

How a car works mechanically

YES Electric • a plain-language course for shop helpers and car buyers

First edition (October 2026). Prices and hours in this course are rough numbers for a 2008–2016 sedan and will change by car and by year. Treat them as a guide for deciding, not a quote.

A car is a machine that turns gasoline into spinning wheels. Here is the whole chain, from the gas tank to the road, in the order the power travels.

Step 1. Gas gets to the engine. The fuel pump in the tank pushes gasoline through a pipe up to the engine. Air comes in through a filter at the front. The engine's computer measures how much air is coming in and squirts just the right amount of gas into it through little nozzles called injectors. The mix is roughly 14 parts air to 1 part gas, like a very fine mist.

Step 2. The explosion. The engine is a block of metal with four (or six or eight) holes in it called cylinders. In each hole is a piston, which is like a metal can that slides up and down. The piston slides down and sucks in the gas-and-air mist. It slides up and squeezes that mist into a tiny space. At the top, the spark plug fires, the mist explodes, and the explosion shoves the piston down hard. Then the piston comes back up and pushes the burned smoke out the exhaust. Suck, squeeze, bang, blow. Every cylinder does that over and over, thousands of times a minute.

Step 3. Up-and-down becomes round-and-round. Each piston is hooked to a bent shaft at the bottom of the engine called the crankshaft. It works exactly like your legs on a bicycle. Your knees go up and down, but the pedals go around. The pistons go up and down, and the crankshaft goes around. The cylinders fire one after another so there is always one pushing, and the crankshaft spins smoothly.

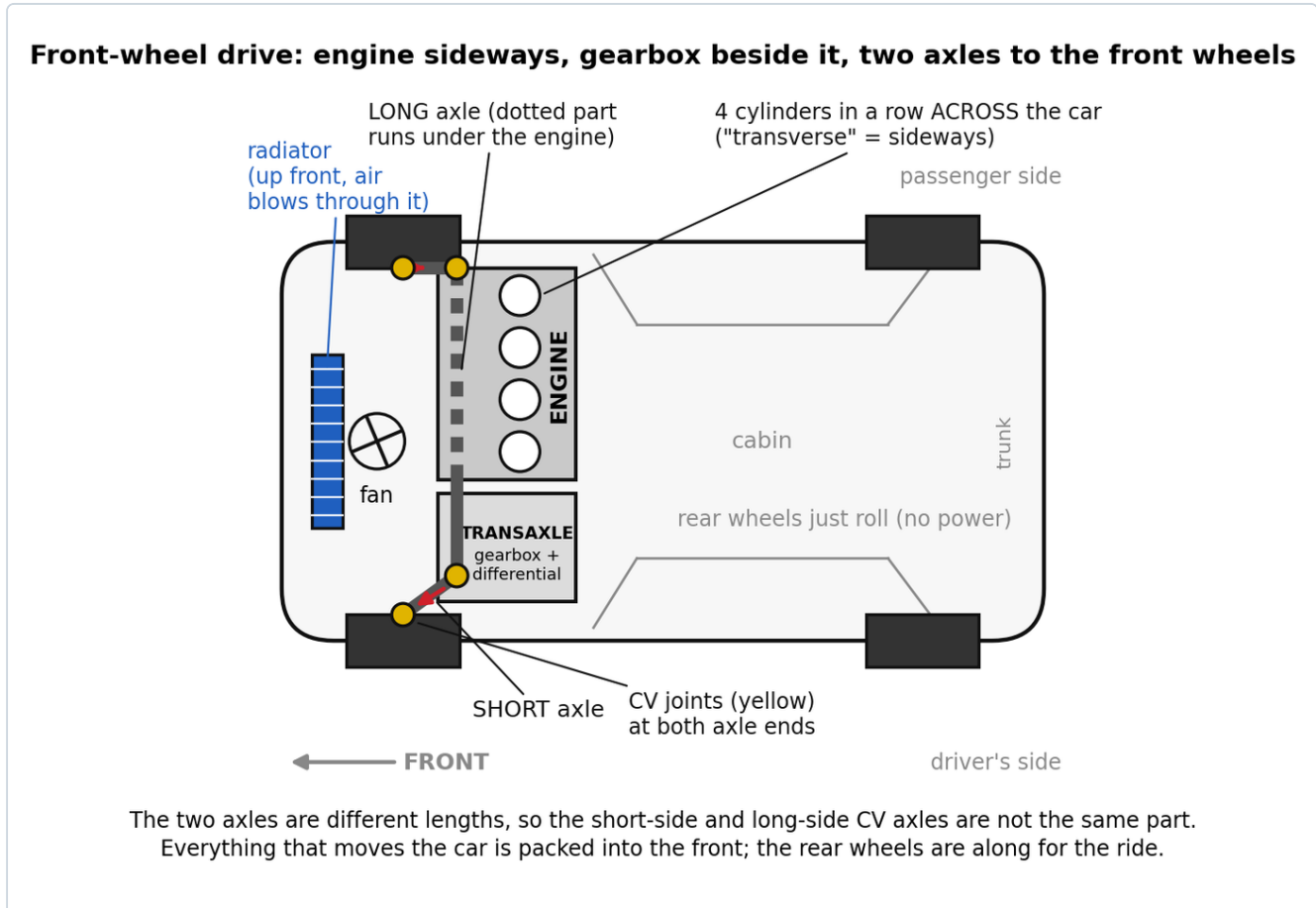
Step 4. The valves and timing. Each cylinder has little doors on top called valves. One opens to let the mist in, one opens to let the smoke out, and both stay shut during the squeeze and the bang. A second shaft called the camshaft opens and closes them. The timing belt or chain connects the crankshaft to the camshaft so the doors open exactly when the piston needs them to. If that belt breaks, the doors stay open while the piston comes up, and the piston smashes them.

Step 5. Keeping it cool and oiled. All those explosions make the engine hot enough to melt itself, so water runs through passages inside the block, the water pump keeps it moving, and the radiator at the front cools it in the wind. Meanwhile the oil pump sprays oil on every moving part so metal never rubs dry on metal. Lose the water and the engine overheats. Lose the oil and it seizes, meaning the parts weld themselves together and stop.

Step 6. The spinning gets to the wheels. The crankshaft comes out the back of the engine and goes into the transmission. The engine likes to spin fast, but the wheels need to spin slow

with a lot of push when you start off and fast with little push on the highway. The transmission is a box of gears that trades speed for push, just like the gears on a bike. Low gear is easy pedaling up a hill. High gear is cruising. An automatic picks the gear for you.

Step 7. Out to the tires. From the transmission, two axles run out to the front wheels (on most cars) and spin them. Each axle has a flexible joint at both ends so the wheel can bounce over bumps and turn corners while still being spun. The tires grip the road, and the car moves.

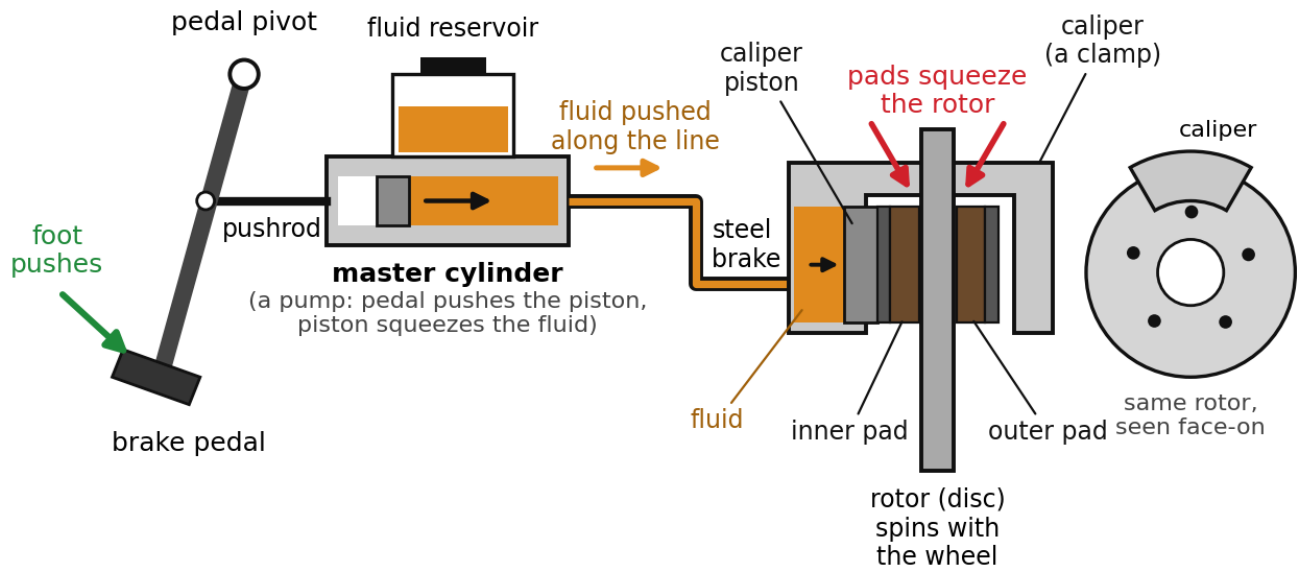


A front-wheel-drive car seen from above with the front on the left. The engine sits sideways with the transaxle beside it, and two CV axles of different lengths run out to the front wheels. The rear wheels get no power.

Drawing made for this course.

Step 8. Steering and stopping. Steering: the wheel in your hands turns a long bar called the rack, which pushes rods that point the front wheels left or right. A pump helps so it is not heavy. Stopping: when you press the brake pedal, you push fluid through tubes to each wheel. The fluid squeezes pads against a metal disc that spins with the wheel, and the rubbing turns the car's motion into heat. That is why brakes get hot and wear out.

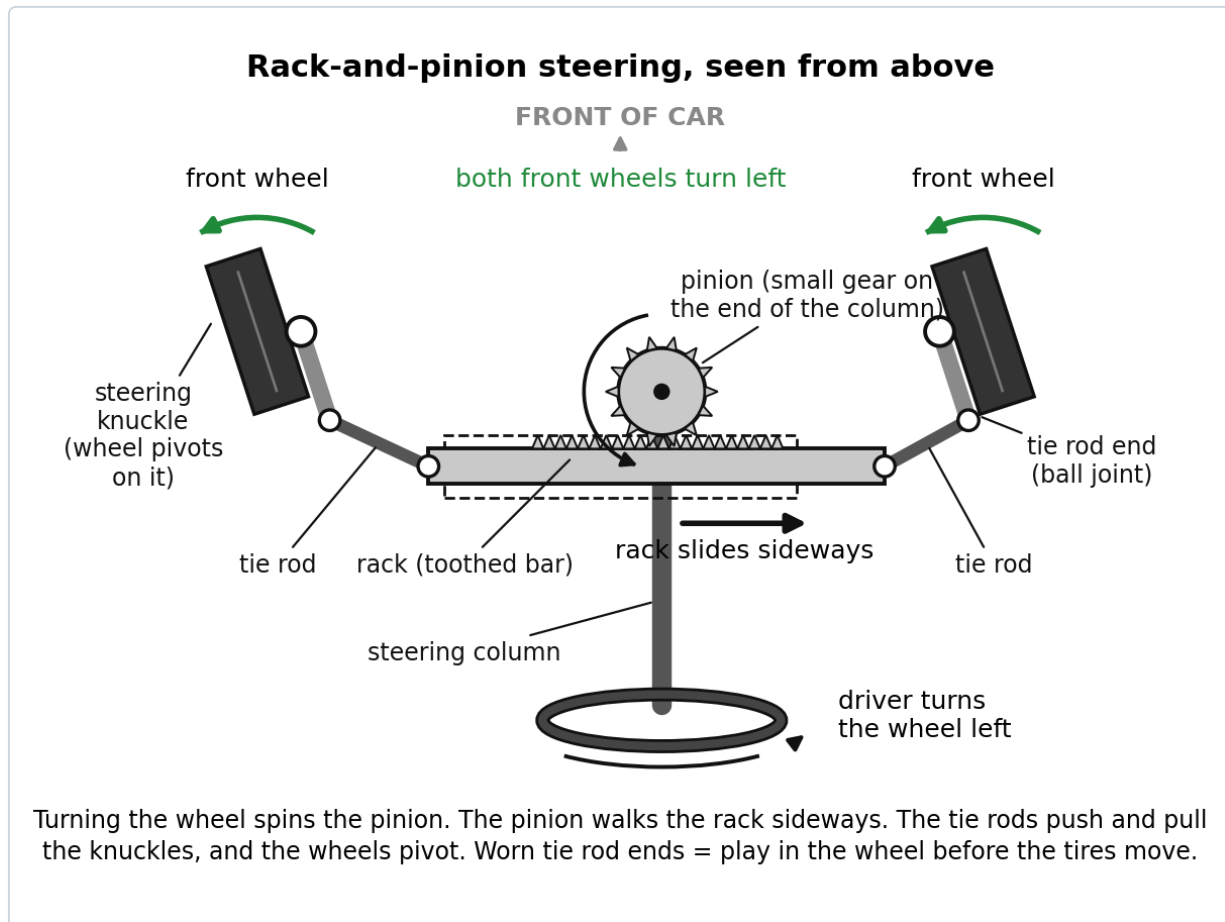
Brakes: your foot squeezes fluid, the fluid squeezes the wheel



Fluid cannot be squashed, so a push on the pedal comes out as a push on the pads, at every wheel.
Air in the line CAN be squashed. That is why a spongy pedal means air (or a leak).

The brake circuit from pedal to wheel: the pedal pushes a piston in the master cylinder, the fluid travels down a steel line, and the caliper piston squeezes the pads against the spinning rotor. Follow the orange fluid path.

Drawing made for this course.



Rack-and-pinion steering from above: the steering column turns a small pinion gear, the pinion slides the toothed rack sideways, and the tie rods push and pull the knuckles so both front wheels turn.

Drawing made for this course.

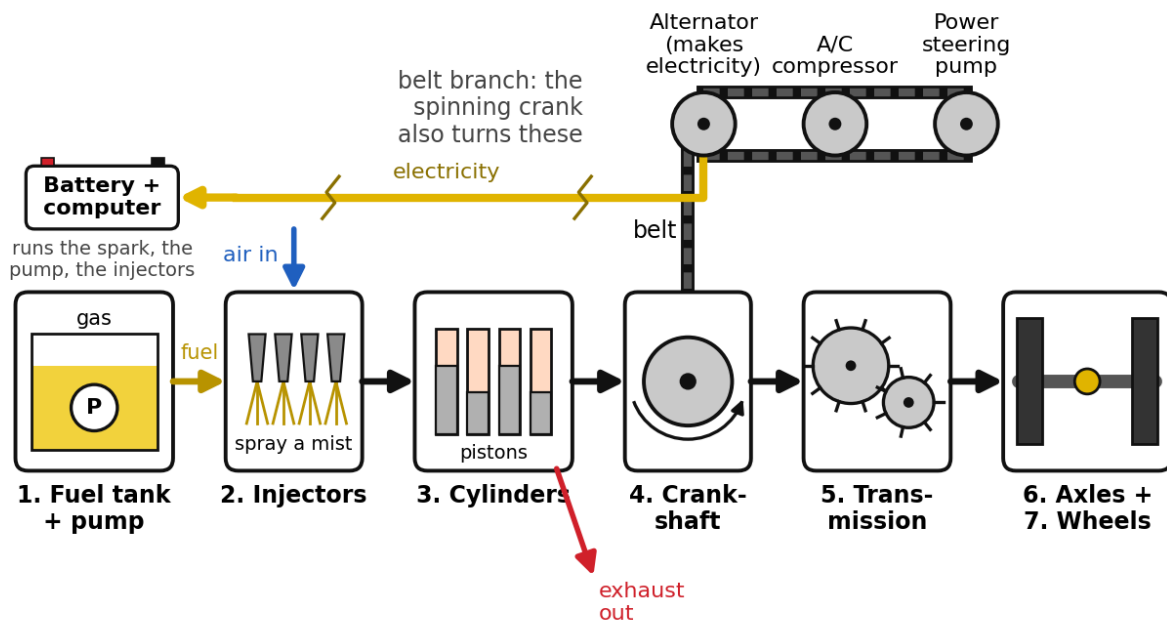
Step 9. Riding on springs. The whole car body sits on four springs, one at each wheel, so bumps go into the springs instead of your seat. Shocks and struts keep the springs from bouncing you around after each bump. Ball joints and control arms hold each wheel to the car while letting it move up, down, and side to side.

Step 10. The electrical side. The battery gives the starter motor one big jolt to spin the engine until it catches. Once it is running, the alternator, spun by a belt off the crankshaft, makes all the electricity and refills the battery. That same belt also spins the air conditioner pump and the power steering pump. A computer watches dozens of sensors and adjusts the gas, the spark, and the shifting every fraction of a second. When something reads wrong, it turns on the check-engine light and stores a code, and that code is what the scan tool reads.

Step 11. The exhaust. The burned smoke leaves the cylinders, passes through sensors that sniff it so the computer can tune the mix, goes through the catalytic converter that cleans it, through the muffler that quiets it, and out the tailpipe.

So the short version: gas and air explode in the engine, the explosions spin a shaft, the transmission trades that spin for the right amount of push, the axles spin the tires, and everything else on the car either feeds that chain, cools it, steers it, or stops it.

Power flow: tank to tires



Main line, left to right: fuel is pumped to the injectors, burns in the cylinders, spins the crank, the transmission picks a gear, the axles turn the wheels. The belt is a side road off the crank.

Power moves left to right: fuel from the tank to the injectors, burned in the cylinders, spinning the crank, through the transmission and axles to the wheels. Notice the belt branch off the crank that turns the alternator, A/C compressor and power steering pump.

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