Funnels

Suggested Age: 6-8
Time: 20 minutes

Sand is a granular media that displays both properties of a solid and a liquid. When it is in a pile, it acts as a solid. For example, sand on the beach is hard. You can walk on it without sinking in. But if you poured sand out of a bucket, it looks almost like you're pouring a liquid! These phenomena make sand a very interesting topic and it is being widely researched for its solid and liquid properties!

Sand acts as a solid on the beach, but as a liquid when being poured through a funnel.

In this activity we will:

- Examine the time difference of various granular media pouring out through holes of different diameters.

Materials

- Three or four kitchen funnels with different diameter holes (can usually be purchased as a set)
- 1 cup measuring cup
- Sand
- Sugar

- Pepper
- Stopwatch
- Disposable bowls to hold grains (3)
- Disposable to catch grains (3)
- Masking tape
- Something to write with (pen, pencil, marker)
- Ruler

Safety

Be sure to work in an area which can be easily swept. Sand, pepper, and sugar are very difficult to get out of carpet, thus, a room with a smooth floor surface is an ideal location. They are also irritants if they get into your eyes. Do not touch around or near your eyes while doing this activity and be sure to wash your hands thoroughly at the conclusion.

This activity is best done with one other person; the assisting parent will be able to do this.

Preparation

To prepare for this activity, you must measure out the various grains and place them into their corresponding containers:

1. Label one of the holding bowls “sand”, one “sugar”, and one “pepper”.
2. Label one of the catching bowls “sand”, one “sugar”, and one “pepper”.
3. Measure out 1 cup of sand and pour it into the holding bowl labeled “sand”.
4. Repeat with for the sugar and pepper, placing each in their appropriate bowl.

Pre-Activity

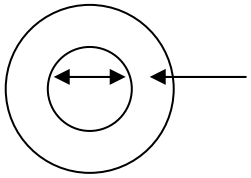
Discuss with the children through which funnel they believe that the sand will pass the quickest. How about for the sugar? And the pepper? Will the difference in the

type of grain cause a time difference? Or will the sand, sugar, and pepper pass through the same funnel in the same amount of time?

Activity

When you play a game that has a time limit, these games usually have an hourglass for a timekeeper. In these hourglasses, you usually see very small grains (sand or other granular media). Is this a good and cost effective method of keeping the time for each player or team even? Why or why not? If you don't think it is a good way, what other timekeeper would you suggest that game companies should provide?

- Starting with the smallest (thinnest end) funnel, measure the inner diameter and record in the table at the end of this activity. See diagram.



- Repeat this measurement for each of the larger funnels, recording their diameters below.
- Make sure that your stopwatch shows a time of zero to start timing. If you do not have a stopwatch, a clock that times seconds will work as well, though it will not be as accurate.
- Have your partner hold the funnel with the smallest diameter above the catching bowl labeled "sand" in one hand and the stopwatch in the other.
- When your partner indicates they are ready, pour the sand into the funnel. Your partner should begin timing at this exact moment. (Note: You may need to do a few practice runs to synchronize the start of the stopwatch and the pouring of the sand.)

- As soon as all of the sand has passed through the funnel and landed in the catching container, have your partner stop the timing. Record this time below.
- Pour the sand back into the holding container and repeat this measurement (the last three steps) once more.
- Repeat the last four steps for the sugar and the pepper, recording the times below.

- Repeat the last five steps using the other two or three funnels, increasing the diameter of the aperture each time.
- Average the times for each funnel and grain type using the formula provided below the table. Record these values in the last row of the table.
- What do you observe about the average times for each grain and funnel? Was it what you expected? How can you explain this?

	Funnel Diameter	Sand Run #1	Sand Run #2	Salt Run #1	Salt Run #2	Pepper Run #1	Pepper Run #2
Funnel #1							
Funnel #2							
Funnel #3							
Funnel #4							
Funnel #5							
	Average						

Average = (Run #1 + Run #2)/2

Extension Activity

1. Create your own hourglass using two empty 20 oz bottles. Make sure that they are clean and dry. Using a funnel, pour one to one and a half cups of sand into one of the bottles so that it is about half full. Tape the 20 oz bottles together at the necks securely. To find out how long it takes for the timer to run through, use your stopwatch and start it as soon as you flip the hourglass. Stop the timer when all of the grains have fallen through to the other side. Now you've made your own hourglass! Design a game that requires this much time to play!

References

http://www.loc.gov/rr/scitech/mysteries/hourglass.html
http://www.crystalinks.com/clocks.html