Pinewood Derby Advice to the Beginner - Keep it Simple!

Countless times I have had the following phone conversation: "Hi, my son just got a pinewood derby kit, but when we opened it all we found was a block of wood, four wheels, and some nails. What the heck are we supposed to do with it? I expected it to have a car that looked like the photo on the box!"

It can be very daunting to participate in your first pinewood derby race. The event demands some woodworking skill, some understanding of physics, and access to some basic tools and supplies. For many people one, two, or three of these requirements are missing.

So, let me share some advice for those of you that are participating in your first race.

CAR BODY

Unless you have some experience with woodworking and the tools of the trade, then I suggest going with a basic wedge-type design. Not only is it a simple shape to cut, it also simplifies sanding and finishing. All that is needed to build a wedge is a saw and a hand drill. If you are missing these items, then you can purchase wedges already cut and drilled from several sources.(1)

I recommend recessing weight into the car body. With a wedge, the easiest way to do this is to use lead wire(2), placing it into holes drilled into the car (see the next section). Holes drilled into the side or back of the car can be covered with wood plugs or with wood filler before finishing.

Note that on many kits - including BSA kits - one axle slot is closest to the end of the block. I recommend using that closest slot as the rear slot (the opposite of the car pictured on the BSA kit box).

WEIGHT AND PLACEMENT

To ensure that the car performs well, you will need to add weight to bring the completed car to the maximum weight (usually 5 ounces). An easy weight to use is lead wire. This product is 3/8 inch in diameter and can be easily cut into pieces and reshaped. Note that this product is not typically available in hobby shops, but is available from some on-line stores.

Generally, you will need between 2.5 and 3 ounces of weight for a wedge-shaped car.

On most tracks, best performance is attained by locating the added weight towards the rear of the car. For a wedge-shaped car, a good rule of thumb is to place 1/3 of the added weight behind the rear axle, 1/3 on top of or just in front of the rear axle, and the final 1/3 about 1-1/2 inches in front of the rear axle.

CAR FINISH

If you are unfamiliar with painting models, and you are making a simple shape (like a wedge), then consider using a Body Skin.(3) These are full body decals that work well on simple cars. If you decide to paint, then consider using Acrylic hobby paints. They generally work well and clean up with water.

WHEELS

Although the wheels can be used directly from the box, some preparation is recommended. This includes sanding the tread surface and inside edge (with the wheel mounted on a wheel mandrel and spinning on a drill), squaring or coning the inside wheel hub, and polishing the bore. Tools are available from on-line stores to assist in these preparation steps.(4) As an alternative, prepped wheels are available from many on-line stores.(5) Just make sure to check your local rules to find out what is allowed/disallowed in your race.

AXLES

If your kit uses nail-type axles, then you certainly want to remove the flaws by placing the nail in the chuck of a drill, point first, and then applying a small file to the spinning axle. Then polish the axles with sandpaper and/or other polishing materials.(6) As in the case of wheels, prepped axles are also available from many sites.(7)

LUBRICANT

The wheels and axles must be lubricated. Unless restricted by your local rules, go with graphite. It is the number one lube used, and is readily

available.(8) Be sure to work the graphite into the wheel hub by spinning a wheel on an axle multiple times. To keep your car clean, lube the wheels and axles before attaching them to the car.

FINAL ASSEMBLY

Mount the wheels and axles onto the car by inserting the axles into the axle slots or axle holes. A new tool, the Pro-Axle Guide (9) is available to help with this step. But in a pinch, you can use a dime as a gap gauge to keep the proper spacing between the car body and the inside wheel hub.

With axle slots, the axles will need to be glued in place (a dab of white glue spread over the exposed axles works well - just keep the glue away from the wheels). However, before gluing the axles in place, check the alignment of the car (see Volume 5, Issue 6, Wheel Alignment: Make It Straight!).

CONCLUSION

I hope that this break-down of the car building steps will ease your mind as you build your first car. Just remember, take your time, make sure your child is fully involved, and enjoy the process. Good luck!

(1) See http://www.maximum-velocity.com/kits.htm#kits
(2) See http://www.maximum-velocity.com/speed_supplies.htm#lead
(3) See http://www.maximum-velocity.com/decals_etc.htm#body_skins
(4) See http://www.maximum-velocity.com/specialty_tools.htm
(5) See http://www.maximum-velocity.com/kits.htm#bsa_speed
(6) See http://www.maximum-velocity.com/speed_supplies.htm#polishing
(7) See http://www.maximum-velocity.com/kits.htm#bsa_speed
(8) See http://www.maximum-velocity.com/speed_supplies.htm#lube
(9) See http://www.maximum-velocity.com/specialty_tools.htm#axleguide

Keep Wheels & Axles Straight

Crooked axles will cause your car to ride the center guide rail, or will cause the wheels to slide in addition to rolling. In either case, the extra friction will slow your car down. Keeping your wheels and axles straight is probably the most important step in building a faster car.

The time to think about keeping your axles straight is before you start shaping your car. It is much easier to create straight holes for your axles when the sides of the block of wood are still square, than after you have shaped your car. Later, when you've finished shaping and painting your car, the axles will fit easily into these holes, and your wheels and axles will be straight.

One obvious technique for creating straight axle holes is to pre-drill them with a drill press. If you use a bit that is slightly smaller than the axle nails in your kit, then you may not need glue to hold your axles in place and you won't have to worry about the axles wobbling in oversized holes.

In our derby workshops, we use a variation of this technique. Instead of a drill bit, we use an axle nail with the head sawn off. *Without turning on the drill press,* lower the axle nail straight into the block of wood. If you don't have access to a drill press, you can clamp an axle nail in a pair of pressure pliars (e.g., Vice-Grips), and carefully insert the axle nail straight into the pre-cut axle slots.

Polish the Axles

This works best if two people work together. Lock an axle into the chuck of a hand drill, leaving the head of the axle plus about 1/2 inch of the axle itself sticking out. While one person holds the drill and turns it on, the other person should polish the exposed axle with a thin strip of wet emery paper. Polish both the axle shaft and the inside of the axle head. Keep the emery paper moving to avoid creating grooves in the axle. For an even better polish, you can use steel wool, metal polish, and/or jeweler's rouge after an initial polishing with emery paper.

Examine the axle closely (with a magnifying glass, if possible). It should be perfectly smooth. Test the axle by inserting it through a wheel and spinning the wheel with your finger. The wheel should spin smoothly and slow down very gradually.

Prepare the Wheels

When you get your wheels, they may have irregularities left over from the casting process (e.g., a peg-like sprue or paper-thin flash). You should remove these irregularities, and then carefully sand any remaining roughness with emery paper. Metal polish can restore the glossy finish to your wheels.

Commercially available mandrels allow you to spin your wheels with a hand drill (this is similar to the axle-polishing technique described previously). This can be a big help in removing fine irregularities, but be careful not to reshape or damage your wheels. Make sure the wheel is secure within the mandrel; if the wheel rotates on the mandrel you'll overheat and melt its plastic hub, completely ruining the wheel.

Be careful to **avoid reshaping your wheels** in any other way, or you may disqualify your car!

Lubricate the Wheels

Various lubricants are available from hobby shops. The standard derby lubricant is graphite powder, which is good, but can be messy (especially when used in excess). Penetrating oils (e.g., WD-40) can also work well. Some people recommend talcum powder (baby powder), or high-tech lubricants with Teflon, silicone, or molybdenum sulfide. Some liquid lubricants can get sticky though, so test them before using them on your car. Some derbies restrict which lubricants you can use, so check your derby's rules.

I've found that the best way to lubricate the wheels is to apply the lubricant to the inside of the wheel hub first. Once the wheel is lubricated, insert the axle through the hub and mount the it on the car. If the wheel is mounted first, it's very difficult to get lubricant between the wheel and the axle.

Avoid mixing lubricants, and especially do not mix dry lubricants with wet lubricants. The result is often a sticky mess.

Don't Bind the Wheels

If you push the axles in too far, the wheels will bind against the sides of the car. Leave a little room for the wheels to move sideways, along the length of the axle.

Paint Early, Paint Often

This sounds like an appearance suggestion, but it is also a speed suggestion. Paints and finishes that haven't cured completely tend to be slightly tacky, and then stick to the wheels and slow the car down. Leave yourself time to apply your final finish coat well in advance of the actual race, so that it will finish curing before you put your wheels on. Also, a single heavy coat will take longer to dry and cure, so be sure to apply several light coats instead.

Here are two other ways to create a low-friction contact surface where the wheels touch the car body.

- Keep the contact points of the car body completely clean. Before painting the car body, mask these locations. Use a circle of paper held in place by masking tape; the circle of paper protects the wood from picking up adhesive from the masking tape.
- Before mounting the wheels, rub graphite into the paint at the contact points. With reasonably well-cured paint, this technique replaces any residual tackiness with a dry lubricant. Be careful not to spoil the paint on the rest of the car though; graphite creates ugly black fingerprints.

Reduce Air Resistance

Fancy aerodynamic styling doesn't improve a car's speed significantly, but air resistance is still an important factor. To reduce air resistance, design your car low to the ground. A smaller cross section will create less air resistance.

Weight Your Car Well

Heavier cars are faster than lighter cars, so try to get your car as close to the maximum weight as possible. It's a good idea to plan for a way to adjust the weight on race day. That way you can add as much weight as possible, or you can remove excess weight without risking significant damage to your car. If you plan ahead, you can create a way to add small metal objects (e.g., screws, BBs, coins