

Constant Velocity

Apparatus

spring balance, smooth ramp, trolley

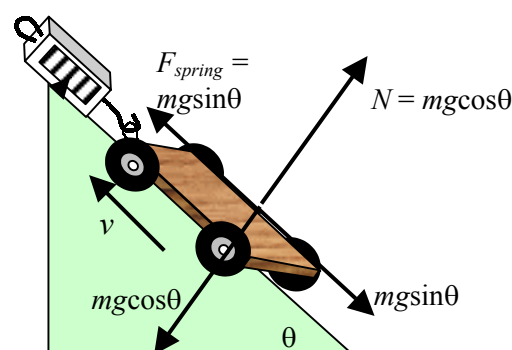
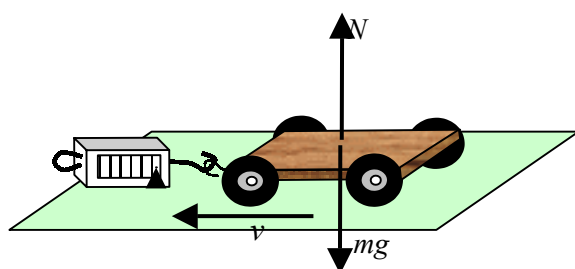
Action

The students attempt to pull the trolley up the ramp with constant velocity. (This can be quite difficult and may take a few tries.) They should compare the reading on the balance when the trolley is on the ramp and still to when it is pulled at constant velocity.

They then pull the trolley with constant velocity along a flat table top. They should compare the readings on the spring balance when the trolley moves along the table at constant velocity and when it moves up the ramp at constant velocity.

The Physics

On a flat surface the net force acting to give a constant velocity is zero. Hence at constant velocity the spring balance will read close to zero. On a flat surface we need just enough force to oppose frictional forces. To pull a trolley up a ramp at constant speed we need to apply a constant force of $mg\sin\theta$ so that the net force is zero. N balances the component of mg perpendicular to N , which is $mg\cos\theta$. The pull must be equal to the component of gravity $mg\sin\theta$.



Accompanying sheet

Constant Velocity

Pull the trolley along the table top with constant velocity.
What does the spring balance read? Why?

Pull the trolley up the ramp with constant velocity.
(This is not easy and may take several attempts.)
What does the spring balance show now?

Why are the readings different?
Is friction important here? How can you tell?