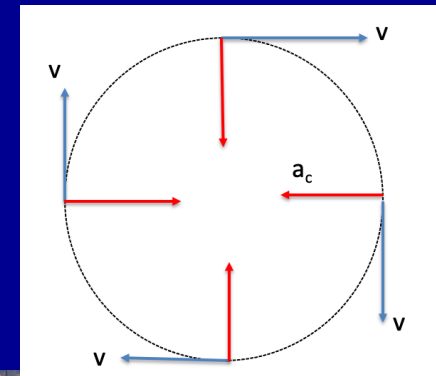


Circular Motion

- Uniform Circular Motion
- Acceleration
- Forces in Circular Motion
- Banked curves
- Centripetal forces
- Centrifugal vs. Centripetal Force



Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

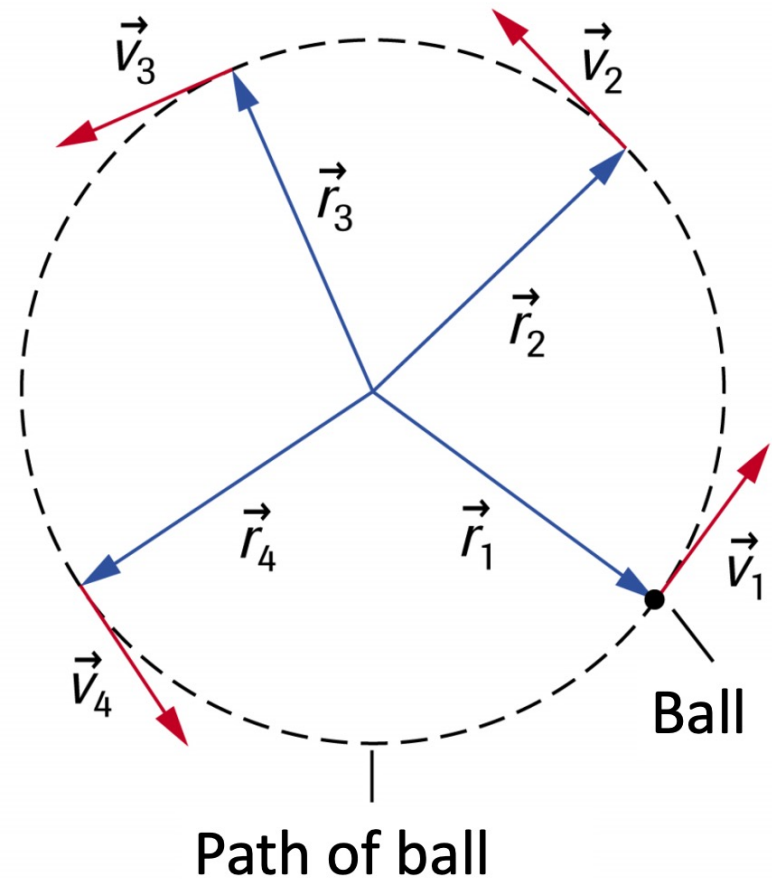
- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

The paid full version of your resource includes both Google Slides and PowerPoint and is Google Classroom Ready



Uniform Circular Motion

- The speed and radius of an object remains constant
- The velocity vector changes because its direction changes.



Acceleration

- A moving body undergoes acceleration if its speed or direction changes
- Uniform Circular Motion produces centripetal acceleration



- “Centripetal” from Latin:
→Centrum = “centre”; Petere = “to seek”

**This Slide Has Been
Removed**

Centripetal Acceleration

- Centripetal acceleration is caused by a changing velocity vector (changes direction)

- _____



Centripetal Acceleration

- The magnitude of centripetal acceleration can be calculated by:

$$a_c = \frac{v^2}{r}$$

- Where a_c is the centripetal acceleration, v is the speed of the object and r is the radius of the circle.
- The direction of a_c is always towards the centre of the circle

Check Your Understanding

A child on a merry-go-round is 4.4 m from the centre of the ride, travelling at a constant speed of 1.8 m/s. Determine the magnitude of the child's centripetal acceleration.

$$a_c = \frac{v^2}{r}$$

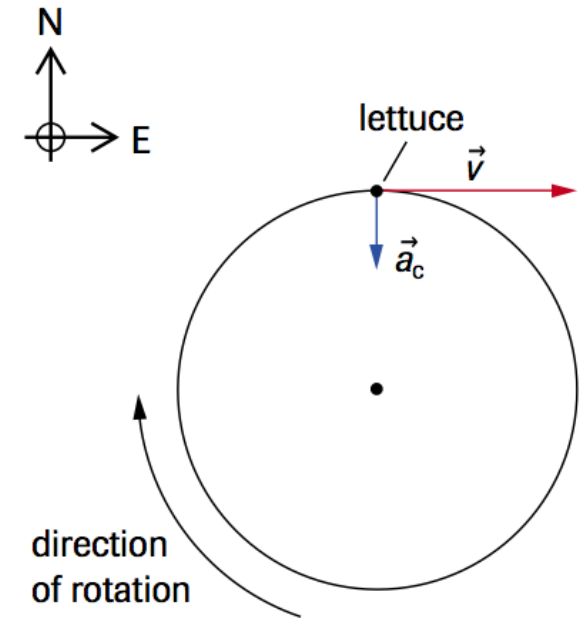
**This Slide Has Been
Removed**

Our Equations for Uniform Circular Motion

- If speed (v) is known:
$$a_c = \frac{v^2}{r}$$
- If speed is not known but period (T) is:
$$a_c = \frac{4\pi^2 r}{T^2}$$
- If f is used in place of T due to a high revolution rate
$$a_c = 4\pi^2 r f^2$$

Check Your Understanding

Find the magnitude and direction of the centripetal acceleration



$$a_c = 4\pi^2 r f^2$$

Check Your Understanding

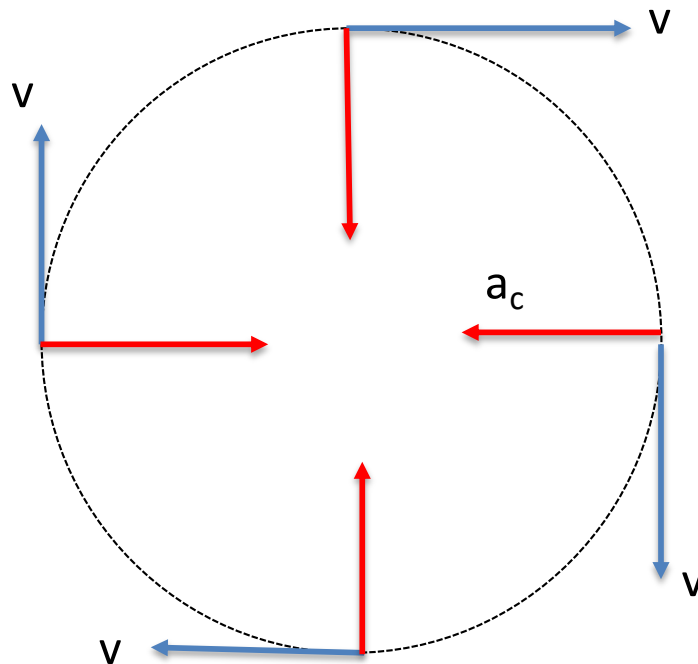
Determine the frequency and period of rotation of an electric fan if a spot at the end of one fan blade is 15 cm from the centre and has a centripetal acceleration of magnitude $2.37 \times 10^3 \text{ m/s}^2$.

$$a_c = 4\pi^2 r f^2$$

**This Slide Has Been
Removed**

Analyzing Forces in Uniform Circular Motion

According to Newton's Second Law, there is a net force acting towards the centre of the circle that causes the centripetal acceleration (a_c).



- The equations for centripetal acceleration involving the period and frequency of circular motion can also be combined with the second-law equation ($F = ma$). Thus, there are three common ways of writing the equation:

$$\sum F = \frac{mv^2}{r} = \frac{4\pi^2 mr}{T^2} = 4\pi^2 mr f^2$$

- ---

Check Your Understanding

A car of mass 1.1×10^3 kg negotiates a level curve at a constant speed of 22 m/s. The curve has a radius of 85 m.

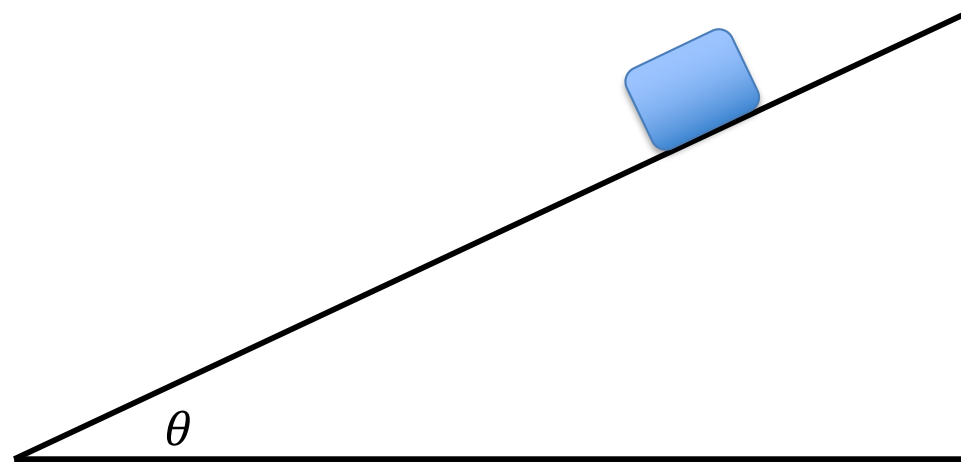
- a) Name the force that provides the centripetal acceleration.
- b) Determine the
- c) Determine the minimum coefficient of static friction needed to keep the car on the road.

$$\Sigma F = \frac{mv^2}{r} = \frac{4\pi^2 mr}{T^2} = 4\pi^2 mrf^2$$

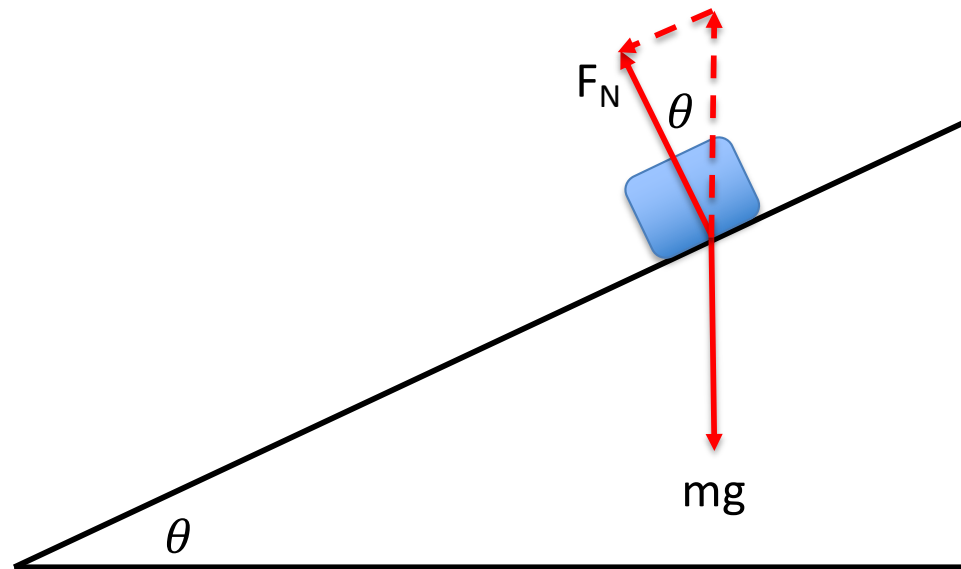
$$\mu_s = \frac{F_{s,max}}{F_N}$$

**This Slide Has Been
Removed**

Banked curves



Banked Curves and FBD



What additional force is now present?

Check Your Understanding

A car of mass 1.1×10^3 kg travels around a frictionless banked curve of radius 85 m. The banking is at an angle of 19° to the horizontal, as shown below.

- a) What forces provide the centripetal acceleration?
- b) What constant speed must the car maintain to travel safely around the curve?

**This Slide Has Been
Removed**

Centripetal Forces

- What forces can cause something to move in a circle?
 - Tension, gravity, static friction
 - _____
-
- Note: all forces that are centre seeking are centripetal forces

Centrifugal vs. Centripetal Force

- ---
- It's not really a force; it results from inertia i.e. the tendency of an object to resist any change in its state of rest or motion
- **Centripetal force** is a "real" force that counteracts the centrifugal force and prevents the object from "flying out", keeping it moving instead with a uniform speed along a circular path

**This Slide Has Been
Removed**