Clicker Question

An automobile of mass 1500 kg moving at 25.0 m/s collides with a truck of mass 4500 kg at rest.

If the bumpers of the two vehicles lock together during the crash, the force exerted *by the car on the truck* is

A. greater than

B. less than

C. the same as

the force exerted *by the truck on the car* during the collision.

Clicker Question

An automobile of mass 1500 kg moving at 25.0 m/s collides with a truck of mass 4500 kg at rest.

If the bumpers of the two vehicles bounce off each other, then the force exerted *by the car on the truck* is

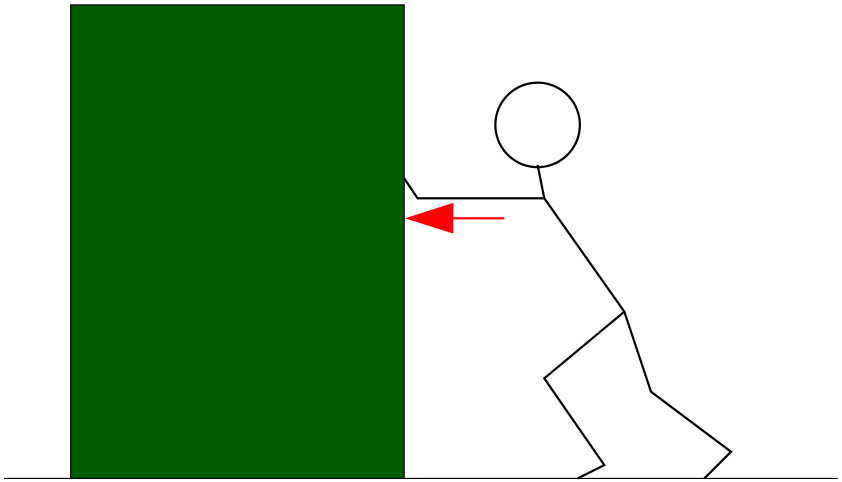
A. greater than

B. less than

C. the same as

the force exerted *by the truck on the car* during the collision.

Frictional forces

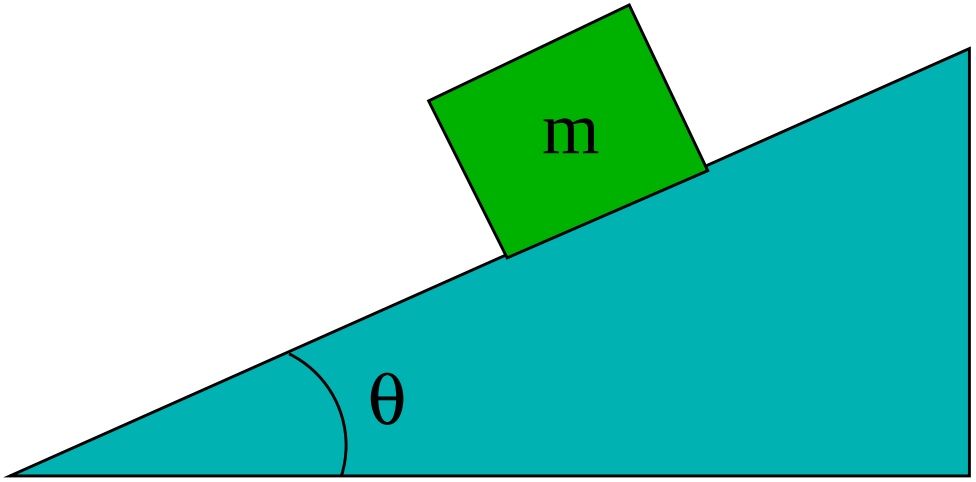


Frictional forces

- friction $always$ opposes direction of motion
- frictional force is always parallel to surface
- frictional force is always perpendicular to the normal force

Example–Frictional forces

Consider a block of mass m sliding down a rough ramp as shown below. If the coefficient of kinetic friction is $\mu_k = 1/2\sqrt{3}$ and the ramp angle is 30°, what is the resulting acceleration down the ramp?



Clicker Question

You are pushing a wooden crate across the floor at a constant speed. You decide to turn the crate on end, reducing by half the surface area in contact with the floor. In the new orientation, to push the same crate across teh same floor with the same speed, the force that you apply must be about

A. 4 times as great

B. twice as great

C. equally great

D. half as great

E. 1/4 as great.

Clicker Question

An object is held in place by friction on an inclined surface. The angle of inclination is increased until the object starts moving. If the surface is kept at this angle, the object

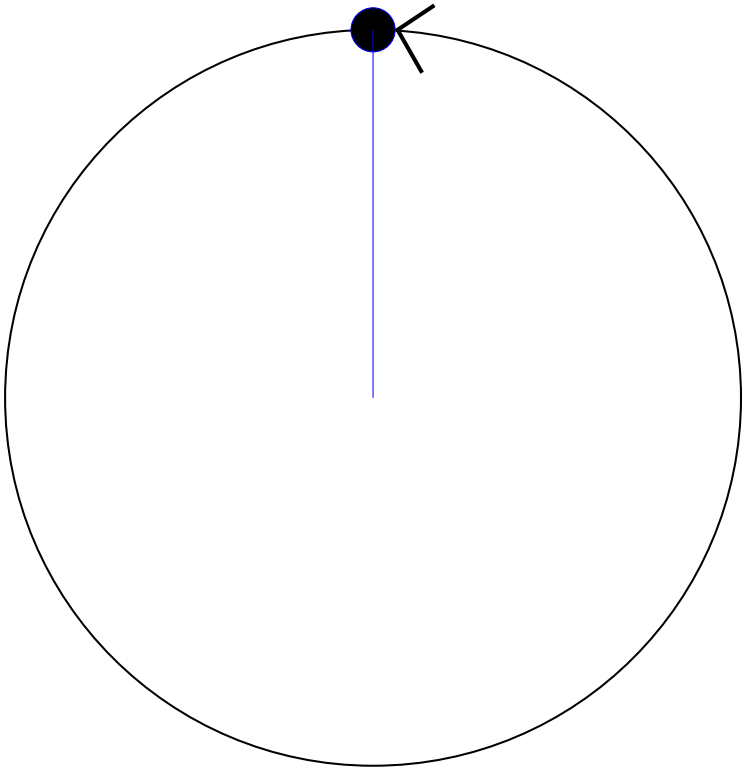
A. slows down

B. moves at uniform speed

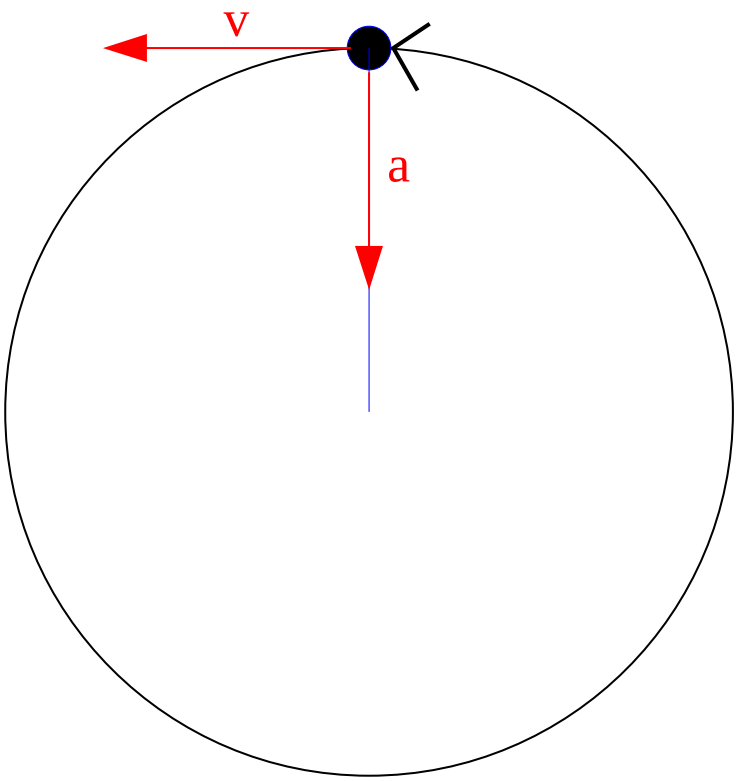
C. speeds up

D. none of the above

Circular Motion

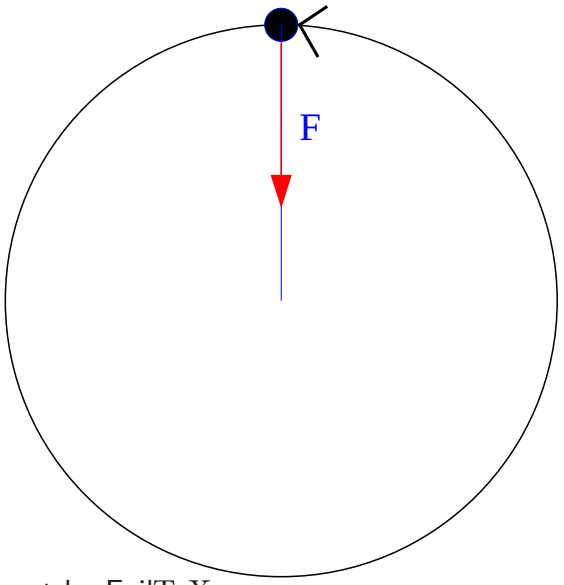


Circular Motion



Centripetal Force

centripetal force – the component of the net force that keeps an object in circular motion. It is NOT a separate force that appears on free body diagrams.



$$|\vec{F}_{net}| = F_{net} = ma$$

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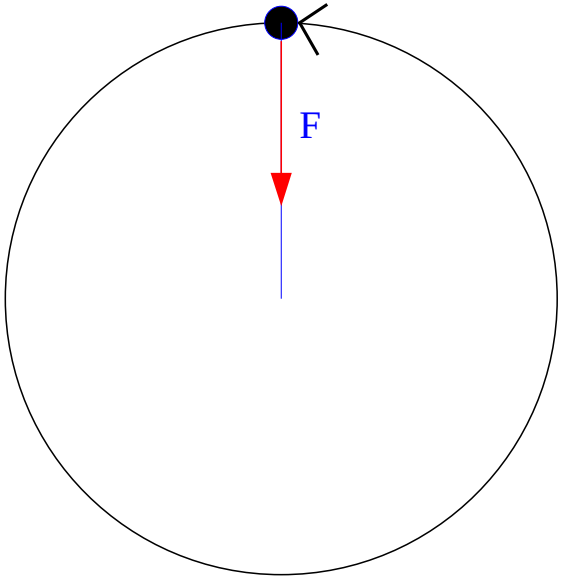


$$|\vec{F}_{net}| = F_{net} = ma$$

For uniform circular motion

$$a = \frac{v^2}{R}$$

$$\Rightarrow F_{net} = \frac{mv^2}{R}$$

is the centripetal force

Centripetal Force

NOTE: Free body diagrams include all forces acting on a body; They do *not* include the net force. Centripetal force is part of the net force.

Clicker Question

A car rounds a curve while maintaining a constant speed. Is there a net force on the car as it rounds the curve?

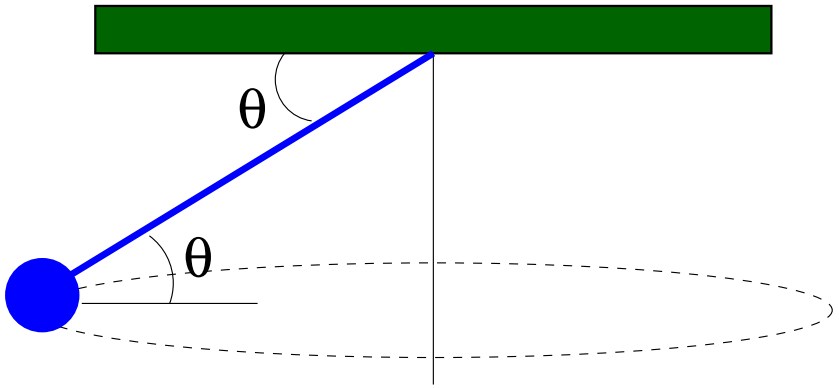
A. No–its speed is constant.

B. Yes.

C. It depends on the sharpness of the curve and the speed of the car.

Example 5.5

A ball of mass m whirls around in a horizontal circle at the end of a massless string of length L. The string makes an angle θ with the horizontal. Find the ball's speed and the string tension.



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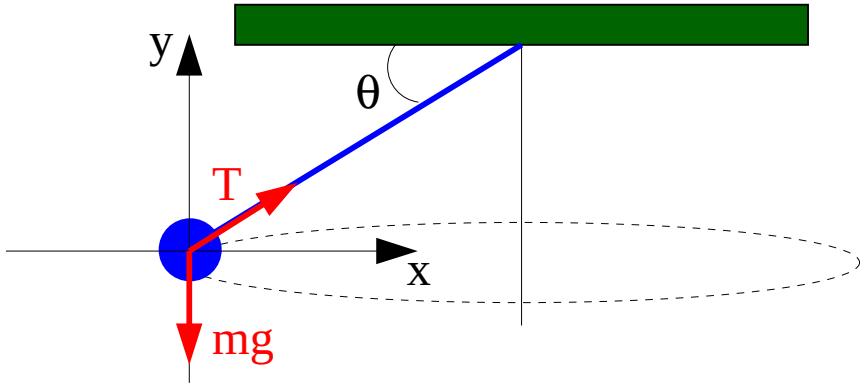


Clicker Question

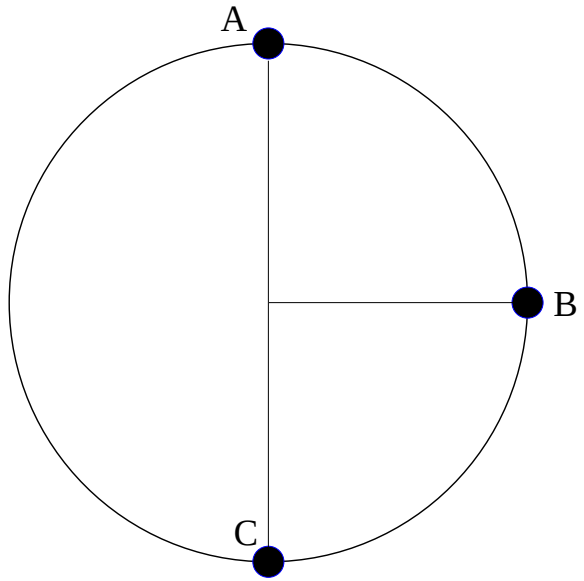
A ball of mass m whirls around in a vertical circle at the end of a massless string of length L. Assume the speed of the ball is constant. At which point will the magnitude of acceleration be the greatest?

A. A

B. B

C. C

D. The acceleration will have the same magnitude at all points.



Clicker Question

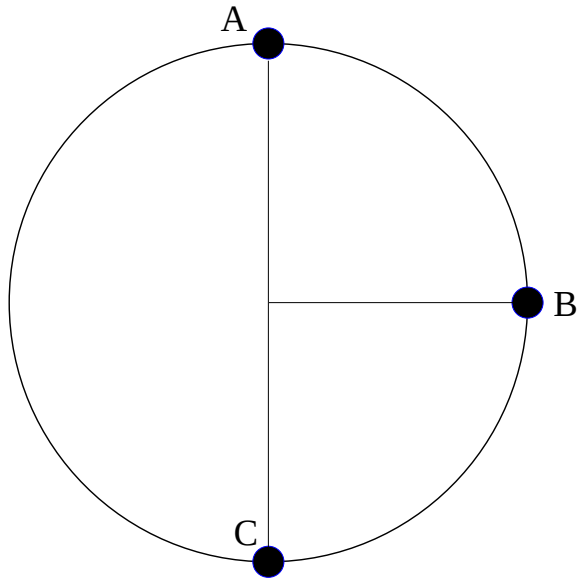
A ball of mass m whirls around in a vertical circle at the end of a massless string of length L. Assume the speed of the ball is constant. At which point will the tension in the string be the greatest?

A. A

B. B

C. C

D. The tension will be the same at all points.



Example

Consider 2 blocks on the frictionless double-ramp shown below. The blocks are attached by a massless rope that runs over a frictionless massless pulley. Find the tension and acceleration in terms of the masses of the two blocks and the ramp angles. What is the relationship between masses for this system to be in equilibrium?