

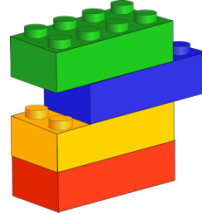
LEGO STEAM CHALLENGE– HOW DOES THE DISTANCE BETWEEN A LIGHT SOURCE AND AN OBJECT AFFECT SHADOW SIZE?

In this activity, you will be building different objects out of Lego and then examining the shadows that they create in order to answer the question:

How does the distance between a light source and an object affect shadow size?

MATERIALS YOU WILL NEED:

- Lego
- Paper
- Flashlight
- Ruler
- Pencil
- Tables for task 2 and task 3, grid paper, and conclusion paper (if you have a printer)



TASK 1– BUILDING

1. Begin by building 3 different lego towers/buildings/animals/robots (You pick the theme!).
 - a. They must be free-standing (that means you can stand them up without holding them)
 - b. They can be different shapes and sizes
 - c. Try not to make them too big (or it may be hard to examine the shadows you create). I would say no more than 15cm tall and 15cm wide.

Here are some examples:



TASK 2– MAKING OBSERVATIONS

1. Begin by measuring how tall all your lego items are and record on the recording sheet OR on a table that you create.
2. Explore the shadows created by shining the flashlight on your lego.
 - a. Try shining the light from one side.
 - i. OBSERVE: Where is the shadow formed? What does it look like?
 - b. Shine the light from the other side.
 - i. OBSERVE: Where is the shadow formed? What does it look like?
 - c. Repeat the above processes shining the flashlight from the front and then from the back of your lego.
 - d.

ANY RECORDING SHEETS REQUIRED ARE AT THE END OF THIS DOCUMENT.

TASK 3- CHANGING SHADOWS

For this activity, you may need to try a few different spots to find the perfect spot where you can see your shadows well enough. A darker space will be better.

1. Take a piece of paper and draw an “x” on it. This will be the spot where you will place your lego during the next steps. Line up a trail of paper behind the paper with the “x”. This is where your shadows will be formed.
2. Take one of your lego creations and put it on the “x”.
3. Measure 50cm away from your lego and put your flashlight there.



4. Turn your flashlight on and then measure the length of the shadow created. You may need a hand with this. **RECORD** the length of the shadow formed on your table.
5. Keep your lego on the “x”. Move the flashlight to 40cm away from your lego. Turn the flashlight on and measure the shadow formed. **RECORD** the length of the shadow formed on your table.
6. Repeat the above steps with the flashlight at 30cm, 20cm, and 10cm. Be sure to **RECORD** the length of the shadow formed each time.
7. After you have finished measuring all shadows for your first lego object, you may repeat the above steps with your other lego builds.

DISTANCE BETWEEN FLASHLIGHT AND LEGO (CM)	LENGTH OF SHADOW (CM)		
	LEGO BUILD 1	LEGO BUILD 2	LEGO BUILD 3
50CM			
40CM			
30CM			
20CM			
10CM			

TASK 4- LOOKING AT THE DATA

For this next part you have the option of creating a bar graph to show your data **OR** going onto excel to create a bar graph. I recommend just graphing the data for one of your shadows (single bar graph).

NOTE: If you would like an added challenge, you can create a multiple bar graph instead to show the length of each of your shadows on one graph (For example, if you measured shadows for 3 different lego objects; you would have three different bars at 10cm, three different bars at 20cm...etc. Each bar would be a different colour and you would need to include a legend).

1. Watch the video below to learn a bit about bar graphs.

Flocabulary Bar Graph Song <https://www.youtube.com/watch?v=kx4K4knUJME>

OPTION A: BAR GRAPH (USE THE PAPER PROVIDED OR USE LINED PAPER AND A RULER TO DRAW YOUR BAR GRAPH)

EXAMPLE BAR GRAPH- YOU MAY NEED TO ADJUST THE NUMBERS FOR THE LENGTH OF SHADOWS DEPENDING ON YOUR RESULTS.

LENGTH OF SHADOW (CM)	35CM					
	30CM					
	25CM					
	20CM					
	15CM					
	10CM					
		10CM	20CM	30CM	40CM	45CM
	DISTANCE BETWEEN FLASHLIGHT AND LEGO					

OPTION B (ADVANCED) : CREATING A BAR GRAPH ON EXCEL

WATCH THE FOLLOWING YOUTUBE VIDEO TO LEARN HOW TO CREATE A BAR GRAPH IN EXCEL.

<https://www.youtube.com/watch?v=X7O6WQl62Ks>

USE THE FOLLOWING DATA TABLE SET UP TO ENTER YOUR DATA INTO EXCEL.

DISTANCE BETWEEN FLASHLIGHT AND LEGO (CM)	LENGTH OF SHADOW (CM)
50CM	You will enter your results for each distance between the flashlight and shadow here.
40CM	
30CM	
20CM	
10CM	

TASK 5– MAKING A CONCLUSION

USE THE QUESTIONS BELOW TO HELP YOU WRITE A PARAGRAPH TO EXPLAIN WHAT YOU LEARNED ABOUT SHADOWS.

HOW DID THE SHADOWS CHANGE AS YOU MOVED THE FLASHLIGHT CLOSER TO THE LEGO?

WHAT CAN YOU CONCLUDE ABOUT SHADOW LENGTH AND THE DISTANCE AND OBJECT IS FROM A LIGHT SOURCE?

DID THE SHADOWS FOR ALL OF YOUR LEGO CHANGE IN THE SAME WAY? IF NOT, WHAT WAS DIFFERENT? DOES THIS DIFFERENCE MAKE SENSE TO YOU? EXPLAIN

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RECORDING SHEETS

TASK 2: DATA TABLE TO RECORD HEIGHT OF EACH LEGO BUILD.

LEGO BUILD (YOU MAY NAME THESE IF YOU ' D LIKE)	HEIGHT OF LEGO BUILD (CM)
1	
2	
3	

TASK 3: DATA TABLE TO RECORD LENGTH OF SHADOWS

DISTANCE BETWEEN FLASHLIGHT AND LEGO (CM)	LENGTH OF SHADOW (CM)		
	LEGO BUILD 1	LEGO BUILD 2	LEGO BUILD 3
50CM			
40CM			
30CM			
20CM			
10CM			

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TASK 4: BLANK GRID PAPER FOR BAR GRAPH

