



Engineering Design

Engineering is about solving challenges by building something new or repurposing something that is already in existence. Youth love engineering activities because they are hands-on and they can use their imagination. In order to translate the activity into a learning opportunity which can be applied anywhere, including the school day, please select on process, either the Solution Fluency Model or the Inquiry Model to ensure youth understand the process of learning, rather than simply jumping into a task because it is fun and exciting. Be sure they follow the process you select and you can see evidence of each of the steps BEFORE they have the supplies and are randomly trying to meet the challenge without being intentional in their solution finding process.

Marble Roller December 7, 14, 21, 28

The Engineering Design Challenge for December will take all five days. It is an iterative project and once the original marble roller is created, youth will add to the design a new challenge. This will require them to revise their plan. Each addition will require youth to go back to the Inquiry Design model and figure out how to incorporate this new addition into the existing model. It is not about starting over, it is about adding to it.

December 7	December 14	December 21	December 28
Create a marble roller which will take a marble from the start of the marble run to end in a cup	Add a tunnel to the original marble roller	To the original marble roller to which you have added a tunnel. This challenge is to add a “hill”, which means there must be an incline and a decline either before or after the tunnel.	Adjust the marble roller—adding to or removing from your existing marble roller, so it will take exactly one minute from beginning to end

Possible Criteria for Success: materials they select, timing for each of the challenges—time from start to finish, incline needed to have marble go up and down the hill, marble does not go off course

What you will need:

Invite youth to bring any recyclable items from home (water or soda bottle lids, plastic containers like for yogurt, other items they think they may need to meet the challenge. Save these items if they are unused to add to your maker space supplies.



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- Paper plates—heavier ones are better, multiple sizes
- Card stock
- Glue
- Painter's tape
- Marbles
- Crayons, colored pencils
- Straws
- Scissors (may not be altered)
- Craft sticks
- LEGOS
- Wooden blocks
- Any supply youth bring or request which you can easily accommodate—add to your Maker Space supplies

What you will do:

1. Assemble the teams. Review the Inquiry model which they are to apply in the planning and execution of this challenge.
2. Explain their task is to use the materials they select to create a way to cushion the balloon's fall so it will not pop. Place additional Criteria for Success you select here or have the children self-select the Criteria for Success.
3. Have teams complete an index card with the Criteria for Success.
4. Explain the winning teams will be the teams that can create a solution to meet the Criteria for Success of the challenge.

Below, you will find pictures of Marble Rollers which have been built by youth.



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Debriefing

When the challenge is finished it is important to debrief the engineering process with the youth. The debriefing process begins with a quick review of what was done. Since this is a group project have the group review.

The second step is to reflect on what has been learned. Here are some questions which may help youth reflect.

1. What question did we answer or problem did we solve?
2. How did we work meet the criteria for success?
3. Did the criteria place constraints on materials, time or cost?
4. In what ways did our drawing guide our work?
5. How could it have been more helpful?
6. What data did we collect?



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7. In what ways was it the data needed?
8. What other data could we have collected?
9. What did we learn from the data we collected?
10. When we look at our solution compared to the solution of others, which do we think more successfully met the criteria for success and meet any constraints on the solution?

Step three is to determine how the information gained in this Design Challenge can be used during the next one.