First Lego League Curriculum - Ontario

Activity Sheet	
Gr 5 - Lesson #3	Move Object – Long Arm Lifter
Date:	Name(s):

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

Learn

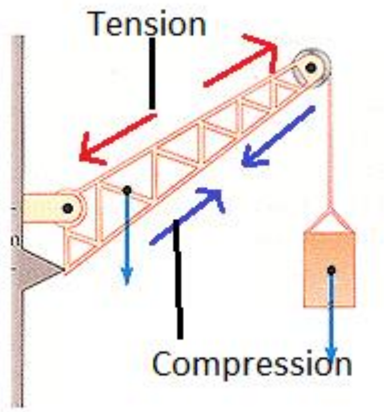
When designing and building any structure meant to support weight, you must carefully consider the forces involved in order to make sure it's going to work.

You must not only know how large the forces will be, put in whether they are squeezing forces (compression) or pulling forces (tension).

Most materials and shapes are only good at withstanding one or the other, but not both.

Take a crane for example:

The top of the crane is being pulled by the weight so it is in tension, while the bottom is being squeezed and is in compression.



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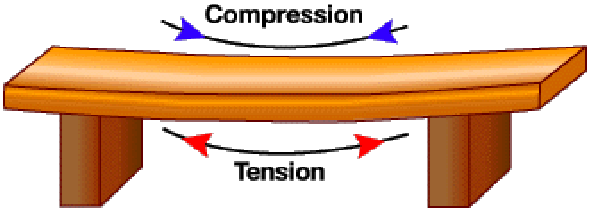
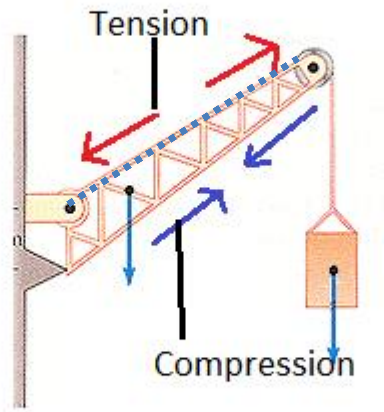
The opposite is true for bridges however. Where the top is in compression, and the bottom in tension.



The top of the crane out be replaced by a strong rope and would still work. The bridge would not.

This shows us how important it is to think about the direction of forces.



Predict and Plan

There are many ways to construct a structure, but with all of them, you must figure out which parts of your structure are in tension, and which are in compression. Below is an oversimplified example. Take a guess at which beams are in compression and which are in tension (label it below).

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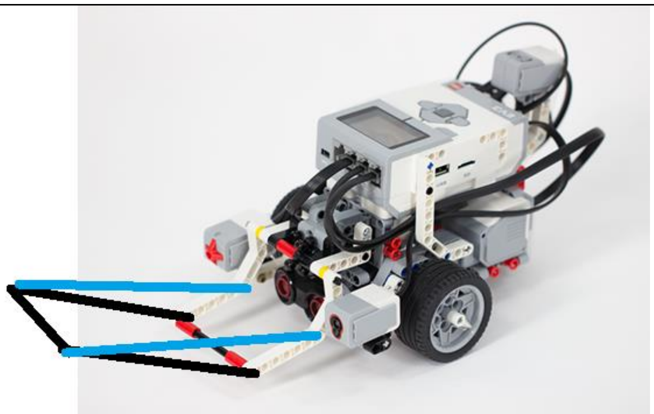

Demonstrate/Design/Discover

- ✓ Now that you've had experience with the coding activity, and using the front motor. It's time to test the limits.
- ✓ Design an arm out of every day materials that is capable of lifting up the cuboid  from as far away as possible.
- ✓ There must be, somewhere on your structure, a string that is actively in tension.
- ✓ The cuboid is fairly light, and thus the motors will likely be strong enough to lift it at quite a large distance. It only needs to hold and lift the cuboid for a moment (unless otherwise stated), so make sure your teacher is watching the final test.

Tips: Good every day materials include cardboard, used containers, string, tape, and coat hangers.

…a playground for innovative minds

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Record
Sketch your final result below on the robot given. Also include: 1) Labels describing all major materials 2) Labels describing which parts are in tenion or compresion.

Length of arm in cm: _______________ Successful? Yes or No?

Questions	
Question 1 Science	Did your arm work as planned? Did anything surprise you?
Question 2 Science	How would the forces on the arm change if we used a heavier load?
The forces would increase.	
Question 3 Science	Now that you've tested a design, what changes would you make if you were tasked to build another design?
Question 4 Coding	Does your design resemble any existing structures, such as cranes, bridges, fishing rods, towers or anything else?

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Question 5 Math	What materials proved to be very useful? Explain why.

Extension Coding and Science	If you’re structure was successful see how much weight can hold. If not, try again! Find the weak point of your last creation and strengthen it with braces or better materials.