FISHER SCIENCE EDUCATION

HEADLINE DISCOVERIES

Are we there yet?

We all look for the faster way to do things, and driving is no different. As you step on the gas pedal, your car accelerates briskly and you slowly sink into the back of the seat. You may get to your destination quickly, but you wish you could get there sooner. Better engine designs and lighter vehicles have made today's cars much quicker than their predecessors. Even with today's advances, they still aren't the bad boys of the pavement pounders.

Top fuel dragsters rule the blacktop. Although they aren't street legal, they are the pinnacle of getting from Point A to Point B in a big hurry. IHRA (International Hot Rod Association) Motorsports defines drag racing as "A straight-line acceleration contest between two vehicles over a measured distance. The objective is for one vehicle to get to the finish line first." In professional classes, the distance is one quarter-mile (1,320 feet, 402.3m). The typical grocery-getter has four doors, seating for five, and a 200hp engine. Top fuel dragsters have no doors, one seat, and a 6000–8000hp engine. An average family sedan will zip from 0-60mph in about 10 seconds. Dragsters do it in a mind-numbing 0.2 seconds. Quarter-mile times are very different, too. Family car: 16.0 seconds at 85mph. Dragster: 4.6 seconds at 325mph.

What has 6000hp, uses 20 gallons of fuel per mile, exerts anywhere from +7 to -11Gs on the driver, and is driven daily for a job that only lasts 4.5 seconds?

They both have four wheels

So what makes a dragster so much faster than the average car? It's all in the design.

Dragsters are made for going very fast, in a short amount of time, in a straight line. They weigh only 2200 lb. with the driver, which is several hundred pounds less than the family sedan. The engine is three to five times larger than what is under the hood of most cars.

Instead of gasoline, dragster engines run on nitromethane. The sedan averages around 30 miles per gallon. The dragster averages 20 gallons per mile. At $30 per gallon, that's an expensive commute! Nitromethane is an extremely volatile fuel. Simply put, gasoline burns and nitromethane explodes.

That explosion equals more horsepower. The reaction moves the pistons inside the engine with greater force. This power is transferred through the transmission to the differential and rear tires. The initial propulsion is called the launch. To maintain traction, dragsters require huge, smooth racing tires called slicks. Traction is crucial to propel the dragster down the track.

Along for the ride

Clay Millican, the winningest top fuel dragster driver in IHRA history, says the launch is "like the initial hit of a car crash, when a big and fast dump truck hits your car in the rear." Dragsters "are the fastest-accelerating piston-driven vehicles on earth. The space shuttle leaving (the launch pad) doesn't pull the G-forces these things do."

Dragsters will exert between 5 and 7Gs on the driver during the course of the run. "The car accelerates strongly the whole way down the track," according to Millican. Although drag races are determined by who reaches the finish line first, bragging rights can also be earned by a high top speed or a low elapsed time (ET), which is the time it takes to drive the quarter mile track. Millican owns both records in the IHRA, with a 4.566-second ET and a 326.63mph top speed.

What is it like to go 326mph? Is any scenery even visible, or is it just a blur? "It's amazing what you can see at that speed," Millican revealed. "We walk up and down the track before the race (to find irregularities in the surface). Sometimes you have to miss things on the track. The runs aren't always made straight." And you think dodging potholes at 60mph is difficult!

The lowdown on the slowdown

Going fast may be what wins races, but eventually the dragster has to stop. At over 300 miles per hour, the cars can quickly cover a lot of ground. To safely slow the dragsters, the drivers rely on really good brakes and a pair of parachutes. "Sometimes (stopping) is more exciting than the race," exclaimed Millican. "When you pop the chutes, you are stuck in a forward position against your seat belts. (The force on your body is rated) anywhere from –7 to –11Gs. If your belts weren't on tight, you wouldn't stay in the car."

Not many people will ever get the opportunity to drive a top fuel dragster. For a commute to work or a family outing, it isn't a very practical car. But isn't it nice to know that there's hope for that slow family sedan?

MORE!➤

RUBBER BANDS AND SPRINGS– POTENTIAL ENERGY CONVERTED TO KINETIC ENERGY

OBJECTIVES

Students will: Experiment with a Spring Motor Turbo Racer to learn about motion.

Collect, organize, graph and analyze data from the experiment.

INTRODUCE THE CONCEPT

Tell students that they will be testing how far the racer moves for each winding of the spring motor, but first, they have a few things to do to get ready.

BUILD AND EXPLORE

Learn how to count the number of windings:

Tell students that they will be measuring the distance traveled by their racer when the spring motor is wound to different tensions. Before they get started they need to know how much to wind the racer for each test.

Have students place a small piece of masking tape on the outside surface of one of the rear hubs, near the tire. Tell them that the tape will serve as a marker to help them count how many times the wheel turns as they wind the spring motor.

MARK THE TEST AREA

Have the students place a strip of masking tape on the floor to mark a starting line. Students can use a tape measure to measure how far their racers have traveled from the line. Remind students that whichever part of the racer sits on the starting line (such as the front wheel), the location of that same part should be taken as the stopping point.

TEST YOUR RACER WITH REPEATED TRIALS

Now students are ready to run their tests. Explain to students that they will measure how far the racer travels for one winding, two windings, and so on up to five windings for the spring motor racer.

For each number of windings, students should run three trials. Running repeated trails will help them make sure their results are reliable. Remind students to record their measurements on a data chart.

Encourage members of each group to take turns running the racer and making measurements. Once the measurements are completed, students should calculate the average distance traveled for each number of windings and record it on their chart.

Students can then prepare a line graph to illustrate their data.

MATERIALS:

- K'NEX Spring Motor Turbo Racer (see kit **HS83155** below)
- Tape Measure **(HS40654T)**
- Masking Tape **(HS17306)**

Powerful, dynamic tools for creative learning!

K'NEX* sets will challenge your students to solve real-world problems and apply their knowledge. The Forces, Energy and Motion set uses rubber band- or spring-powered vehicles to investigate the priciples of potential and kinetic energy. Includes 790 pieces, four spring motors, instructions, and an Educator Guide with eight lesson plans. Supports 12-16 students working in teams of 3-4.

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