Buoyancy Battle: Cans
Lesson Plan

Amount of time demo takes: 3-5 mins.
Try this at home!

Materials
● Glass fish tank
● Soda cans
  ○ 2 ‘Regular’ beverages
  ○ 2 Diet beverages
  ○ 2 Grape soda/lemonade
● Sugar packets
● Small plastic jar w/lid (not clear)
● Towels (to dry the table)
● Optional: Gloves

Set-up Instructions
1. Fill tank with water
2. Set cans on table
3. Put sugar packets in red container with lid on
   a. Check the cans of pop to see how many grams of sugar are in one can. The sugar packets are 3.5 grams each, so it should be fairly easy to determine how many packets to use.

SAFETY! Safe Demo!

Lesson’s Big Idea
● The cans of soda are the same size/volume: the difference is the density of the liquids.
● Regular soda has a lot of sugar, diet soda has artificial sweeteners, and water has neither.
● Cans of regular soda contain a lot of sugar and thus are usually more dense than water, so they sink. Diet sodas, with artificial sweeteners, are usually less dense, so they float.

Instructional Procedure
1. Hold up a can of regular soda and ask the students if they think it will float when placed in water. Have them give their input and explain why they choose the way they do.
2. Have them put the can in the water (it will sink).
3. Repeat 1 with a different kind of regular soda, then with diet soda, etc.
4. Discuss with the students any patterns they may have seen - did certain kinds of beverage sink more often? Why do some float?
5. Take the cans out of the water and compare what is different between the drinks, especially between diet and non-diet beverages. The main difference will be the amount of sugar in each. Cans with more sugar will sink because the sugar dissolves in the drink making the drink more dense than the water.
6. To make a case for how much sugar is in a can of pop, have the students guess how many sugar packets are in the red container then open it. They (and their parents!) will probably be surprised.

Background Information

- It is also very interesting to note that if you trap an air bubble under the bottom of the can when you put the ‘regular'/non-diet cans into the tank, the can will float. The buoyant force of the air bubble offsets, almost exactly, the additional density of sugar.
- \[ \text{density} = \frac{\text{mass}}{\text{volume}} \]
- Densities:
  - Sodium: 0.968 (g/cm\(^3\))
  - Glucose (C\(_6\)H\(_{12}\)O\(_6\)): 1.1 (g/cm\(^3\))
  - Water (H\(_2\)O): 1.0 (g/cm\(^3\))
  - Aspartame (artificial sweetener) (C\(_{14}\)H\(_{18}\)N\(_2\)O\(_5\)): 1.35 (g/cm\(^3\))
- Molar Masses
  - Sodium (Na): 23g/mol
  - Glucose (C\(_6\)H\(_{12}\)O\(_6\)): 180g/mol
  - Aspartame (artificial sweetener) (C\(_{14}\)H\(_{18}\)N\(_2\)O\(_5\)): 294.303 g/mol
  - Sucrose (sugar) C\(_{12}\)H\(_{22}\)O\(_{11}\): 342.296 g/mol

Assessment/Sample questions you can ask

- Do you think the can will sink/float and why?
- Why does the regular soda can sink?
- Why does the diet soda can float?
- Were you surprised by how much sugar is in a can of pop?

Conclusion

- Density. More dense objects will sink. Less dense objects will float.

Clean Up

- Remove cans from tank, put lid on container of sugar packets, dry off table if it gets too wet.
- At the end of the day
  - Remove cans from tank and dry them off, then put them in the bin.
○ Put all sugar packets into the container and put the lid on.
○ Dump the water out of the tank and dry it out.
● When completely finished gather all materials listed for this demonstration and make sure everything is accounted for. If something was used up, broken or damaged, let someone know so it can get replaced or fixed.

References
● http://scifun.chem.wisc.edu/homeexpts/cans.htm
● http://www.youtube.com/SpanglerScienceTV#p/u/87/MzsORE0ae10
● Formulas and molar masses calculated using WolframAlpha

Next Generation Science Standards
● K-5