



Marble Rush™ Corkscrew Rush Set™ Random Challenge

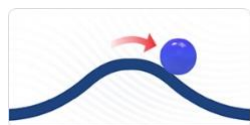
This Marble Rush™ challenge explores the concept of randomness and how it makes things unpredictable. The Green Vortexes, Corkscrew Tumbler, and Yellow Marble Tray are fun components that make exploring this concept a great STEM investigation.



Marble Rush™ Golden Rules of Physics



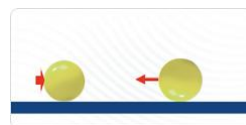
Rule #1: Gravity
Gravity pulls things down.



Rule #2: Slope
Slope affects speed.



Rule #3: Random
Random is unpredictable.



Rule #4: Force
Force is a push or a pull.



Rule #5: Friction
Friction is everywhere.

Learn About Random

Random is a word to describe when something happens without purpose or pattern. This concept can be observed or demonstrated by constructing and playing with the marble track set and noting the order of the marbles at the track's start and end. Paying attention to specific track pieces can reveal how the order of the marbles can get reordered along the way. You can also make a few simple adjustments to the tracks to introduce (or remove) randomness to the order of the marbles.

Real World Connection

Many things that happen in our daily life appear to be random. In a bag of candies with equal quantity of different flavors, the piece that you blindly pull out of the bag is random. When we use the term random, we sometimes think we have no way to know what will come out. But in fact, in mathematical terms, we have a pretty good idea. If the bag of candies has equal quantity of 5 different flavors, then there is 1 out of 5, or 20% chance of pulling any flavor. We can easily tip the scale to one flavor by simply adding a few more pieces of your desired flavor. In this challenge, young scientists will investigate whether racing down the marble tracks will yield random or predictable outcomes.

Hands-On Challenge: Random!

What's Needed:

- Marble Rush™ Corkscrew Rush Set™
- 5 different colored marbles
- A piece of paper
- Something to write with (pencil, pen, crayon, marker)



Complete the construction set as illustrated, then drop a few marbles into the Green Fill & Tip Barrel and guess which marble will finish first. Then, tip the Green Fill & Tip Barrel over and see what happens. Did you guess right?

Now, focus on the Green Fill & Tip Barrel, note how the order in which you place the marbles into the Green Fill & Tip Barrel isn't always the same as the order of the marbles at the finish. This is what we mean when something is unpredictable or happens randomly.

Collect the same marbles and place them into the Green Fill & Tip Barrel in the same order as the last time you started. Now, make a prediction: do you think they will end in the same order or a different order from last time? Why?

Thinking Critically: Realizing Random

Exploration 1: Random Rearrangement

Investigate ways to change the track layout to see if you can randomize the order of the marbles between the start and end of the track. First, place the 5 different colored marbles at the start and record the order in which you placed them. Start them down the track and then record the order of the marbles at the end. You can rearrange the pieces to see what effect this has on the order in which the marbles finish the track. Draw a simple sketch of your design and write down your prediction of what order they will finish. Finally, record the finishing order.

- Were you ever able to predict the finishing order of all 5 marbles? Why do you think this is?
- What track pieces do you think make things more random?



Exploration 2: Removing Random

Sometimes it is important for things to be predictable instead of random. Try to make it so the finishing order is not random—this means that the order the marble start is the same order that they finish. Complete this activity by first selecting and removing 1 track piece. Then, place 5 marbles at the start, record their order, and see what order they finish in.

- Do the marbles enter the Corkscrew Tumbler in the same order that they exit the corkscrew? Why or why not?
- Which track pieces caused the marble order to be different from the start? How many of these randomizing track pieces were there?



Exploration 3: Random Reliance

The randomization effect can be introduced by the interaction between two track pieces. This occurs when the features of one track piece influences the behavior of the marbles as they pass through another track piece. Experiment with this by creating a layout design where the Yellow Pinch Track feeds marbles into the Large Green Vortex. Then, place 5 marbles at the start and record their order as they enter the Yellow Pinch Track. Then, record the order in which the marbles exit the Large Green Vortex.

- Do the marbles enter the Large Green Vortex in the same order that they exit this piece?
- How does the Yellow Pinch Track influence the behavior of the marbles in the Large Green Vortex?

