FIRST LEGO LEAGUE - Ontario

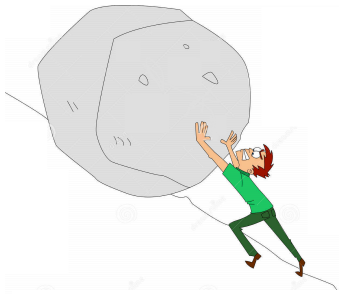
Activity Sheet	
Gr 8 - Lesson #6	Stop at Line – Signal to Work
Date:	Name(s):

Check That I'm Done ☑		
☐ Commented on my code	☐ Modify it task	☐ Coding Challenge

Learn

The scientific definition of Work is very specific. It is the result of when a **force** moves an object a certain **distance**. This always takes energy to do.

Lots of things cause resistance to movement such as gravity, friction, springs, and magnets. All are forces that need to be overcome. The stronger you have to push or pull against these forces and the farther you do it for, the more work you have accomplished. Pushing a bolder up a hill is a good example. You see the result of your work if you let the bolder rolls back down the hill, unleashing the built up energy you gave it.



It's also very important to define what object the work is being done to. The force being applied to the bolder, and the distance it moves would tell you the work being done to the bolder by you. But work is also being done on you, and the ground, and the air etc.

Work is calculated mathematically by the following formula:
Work = Force x Distance (Units are Joules = Newtons x Meters)
Specifically the work done an object is equal to the force you applied to it,

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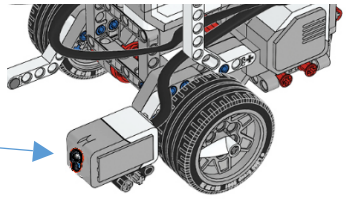
multiplied by the distance for which the force was applied. In the above example the length of the hill, times the pushing force of the person. This formula makes sense since each unit of distance comes with it some force that made it happen. It also has some important consequences for when the force *or* distance equals 0, so does the work.

Remember work is an accomplishment, not an effort. Just because you pushed on something, or something is moving does not necessarily mean work is being done on that object. You pushing on a wall for 5 minutes, or an asteroid coasting through space are good examples of almost no work getting done.

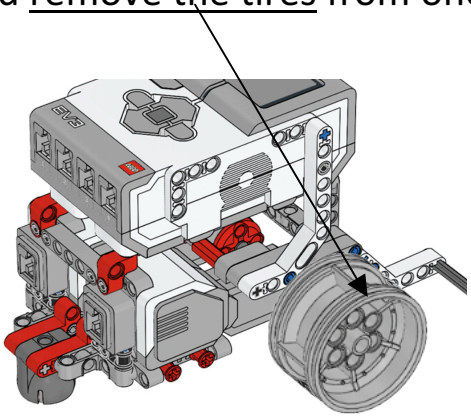
Predict and Plan

Because the EV3 robot is limited by friction, it is only able to pull at 3.5N of force at all times (with the tires on) and only 0.75N with the tires off, regardless of the power setting. (Different floors will change this slightly, if you have access to force meters check the number for yourself).

Rotate the front colour sensor so it is facing forwards and not down.



Join with another group and remove the tires from one of the robots.



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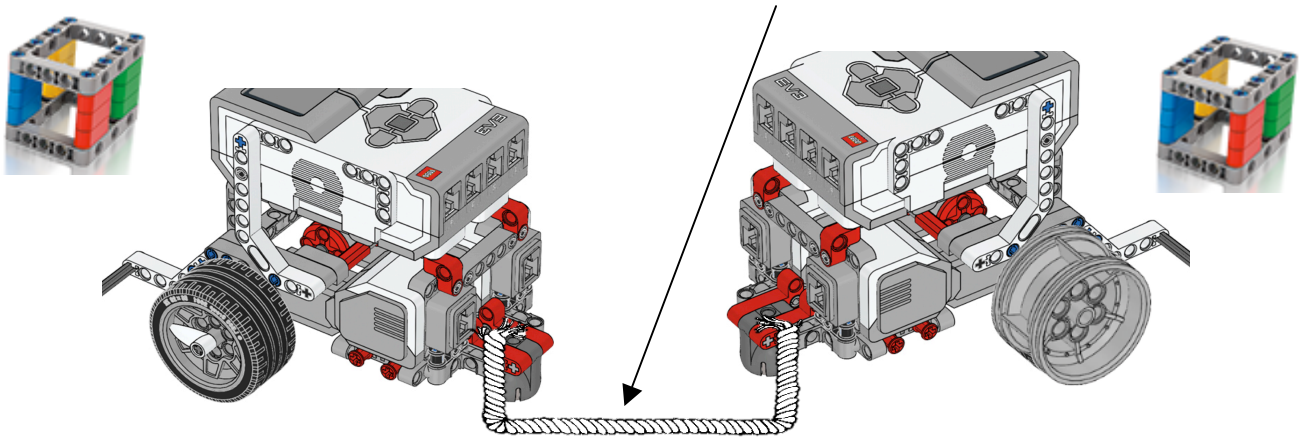
Attach your robots together back to back as shown using string or tape.



Lastly, run a piece of masking tape along the floor so you can mark off how far the robots travel. Make a dark line, marking the center of the two robots.

Demonstrate/Design/Discover

- ✓ Program your robot to use your cuboid like a traffic light.

- ✓ Your robot will wait until it sees a green signal in front of it, then it will pull at full force (100% power) until it sees a red signal (where it will then stop abruptly).

- ✓ Use this set up to conduct 3 tests. Start the robots in the center of your tape line and have them both run counting to 5, then 10, and

lastly 15 seconds (approximately). Make sure to coordinate with the other 'signal operator' so both robots start at about the same time.

- ✓ Carefully mark and measure the distance the robots travelled.
- ✓ Run 3 more tests by only having the tire-less slippery robot run (letting the other robot sit there).
- ✓ Again, carefully mark and measure the distance the robots travelled.
- ✓ Use the table in the "Record" section to keep track of your results.

Tips: Put your program in a loop to help make multiple tests happen quickly and easily.

Record

*Fill in the charts below from your tests, and calculations (be careful of **units**)

Trial	Distance Traveled (m)	Work Done on the Tire-less 'slip-bot', by the Tired 'grip-bot'.
1		
2		
3		

Trial	Distance Traveled (m)	Work Done on the Tired ‘grip-bot’ by the Tire-less ‘slip-bot’.
4		
5		
6		

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