

Tips on Construction of Pinewood Derby Cars

Step 1 Designing your Car

Young boys have difficulty envisioning their final product so it is hard for them to draw it on paper. Trace the block sideways on a sheet of paper. Then trace where the wheels go. Now let your son draw the shape he would like. Cut it out and lay it on the block. Now trace the template on the block. Make the rear axle slot closest to the back, note this is opposite what is shown on the box.

Step 2 Cut out the Car (adults task) Band saw, scroll saw, or coping saw etc.

Step 3 Sanding

Small hands work better with sanding sponges.

Step 4 Polishing the Axles

Use a small file to remove the nail head crimp marks. Starting with about 300 grit sandpaper sand the nails. Work up to as fine of grit as you can find. Chuck the pointed end into a drill or dremel. If you clamp the sandpaper to a thin strip of wood a boy can control the sanding while an adult holds the drill. **Don't forget your safety goggles!**

Step 5 Sanding the wheels

Starting with about 300 grit sandpaper sand the wheels. Work up to as fine of grit as you can find. Only sand enough to remove imperfections and make the wheel round as possible. You can get a wheel mandrel to put the wheel in your drill at Michael's, Hobby Lobby or various other hobby supply places. **Go slow if you try to sand too fast the wheel will melt.**

Step 6 Painting & Decorating

Lacquer paint is a good primer which only takes about 20 minutes to dry. You can purchase a spray can trigger so that young boys can paint. **With boys make sure you have a mask and good ventilation.** Good idea for adults too. Silver metallic sharpies do an excellent job on hubcaps. Black sharpies then cover any errant marks.

Step 7 Weighting

Add weights to bring car to 5oz limit. Lead fishing weights can be hammered into almost any shape. Remember to wash hands after handling lead it is poisonous if ingested. You can use postal scales to get close.

Step 8 Lubrication

Make sure you use graphite or similar dry lubricant in the wheel hubs.

Pinewood Derby Physics

Gravity x Mass x Height = Potential Energy

This is your Engine

Gravity - everybody's is the same

Mass - make sure your car weighs the 5oz limit.

Height - make the center of mass rearward to maximize this. (put the weight in the back) since the car starts on a slope the rear is higher than the front don't make the rear so heavy it pops a wheelie

Friction Slows your car

Potential sources of friction from most to least - generally

wheel to axle

hub of wheel to car

hub of wheel to nail head

wheel to track guide

wheel to track

air to car

Engine

What makes your car go!!

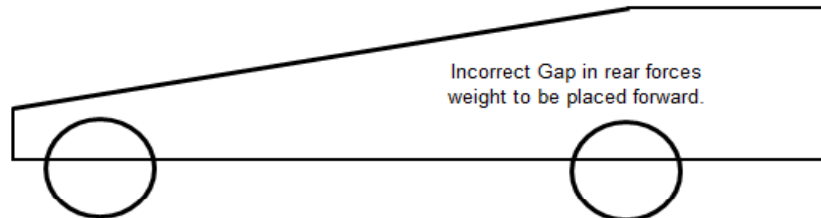
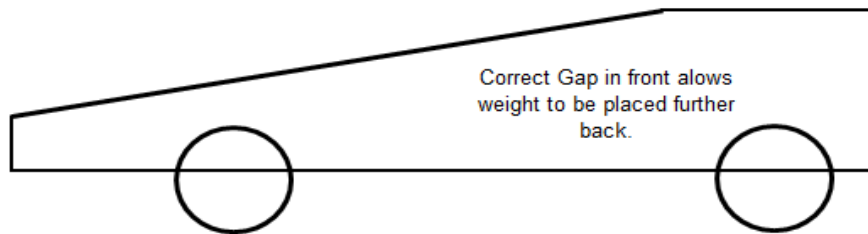
Gravity

Mass x Drop

Mass maximum is 5 ounces

Drop can be increased by moving the weight rearward.

Caution if the front of the car is too light the front wheels might jump out of your lane.



Typical Sources of Friction (roughly in order)

Friction slows your car. By reducing Friction is where you get your speed advantage and win the race.

1. Wheel to Axle (Nail)

Place the pointed end of the nail into a drill. Wrap sand paper around a stick approximately 1/4 in thickness. Hold the stick against the nail while keeping your hands clear of the drill. Use the drill to spin the nail against the sand paper. Use 300 grit sand paper then repeat with finer grit (600, 1000, 2500, etc.)

2. Wheel to Car

Use your finest sandpaper to smooth the hub of the wheel. Be careful not to get sticky paint where the wheel rubs. Work graphite into the spot where the wheel will rub the car body. Make sure that if you glue the axles in not to glue the wheels to the axle. **Don't use superglue it runs everywhere!!**

3. Wheel to Nail Head

File the nail head with a slant so that it only contacts the wheel nearest to the axle. The continue with sanding same procedure as in number 1 above.

4. Wheel to track guide

This is when the car runs into the center guide. The solution is to have a car that rolls consistently straight. This can be accomplished by adjusting the nails (axles) to the optimum positions. Think wheel alignment.

5. Wheel to track

Wheels rubbing on the track. When the friction from the wheels turning around the axle (nail) is removed this is reduced as well. You can rub graphite on the wheel to reduce the rubbing friction as well.

6. Air to car

This is the drag on the car as it moves through the air as it rolls down the track. Using a aerodynamic shape will help to reduce this. You may also use fenders.