RAFT IDEAS

Topics: Probability, Density, Psychology

Materials List

- ✓ Small, plastic drink bottle (empty & clean)
- ✓ 5 Flat squares of #4 plastic, 1 cm (~½")
- ✓ Masking tape (colored if possible)
- ✓ Fine-tip, permanent marker
- ✓ Water

This activity can be used to support the teaching of:

- Probability, Data, Samples, & Models (Common Core Math Standards: Grade 6, Statistics and Probability, 1 & 5; Grade 7, Statistics and Probability, 5-7)

Next Generation Science Standards:

- Properties of materials (Grade 5, Physical Science 1-3)
- Structure of matter (Grade 5, Physical Science 1-1; Middle School, Physical Science 1-1)

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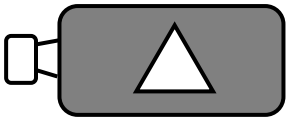
Message in a Bottle ??

It's not magic - it's density and probability... but it's fun!



Message in a Bottle sparks student interest by its intrigue as a random advice generator, but it's really a lesson in probability.

Assembly

1. Write "yes" and "no" responses on both sides of the #4 plastic pieces. Include vague or "non" responses if desired. (See chart for suggestions.)
2. Record responses on each piece to use in testing probability later.
3. Place plastic pieces into the drink bottle, fill it COMPLETELY with water, and cap it tightly. (Optional: Add food coloring to water.)
4. Use the masking tape to make a triangular "target" on the side of the bottle, about 5 cm (2") in diameter. Cover the whole bottle (except the target area) with masking tape, obscuring the bottle's contents.

To Do and Notice

1. Allow students a few minutes to become familiar with the bottle. Students should also make observations of how the plastic moves inside the bottle. *(The plastic floats to the highest point in the bottle*.) Note: Several pieces of plastic might be seen in the target, and the reader should use the plastic piece that completely appears in the window first.
2. Instruct students how to compute the probability associated with their bottles (based on their number of positive and negative possibilities.)
3. Have students test the probability of positive or negative responses with their bottles and then compare their experimental answers to their computed probability. For best results, students should repeat "bottle responses" as many times as possible and record each response. This would be a good time to discuss the importance on numbers of data points in scientific experiments.

The Content Behind the Activity

Science: #4 plastic is LDPE (Low Density Polyethylene). This plastic is less dense than water (1 g/ml), so it always floats to the highest point that it can. An answer seeming to "rise up" is simply a result of basic physical properties of matter.

Math: If students placed the same number of positive and negative responses (and no "non" responses) into their bottles, they would have the same probability of a positive or negative response to any given question (50/50). Their experimental data will get closer to the computed probability the more data points they have.

At times of indecision, many people throughout history have sought random advice generators of all kinds (dice, cards, tea leaves.) Today, these devices are marketed with an air of mystique, intriguing young and old alike. This "Message in a Bottle" activity (similar to a "Magic 8-Ball™) sparks student interest by building on that intrigue; however, the real lessons are the science (density) and math (probability) involved. Students should come away with the knowledge that the advice from the bottle is simply random, and it should be treated accordingly.

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Taking it Further

1. Have each student place a different number of positive and negative responses into their bottles, compute the probability, and then test their bottles' probability. (In the commercial Magic 8-ball™, for example, 50% of the responses are affirmative, 25% are negative, and 25% are vague)
2. Before constructing the bottles, observe different types of plastic, noting properties. Which type of plastic would be best to use inside the bottles?
3. Use this activity in a class as a springboard to discuss human behavior and the desire to seek simple answers to hard questions.

Table of Possible "Message in a Bottle" Responses (Add and/or alter as appropriate):

Possible "yes" responses:	Possible "no" responses":	Possible vague or "non" responses:
Yes!	Don't count on it	Ask again later
Definitely	Absolutely not	Better not tell you now
Of course	When pigs fly	Hard to say
Without a doubt	Outlook not so good	Good question
You betcha!	Are you crazy?	If you are worthy
Most certainly	Very doubtful	Concentrate and ask again

Web Resources (Visit www.raft.net/raft-idea?isid=220 for more resources!)
For a simple, safe way to see what the inside of a "Magic 8-ball™" looks like, go to:
http://8ball.ofb.net/procedure.html