Rolling Down a Ramp

Apparatus

ramp with one section polished very smooth or very lightly oiled, two identical smooth balls

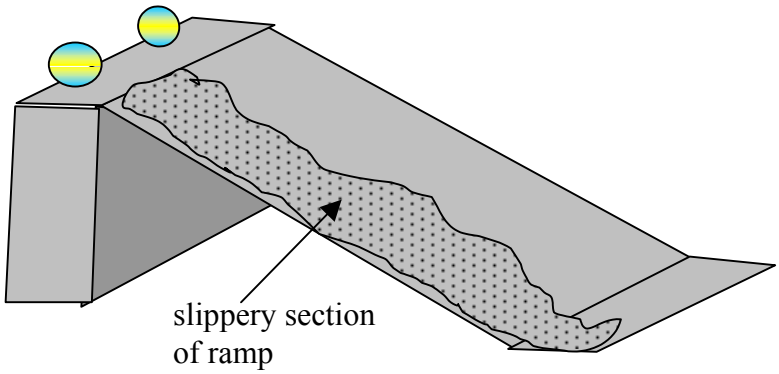
The ramp should be angled such that on one side a ball will slide down without rolling, and on the other a ball will roll down.

Action

The students predict on which side (approximately frictionless, or with friction) the ball will reach the bottom first. They then test their prediction. They should consider the forces acting on the balls in both cases, and the work done by these forces.

The Physics

A ball will get to the bottom of a frictionless ramp faster than one with friction. On the frictionless ramp the ball slides down, and does not roll, all the balls potential energy is converted to translational kinetic energy. When the ball rolls, some of the potential energy is converted to translational kinetic energy and some to rotational kinetic energy, hence it will have a smaller translational velocity and take longer to reach the bottom. The frictional force acts to counteract the sliding that would otherwise occur. The torque means that rotational motion (rolling) occurs.



Accompanying sheet

Rolling Down a Ramp

One side of the ramp is very slippery, the other is not.
On which side will a ball reach the bottom first?

Place the balls at the top of the ramp.

On which side does the ball reach the bottom first?
Why does this ball win the race?

Why is friction necessary for rolling?