SCENE: MACHINES EVERYWHERE

*Setting: Cooper, Olivia, and Hamza are hanging out in the library **working** on their homework.*

Hamza: I never have the energy to do my homework.

Olivia: I keep telling you, Hammy, that's an attitude problem, not an energy problem.

Hamza: I wish I had a **machine** to do all that **work** for me.

Cooper: If you had done your homework, you'd know what **work machines** really do. Hint: not homework.

Hamza: If you say so, Nerd Cooper. What is this "**work**" that **machines** do?

Olivia: I thought **work** was what energy did.

Hamza: *(sarcastically)* Is your name Nerd Cooper?

Cooper: Be nice. And she's right. **Work** is when you change how something is moving: speed it up, slow it down, change its direction or how it's spinning—like when you kick a soccer ball.

Olivia: See Hamza, **work** can be fun!

Cooper: Basically it can be any movement that lines up with a push or pull. I mean that's the science term "**work**." But in everyday English we use the word "**work**" for a lot of different things.

Hamza: So, scientifically speaking, if I kick a ball and the ball knocks over a chair, I did the **work** of making the ball go, and then the ball did the **work** of knocking over the chair?

Cooper: Hmmm...

Olivia: I think so, Ham. You had energy from eating food, and then you **exerted** a **force** when you kicked the ball. Your kick gave energy to the ball, and the ball used the energy to knock over the chair.

Cooper: It's cool to think about how something simple like kicking a ball has all these things going on.

Hamza: *(daydreaming)* I'm a **machine** on the soccer field.

Olivia: Well, they actually don't allow **machines** on a soccer field, but they do in a hockey rink.

Hamza: You mean the Zamboni **machine** that smoothes the ice?

Cooper: Actually, she's talking about the hockey stick.

Olivia: And you would know that if...

Hamza: I know! I know! If I did my homework. Wait, how is a stick a **machine**? It doesn't take gas or electricity. That can't be right.

Cooper: It is a **machine**! The way to figure it out is to think about whether it can transmit **work**.

Olivia: Coop, did you get the thing on the homework about pretending your pencil was a windshield wiper?

Hamza: What!? Oh great. Now I'm curious. I can't believe I'm curious about homework. What have you two done to me?

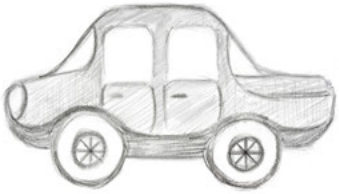
Cooper: Here. Try it. Hold your pencil in front of you by the end and shift it back and forth like a windshield wiper. A small motion of your fingers causes a large motion at the other end of the pencil. That means it's a **machine**. A **lever** to be exact.

Hamza: Oh, that's kind of cool. I see the connection to the hockey stick. A player moves the stick at one end, but the stick moves a lot more at the other end and **applies force** to the puck so it goes faster than the hand moves. Wham!

Olivia: I guess golf and baseball are similar. They use **levers**. But I know people think of **machines** as things like cars or elevators. Not sticks.

Cooper: Well, it's not that cars and elevators aren't **machines**. They're more like a bunch of **machines** put together into a complex **machine**. Look:

Cooper sketches a car and an elevator.



Hamza: I get the wheels on a car, but you mean when I'm in an elevator it's held up with a string?

Olivia: A strong string. More like a metal cable. And the pulley is like a version of the wheel.

Hamza: Stop! I don't think I want to know all this stuff. What if the cable breaks?

Cooper: It won't break if you respect the **load** limit. It's posted inside the elevator.

Olivia: Even if you overload an elevator, I bet it would be okay. Engineers and scientists study **specifications** carefully for safety.

Hamza: They better, or else I'm taking the stairs!