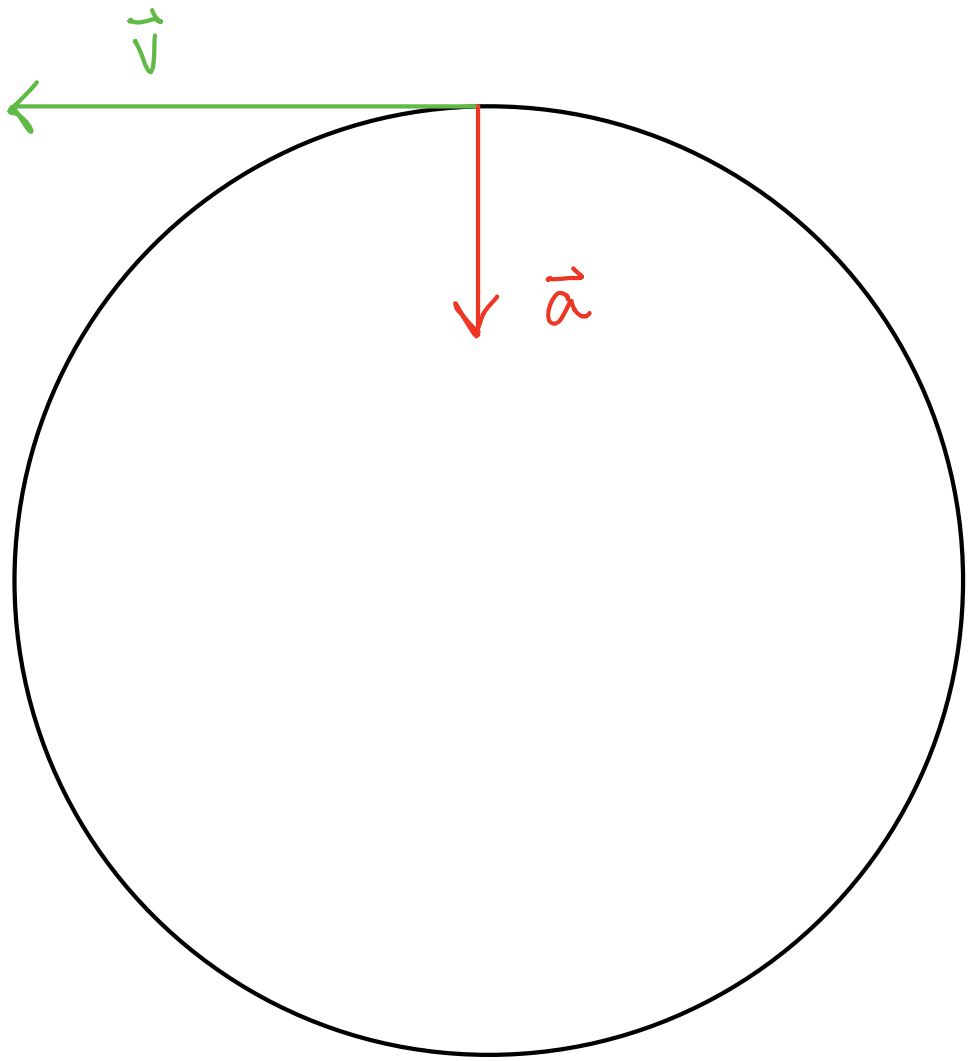
→ $\vec{a}_c$ is always perpendicular to $\vec{v}$ and pointing towards the center of the circle

→ $a_c = \frac{mv^2}{r}$

→ When you're dealing with circular motion, a_c is likely involved

→ $F_c = ma_c = m\frac{mv^2}{r} = \frac{m^2v^2}{r}$

→ Think of F_c as "pulling on" the object to keep it on course


$\vec{v}$
$\vec{a}$

Newton's Laws

① An object at rest will stay at rest, and an object in motion will stay in motion, unless acted upon by an outside force.

② $F_{net} = \frac{\Delta mv}{\Delta t} = m\frac{\Delta v}{\Delta t} = ma$

$m \rightarrow$ resistance to acceleration

$a \rightarrow \frac{\Delta v}{\Delta t}$

③ For every force, there is an equal and opposite force

Types of Forces

- push
- pull
- contact
- weight
- tension
- normal force
- friction
- drag
- thrust
- electric and magnetic force

Units

$$F = ma$$

$$[N] = [kg]\left[\frac{m}{s^2}\right]$$

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→ a Newton (N) is the basic unit of force

→ For reference, 1 lb. = 4.45 N

Free Body Diagrams

→ Represents our object as a particle and shows all forces acting on an object

→ Forces are vectors, so make sure to depict magnitude and direction correctly

Problems

① A skier is being towed up a slope at a constant velocity. Draw the FBD (hint: four forces).

(2) $\left[\frac{N \cdot S^2}{m}\right]$ is a unit for which type of measurement?

a) mass

b) acceleration

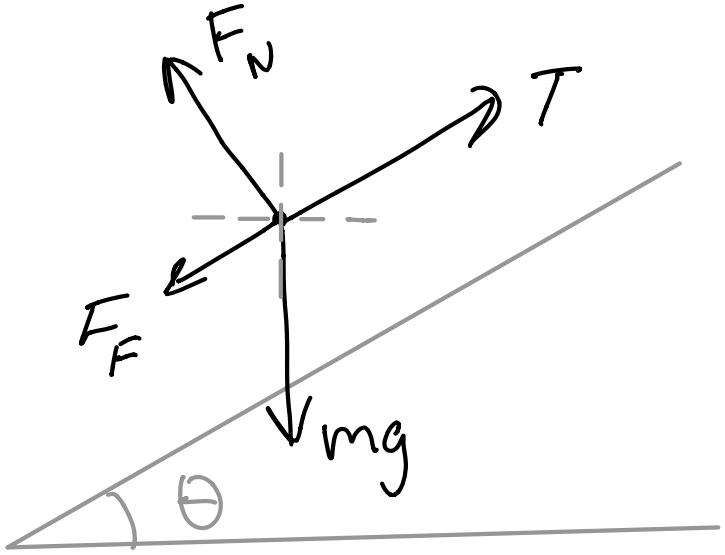
c) momentum

d) velocity

e) distance

Solutions

(1)



constant velocity

↓

no acceleration

↓

no net force

$$y: F_{net_y} = 0 = -mg - F_{F_y} + F_{N_y} + T_y$$

$$x: F_{net_x} = 0 = -F_{F_x} - F_{N_x} + T_x$$

(2) $\left[\frac{N \cdot s^2}{m}\right]$

$[N] = \left[\frac{kg\,m}{s^2}\right]$

$= \left[\frac{\left(\frac{kg\,m}{s^2}\right) \cdot s^2}{m}\right]$

$= [kg]$

[kg] is the standard unit of measurement for mass, therefore choice (a) is correct.