

## Marble Mania



### Racing Marbles through Fluids

Viscosity is a measure of a fluid's resistance to change or deformation. It is a result of the friction between particles in the fluid which are moving around at different speeds.

1. Create a list of fluids that you would like to test. Some possibilities are: olive oil; maple or corn syrup; honey; liquid glue; hand sanitizer; water; shampoo
2. Use an identical container for each liquid and fill it almost full. Each liquid should come to the same height.
3. Hold a marble over the top of each liquid and let it go. Begin timing as soon as it enters the fluid. Stop timing when it touches the bottom. You can also do a qualitative analysis if no stop watch is available.
4. Make a note of the name of the liquid, the distance travelled and the time it took for the marble to travel to the bottom.
5. Repeat the experiment several times for each liquid so you can calculate an average time.
6. Order your liquids from slowest to fastest. Viscosity is inversely proportional to velocity so this will rank your liquids from most to least viscous.
7. Discuss why viscosity is important. Do we want our ketchup and chocolate sauce to be viscous? What about our shampoo or apple juice?

To extend the learning, you can explore whether viscosity is temperature dependent. Try using three identical bottles of clear shampoo: one that has been placed in an ice/water bath, one at room temperature and one in a warm water bath. Drop a marble into each bottle and time how long it takes to travel from top to bottom. Compare the different times and rank the shampoos from least to most viscous.



## Marble-powered Race Car

Design a race car from an index card and see how far it goes when powered by a marble!

1. Fold an index card or a 10cm X 15cm piece of cardstock in half lengthwise (like a hot dog bun!) and cut one end into a point. Decorate your car by adding windows, doors, tires and other design features with a crayon or marker. The folded edge will be the top of your car and the pointy end will be the front.
2. Put a piece of tape on the pointy end to hold the two pieces of card together.
3. Set up a ramp using a stack of textbooks and a ruler that has a groove in the middle.
4. Set your race car up so that it is facing forward and the open back is at the very end of your ramp.
5. Hold a marble at the top of the ruler and let it go. The marble will travel down the centre groove and enter the open back of the race car. Did your car move? If so, measure how far it travelled.

To extend the fun, you can:

- Add or remove textbooks to increase or decrease the angle of the ramp
- Try resting your car on a smooth desk, a large piece of chart paper or a piece of fine sandpaper and see what happens to the distance travelled.
- Try to design a car that travels farther by varying the size or weight of the cardstock or changing the shape of your car.
- Change the number of marbles that you have at the top of the ramp. Does this affect the distance travelled?



## Design Your Own Marble Run

A marble run is a series of ramps, drops, turns, loops and straightaways that a marble must travel through to reach the bottom of an incline. This activity is a great way to bring the engineering process (ask-imagine-plan-create-test-improve) to life. The race is not a fast race: the slowest marble to reach the bottom is the winner!

1. Collect cereal boxes, paper towel, toilet paper & wrapping paper rolls, unused paper cups, painter's tape, bits of string, coloured paper and decorating scraps.
2. Explain the engineering process and let them go. They can attach their run to a convenient doorway, wall or the back of a chair. See how many drops, loop-de-loops and straightaways they can include.
3. Encourage them to test each piece as they add it and redesign on the go. Have a basket or small cup at the end of each run and remember the slowest marble wins!



## Marble Jumping Bean

This is a great experiment to do at Easter if you save the foil from your eggs!

1. Smooth out the foil from an Easter egg so that it forms a square about 7cm by 12cm. If you don't have an Easter egg foil, you can use aluminum foil.
2. Carefully roll it around your finger or a fat pencil to form a tube that is a bit wider than the marble. Put the marble inside the tube and squish each end to seal it inside.
3. Drop your foil tube into a square sandwich container and shake it from side to side. This allows the marble to bash against the ends of the foil and round them out.
4. Once the ends are smooth, hold your bean at the top of an inclined, marble end down, and let it go.

When you put your bean on an inclined plane the marble rolls down the tube until it collides with the sealed end. The marble end is heavy so the foil bean flips over and the marble starts to roll again, until it collides with the other sealed end. Easter bean races are a great event for a Friday afternoon!