

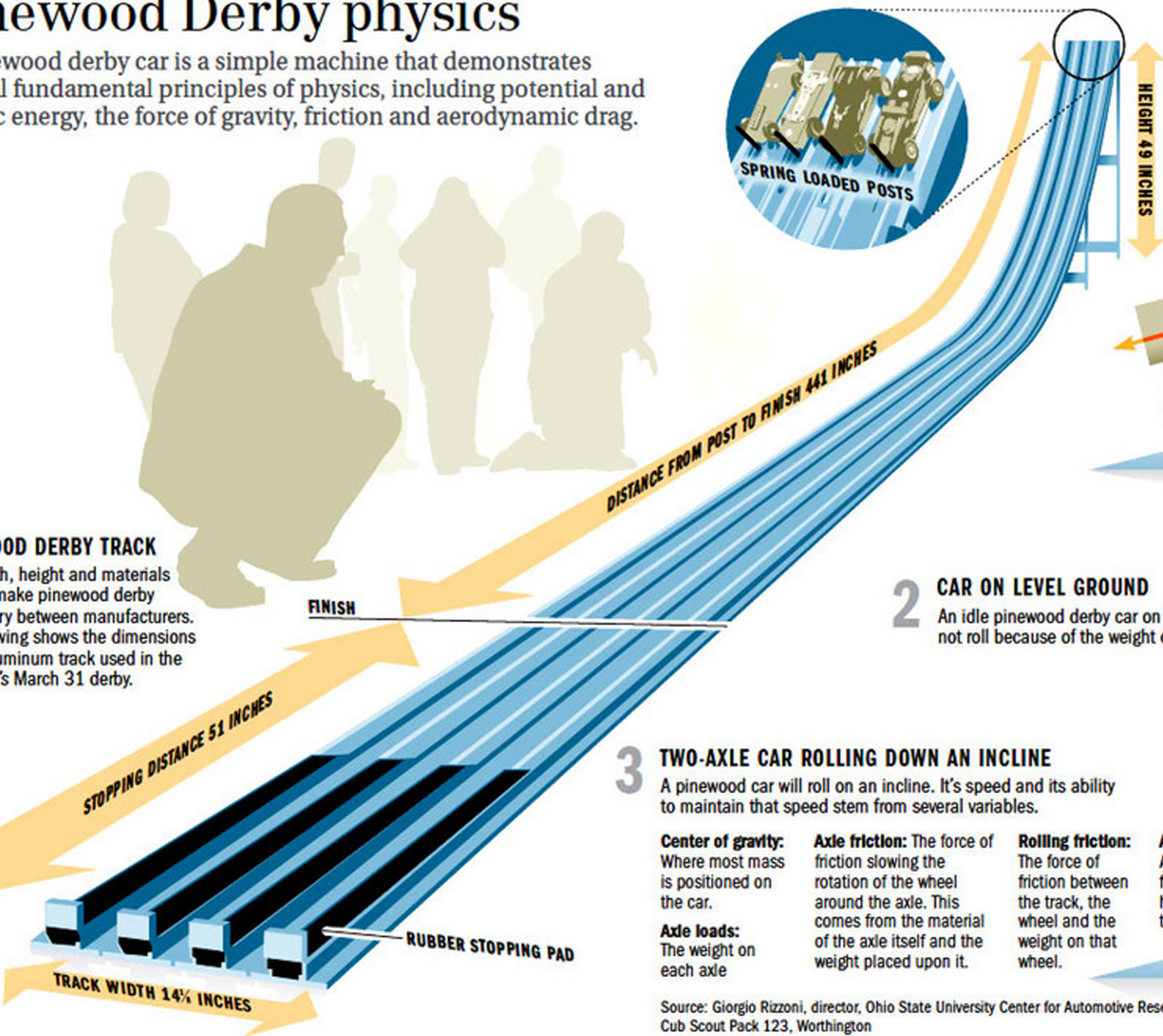
# Pinewood Derby physics

A pinewood derby car is a simple machine that demonstrates several fundamental principles of physics, including potential and kinetic energy, the force of gravity, friction and aerodynamic drag.



## PINWOOD DERBY TRACK

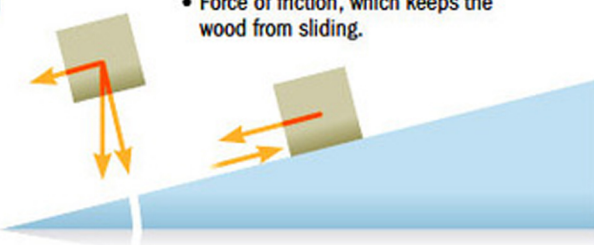
The length, height and materials used to make pinewood derby tracks vary between manufacturers. The following shows the dimensions of the aluminum track used in the Dispatch's March 31 derby.



## 1 BLOCK SLIDING DOWN AN INCLINE

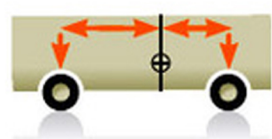
A block of wood perched at the top of an incline has two forces acting on it:

- Force of Gravity, which pushes the block toward the bottom.
- Force of friction, which keeps the wood from sliding.



## 2 CAR ON LEVEL GROUND

An idle pinewood derby car on level ground will not roll because of the weight on each axle.



## 3 TWO-AXLE CAR ROLLING DOWN AN INCLINE

A pinewood car will roll on an incline. It's speed and its ability to maintain that speed stem from several variables.

**Center of gravity:** Where most mass is positioned on the car.

**Axle loads:** The weight on each axle

**Axle friction:** The force of friction slowing the rotation of the wheel around the axle. This comes from the material of the axle itself and the weight placed upon it.

**Rolling friction:** The force of friction between the track, the wheel and the weight on that wheel.

**Aerodynamic drag:** Air density along the front of the car also helps push against the vehicle



Source: Giorgio Rizzoni, director, Ohio State University Center for Automotive Research, Cub Scout Pack 123, Worthington