

But Why: A Podcast for Curious Kids

How Does An Engine Work?

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[Jane] This is But Why: A Podcast for Curious Kids from Vermont Public Radio. I'm Jane Lindholm.

Each episode, we tackle a question from a curious kid and we help find an interesting person to offer an answer.

And you can send us your question by having an adult record it on a smartphone and then send the file to questions@butwhykids.org. This podcast has only been around for a couple of months and we've already gotten questions from at least 20 states and from kids who live in Switzerland, Mozambique, Australia, Israel and India. All of your questions are awesome. We wish we could get to them all. But in this episode, we're going to tackle a question from 7-year-old Sawyer in Hinesburg, Vermont.

[Sawyer] How does an engine work?

[Jane] Thanks for the question, Sawyer.

We know a good person to offer an answer.

[Ashleigh] It's pretty complicated to explain it without actually showing, but I can do my best and I hope that will be sufficient. My name is Ashleigh Belrose.

[Jane] Ashleigh teaches at a local technical center here in Vermont where our podcast is based. One of the things she teaches high school students is how to use a chainsaw. It's part of a forestry management course and Ashleigh says if you're going to learn how to use a chainsaw, ...

[Ashleigh] ... it's pretty useful to know how to troubleshoot a chainsaw if it's giving you some problems.

[Jane] So we enlisted her help in describing how an engine works.

[Ashleigh] An engine is basically a series of controlled explosions. I know that sounds really scary, but they're controlled. That's the good part. So, if you were to imagine yourself on a seesaw—I would expect that most people have been on a seesaw or they know how it works. If you're sitting on one end, you're going up and down, and the force that's driving you going both up and down are your legs. So your legs are the force driving you up and down.

Same thing in an engine. There's a cylinder which basically means like a hollow soup can shape, and there's a piston that's fitted inside that cylinder.

[Jane] What's a piston?

[Ashleigh] So, the piston is just the head that goes up and down, and it's airtight so nothing can get past it. So, it's fitted very snugly inside the cylinder, and it moves up and down.

The way it does is through those controlled explosions. And that, basically, moves it up and down the cylinder, and that movement of the piston is translated in different ways to the moving parts of the vehicle. And that's what makes the vehicle move—is that one or more pistons in the engine.

[Jane] So your vehicle has an engine, you know, if you're riding around in a car, that has an engine, a pretty powerful one. What else has an engine in it?

[Ashleigh] Well, if you think about anything that goes vroom. The one that I use most often is a chainsaw which is easy to explain because it only has one piston.

[Jane] How many pistons are in a regular car?

[Ashleigh] Regular car. So, if you think about V6 has six, and they're oriented in a V, so that's why they call it a V6 engine. The more cylinders you have, potentially, the more power your vehicle is going to have. So, if you talk about a V8 they even have a V12.

[Jane] But you mentioned that a chainsaw only has one piston, so it's a pretty simple engine?

[Ashleigh] Yes.

[Jane] Can you show us a little bit about how a chainsaw engine works?

[Ashleigh] Absolutely. So, chainsaw engine's going to be the two-stroke engine right here.

[Jane] At this point, Ashleigh pulled out a little model of an engine that she could use to demonstrate. We have a video of her explaining the engine, with the help of the model, on the *But Why* Facebook page, if you want to have a look at what she's doing.

[Ashleigh] There's the cylinder. The piston goes up and down inside the cylinder. So, when it goes down fuel gets sucked in. You see the fuel intake line here. With two-stroke, the intake and exhaust are the same, and the compression and combustion are the same. So, you have intake: as your in is coming in, it actually fills up and pushes the exhaust out right here, and then the compression happens because the piston moves back up into the chamber. So, the fuel that was just taken in is being compressed because the piston is airtight on either side of the cylinder, and then when it gets to the top, there is a spark plug that ignites. That's your power stroke.

It pushes the piston back down. And that's the power stroke. So then when it goes back down more fuel will come in, the exhaust from the last combustion will go out, and then momentum drives the piston back up to compression and combustion. And that's how the engine goes, very fast. That's slowing it down very much. But that's the small component between.

And that's how the fuel is used, how the gas is used in the engine to make those little controlled explosions. That's how a gasoline engine works.

The diesel engines are a little different because they do not need sparkplugs. That compression, from the piston moving up, is enough to combust the fuel on its own. Because it's hot enough, compression makes it so it's more combustible.. So, you don't need a spark plug. That's the main difference between a diesel and a gasoline engine.

[Jane] And then there are also electric?

[Ashleigh] Also electric

[Jane] What about... Sometimes you'll go—like there's a farmer's market near me where they have blenders—so, blenders have an electric engine — and, instead, you can do it by manual labor. You can ride your bike.

So, if you're doing it with your own body, is it the same idea that your body is the fuel.

[Ashleigh] Your body's the fuel which makes it more friendly because then you're not putting the exhaust from the engine out. It's just you.

[Jane] and all of your hot air and all of your breath.

[Ashleigh] All of the exhaust from your mouth, yeah, all the CO₂—carbon dioxide.

[Jane] you have some chainsaws here. Can you show me how you start one up and what's happening?

[Ashleigh] Absolutely. There are two ways to start a chainsaw safely...

[Jane] and probably the first thing we should say is, if you're a kid you shouldn't be starting a chainsaw without an adult anyway.

[Ashleigh] And you shouldn't be starting a chainsaw that is too heavy for you, that you can't control.

I'm a little teapot, short and stout, so I stick with the smaller saws myself. And never cut over your shoulder. There's a whole world up there that I don't know about. So, I'll stay close to the ground.

[Jane] OK. So, if you shouldn't pull-start it, meaning you shouldn't take the little handle that helps you jumpstart the engine, and then just drop the chainsaw to use the weight to start it, how should you start?

[Ashleigh] You should start one. Most people can do it. Putting the handle between their legs, they pull up on the choke. The choke controls how much fuel goes to the engine.

So, I'm putting the choke on; so that way, I can warm it up a little bit, And then I push my primer bulb which puts a little bit of fuel in there, just to prime it. And then, I will pull on my pull-start. But I can't actually start it with this between my legs. So, I actually put it on the ground. I'm not going to start inside. We can move outside for that. (*they move*)

So, I put it on the ground, After I do all that stuff, I will pull. You hear (*clicks, then pulses*). Did you hear it rev? So, then I know that it's going to start, so I'll push down my choke, get a little click, and I will prime it three more times, hit my decompression valve one more time and pull. (*engine starts*) Voilà!

[Jane] Let me say it again. Never try to start a chainsaw or any engine without an adult. And you'll have to wear plenty of safety equipment like a helmet, safety glasses, even

protective coverings for your pants, if you're going to use a chainsaw. And be prepared for the adults to say you're not old enough. They might be right. Chainsaws are dangerous equipment. Ashleigh teaches high school students. So, you might have to wait a few years.

But Ashleigh's not just a chainsaw instructor. She has actually won a chainsaw competition. She's a young woman and you might have heard her describe herself as a little teapot. She's pretty short. Unfortunately, she faces some discrimination from students and others who think a woman or a girl can't really be good with a chainsaw. Ashleigh says winning the competition her students were also participating in made a pretty big impression on some of the boys she was teaching.

[Ashleigh] I'm sure my first class will tell you that they listened to me very well all year, but the first month and a half was a little rough for me.

And by "little" I mean a lot and I was in a new role.

But they were sassy and a lot of them didn't listen the first time I'd ask. I'll put it that way. It was a little rough especially with me coming in with my bright pink Carhartt because, although I know how to do all the stuff, and I'm confident that I know how to do all the stuff, but they haven't seen me do it. I had to prove myself in a way.

[Jane] Winning the competition did that.

[Ashleigh] The best part was having all them literally pat me on the back, and give me a high five, and, then, being proud of me and also so blown away that—I believe they were blown away—that I was able to get first place. And after that they listened to me much, much better, much better.

[Jane] Since Ashleigh has some experience with people underestimating her or thinking she shouldn't be working with chain saws, she has some advice for kids out there who are facing resistance.

[Ashleigh] Do whatever you want to do and don't let anybody tell you not to. I can imagine girls or even little boys seeing like their parents or someone—a role model in their life — being worried about their welfare or your safety, and saying "it's really dangerous," or "your hands get really dirty," and "it's really hard on your body to do a job like that." But people have to do these jobs and, if it's what you want to do and something that you're interested in, even if you don't think you're necessarily good at it, or if you think it's really hard, looking at it—if you look at it and say "Well, that seems really hard"—just challenge yourself and do it. I live by a personal mantra: I only do things that I don't think I can do just to prove to myself that I can do them. I've gotten the master's degree in science. I've gotten my commercial driver's license, so I actually drive the bus for my program. I've gotten my motorcycle license. I bought my first motorcycle. I've done a lot of things and I only have done those things because I didn't think I could. And I wanted to prove to myself that I could.

I've had people make fun of me. And I think that kind of comes from me being so blond and so petite and so girly on the outside. But I can still do all the stuff just fine, and I can do it just as well as the next person. And if you compete with me in game of logging competition or training, I will beat you.

And I'm pretty confident about that.

[Jane] Ashleigh Belrose is an instructor at the Center for Technology in Essex, Vermont. Thanks again for the question, Sawyer.

But Why is produced by Melody Bodette and by me, Jane Lindholm, for Vermont Public Radio. Our theme music is by Luke Reynolds. Be sure to check us out on Facebook where we post pictures of our curious kids and videos like the one of Ashleigh explaining how an engine works. And don't forget to send us your questions. Get an adult in your life to record you asking your question on a smartphone. Tell us your first name, and how old you are, and where you live. And then send the audio file with your question to questions@butwhykids.org. We love feedback. If you liked the show or if you think there are ways we could make it better, let us know and we'd love it if you'd give us a review or a rating on iTunes. We'll see you in two weeks. Until then, stay curious.