

Paper Ball Run Challenge

Name: _____

Instructions

Date: _____

Overview: in this contest, you will try to build the slowest paper ball run. Your final score depends on both the amount of paper you use and how long the ball run takes. Watch this video to learn about the project: <https://sbgo.org/fluor-challenge-2022-video>

Materials

You can only use the types and amounts of paper and tape described in the video to build your ball run. You can use scissors, a ruler, a pencil, a tape measure or meterstick, and a stopwatch as you build and test your ball run.

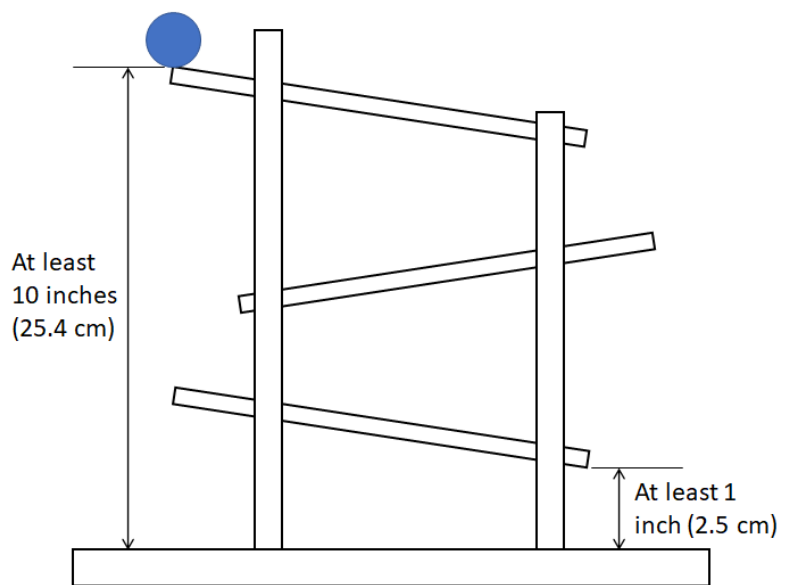
Scoring

Your score is calculated using this equation:

$$\text{Final score} = (4 \times \text{time in seconds}) - (\text{number of sheets of paper})$$

Rules

1. The run must stand on a flat horizontal surface like the floor or a table/countertop/desk/piece of cardboard. It can be taped to this surface. It cannot be taped to or supported by anything else (the ceiling, walls, furniture, a person, etc.).
2. The run must have both an *entrance point* and an *exit point* for the ball.
 - a. The **entrance point** is where the ball is placed into the run. It must be at least 10 inches (25 cm) above the supporting surface.
 - b. The **exit point** is where the ball exits the run. It must be at least 1 inch (2.5 cm) above the surface.
3. The ball cannot be modified in any way or have anything attached to it.
4. The ball must be gently placed into the run to start. It cannot be dropped from above the run, thrown, flicked, etc.
5. Time starts when the ball is placed in the run and ends when the ball exits the run.
6. After the ball has entered the run, you cannot touch the ball or the run, or influence their motion in any way (e.g., by blowing on the ball, shaking the table, or tilting the run, etc.).
7. If the ball gets stuck in the run, you must remove the ball and start over. A ball is considered stuck if it does not move for more than 10 seconds.



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Name: _____

Student worksheet

Directions: Fill out this worksheet as you work on your project.

1. **Background research.** Use this space (and extra paper if necessary) to write down your background research.

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Student worksheet

2. **Design.** Use this page to draw design ideas for two different paper ball runs. Use the back of the page if you need more space.

3. **Compare.** Compare your two designs. Which one do you think will score higher in the contest? Why? Write down your answer.

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Student worksheet

4. **Share.** If you are working in a group, share your ideas with others. Talk about which ball runs will do the best in the contest. Decide as a group what kind of ball run you will build. You can combine ideas from different people to make a single ball run.
5. **Build.** Once you have decided on a design, build your ball run. You might need to make some changes as you build. That is OK.
6. **Test.** Test your ball run by gently dropping the ping pong ball into the entrance. Write your answers to these questions after you test it.
 - a. Did your ball run work like you thought it would?
 - b. Did the ball get stuck at all? If so, why?
 - c. Did any parts of your ball run break or not work like you wanted them to? If so, why?
7. **Iterate.** Your ball run probably did not work perfectly on the first try. That's OK! You might need to repair or improve it and try again. Based on your observations in step 5, what changes could you make to your ball run to improve it?
8. **Test again.** Once you have repaired or improved your ball run, test it again. You can keep improving it as much as you want (as long as you have time).

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Student worksheet

9. Final design.

- a. What works well about your final design?

- b. What could you improve if you had more time to work on your ball run?

10. Calculate your score.

- a. How many pieces of paper did you use in your final ball run design? Round up to the nearest whole sheet. Paper used in earlier designs does not count. _____

- b. Use a stopwatch to measure how long it takes the ball to go from the entrance to the exit of your ball run.

Number of minutes: _____

Number of seconds: _____

- c. Convert this time to seconds.

$$(60 \times \frac{\text{number of minutes}}{\text{number of minutes}}) + \frac{\text{number of seconds}}{\text{number of seconds}} = \frac{\text{total time in seconds}}{\text{total time in seconds}}$$

- d. Use this equation to find your final score.

$$(4 \times \frac{\text{total time in seconds}}{\text{total time in seconds}}) - (\frac{\text{number of sheets of paper}}{\text{number of sheets of paper}}) = \frac{\text{final score}}{\text{final score}}$$

Scores can be submitted with up to two decimal places.