Accelerating on a Ramp

Apparatus

wind up toy car, ramp

Action

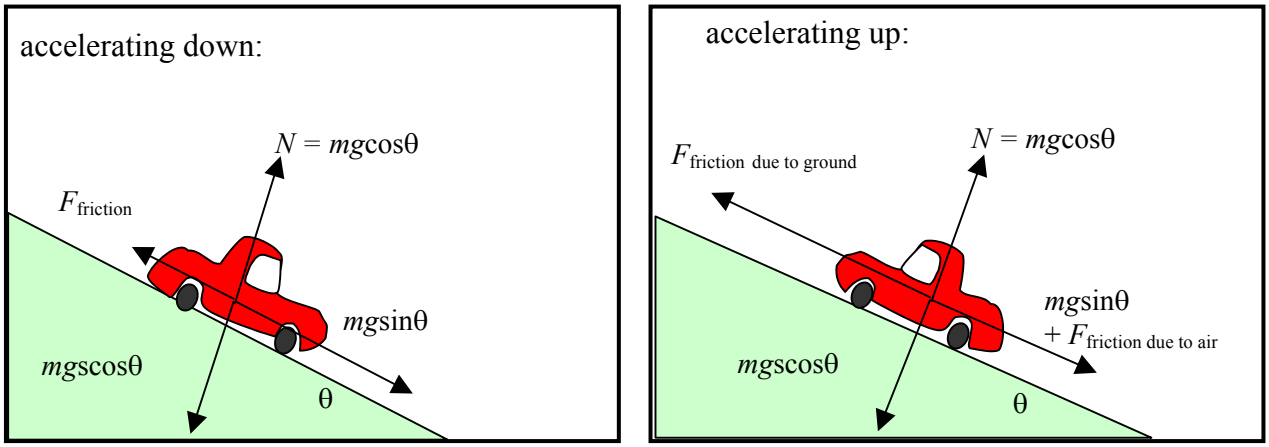
The students allow the car to roll down the ramp (without winding it up). They draw a free body diagram showing the forces acting on the trolley.

They then wind the car up so that it can accelerate up the ramp for at least a short distance. They should draw a free body diagram showing the forces on the car as it climbs the slope.

The Physics

The forces acting on the toy car as it rolls down are gravity, friction and the normal force. The component of gravity along the direction of the slope is greater than any frictional forces and gives an acceleration down the ramp.

When the toy car is wound up and set to climb the ramp its wheels exert a force on the ground. The ground exerts an equal and opposite force, due to friction, on the cars wheels which push the car. As long as the coefficient of friction is great enough that slipping does not occur, and the force on the wheels is greater than the component of gravity down the hill, the car will accelerate.



Accompanying sheet

Accelerating on a Ramp

Place the car at the top of the ramp and release it.
What happens? Why?
Draw a free body diagram of the car.

How does a car accelerate up a hill?
Draw a free body diagram showing the forces acting to accelerate a car up a hill.

A car with some initial speed reaches a downwards slope
and the driver allows the car to roll down the hill.
Will the car necessarily accelerate?