

First Lego League Curriculum - Ontario

Activity Sheet	
Gr 7 - Lesson #1	Building and Setup – Think Inside the Box
Date:	Name(s):

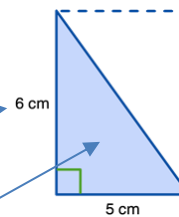
<b>Check That I'm Done</b> <input checked="" type="checkbox"/>		
<input type="checkbox"/> Commented on my code	<input type="checkbox"/> Modify it task	<input type="checkbox"/> Coding Challenge

**Learn**

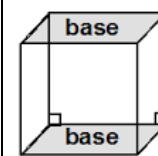
Packaging is a very important part of creating a product. On one hand, the package needs to be large enough to protect the product (and show it off), but on the other hand, packaging materials can be very expensive. Here's some of the math behind packaging.



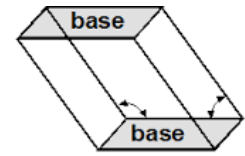
How much packaging you use is determined by the surface area of the box. The surface area of a rectangle can be found by multiplying the Length by the Width.



A triangle is half of a rectangle so it's formula for surface area is  $(\text{Length} \times \text{Width}) \div 2$ .

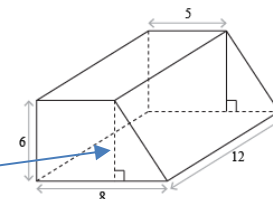


Right prism



Non-right prism

The volume of a right prism is fairly easy to find. You simply take the area of the base (LxW) and then multiply it by the height (LxWxH). This works for any right prism (that is a prism with walls at right angles). For more complex shapes, you can just add the prisms together.





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**Predict and Plan**

Brain storm by writing down at least 5 jot notes explaining what makes good packaging.

Think about some great packages you've seen in the past. Reflect on the effectiveness of the design, how secure it is, how wasteful it is, did it draw you in, did it educate you, was it interactive?

Good packaging is...

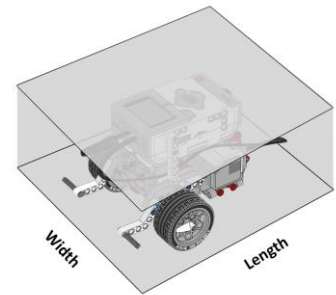
1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

**Demonstrate/Design/Discover**

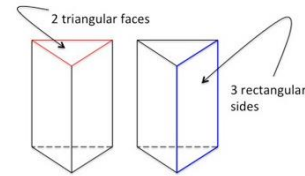
- ✓ It is going to be your job to investigate and then design a great package for your groups EV3 robot.
  - ✓ First, measure your robot carefully to determine some possible boxes below. **Show your work.**
1. A) What is the minimum volume of a box your robot could fit inside if it was a simple rectangular prism?

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B) What's that boxes surface area?

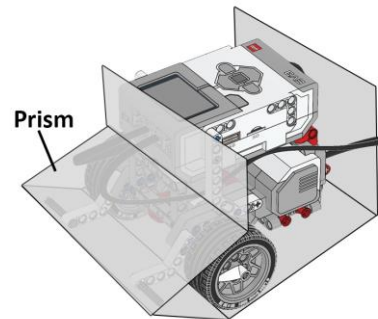


2. A) What is the minimum volume of a box your robot could fit inside if it was a simple triangular prism?



B) What's that boxes surface area?

3. Create a box with the smallest possible volume, using 2 (or more) right prisms. Hint: Start with the smallest base possible.



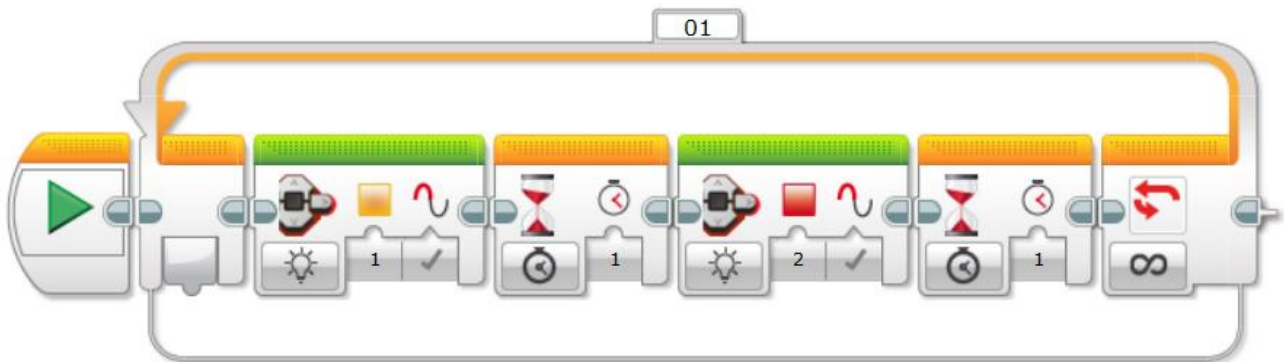
A) What's it's volume?

B) What's it's surface area?

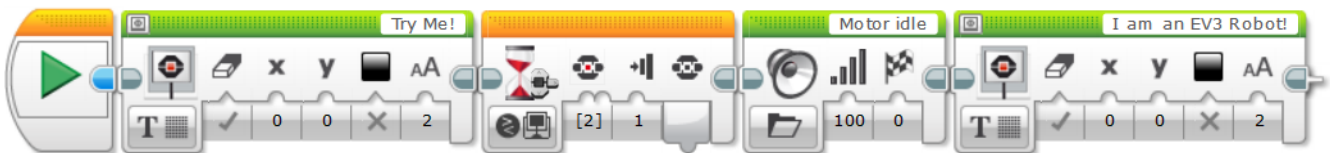
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✓ Pretend you're working for Lego and want to show off this new, pre-built EV3 robot in stores. You will do this by creating a great package and program to capture people's attention. You are going to be constructing this out of paper. You can either choose to minimise the packaging materials OR you can minimise the space it takes on the shelf. The choice is up to you, but be prepared to explain your thinking. Your package MUST also:

1. Cover the entire robot except for a window so they can access the buttons and see the screen.
2. Attract people to your packaging using flashing lights (sample below)



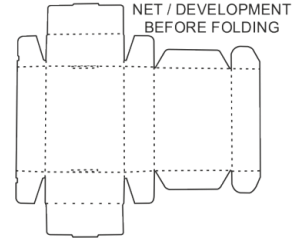
3. Have a try me now button on the brick, which responds with sounds (sample below)



4. Have a description of the robots features and abilities, describe the input and output ports, what's included in the packaging, any warnings, or anything else you feel would help people understand what is inside.

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Tips: It's a good idea to draw on your package BEFORE final assembly. Divide the work fairly amongst your group. Your packaging will need to be assembled with scissors and tape. Using tabs can make it easier to put together.



### Record

What is the exact volume and surface area of the package you designed? Don't forget to subtract the hole for the screen. Show all of your work. Use labels for each calculation.

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Questions	
Question 1 Math	Does less volume always mean less surface area? Explain with an example.
No, if the shape has many sides (but is smaller) it can still have tons of surface area.	
Question 2 Math	How many of your packages can you fit on a shelf that is 45cm tall, by 60cm deep, by 100cm long. (Answer should be a whole number).
Question 3 Math	If packaging cost \$0.05/cm <sup>2</sup> how much money does one of your packages cost?
Question 4 Science	Take an educated guess at the prism shaped packages that would have the largest and smallest surface area (assuming its only one prism).
Triangular prism would be the most, and cylinder would be the least. (The more sides, to the base, the smaller the surface area).	
Extension Coding and Science	<p>Calculate the surface area to volume ratios of all the boxes in the activity.</p> <p>What 3D shape do you think has the lowest surface area to volume ratio?</p> <p>Try and create a box with this shape, put the robot status light on and turn off the classroom lights. What does it look like? (Hint).</p> <p>A spherical lantern</p>