Surface Area to Volume Effects…Bet I can Beat'cha!

Introduction

The surface-area-to-volume ratio affects the chemical reactivity of materials. Chemical reactivity is the tendency for a material to undergo a chemical change. Stainless steel does not visibly react with much (lower chemical reactivity) while sodium will react rapidly with moisture in the air (higher chemical reactivity). Reactions take place at the surface of materials. Flour, a seemingly harmless kitchen staple can be used to make explosives. When it is clumped it is harmless but people have been killed by dust explosions at flour mills.

In this activity you will explore how surface-area-to-volume ratio affects chemical reactivity.

Safety

- Wear goggles during this lab investigation.
- DO NOT eat or drink in the lab.
- Dispose of chemical waste in the waste bottle in the fume hood.
- Use caution when handling glassware.

Materials

- 100 mL beakers
- Aluminum foil
- Copper (II) chloride dihydrate ($CuCl_2 \cdot 2H_2O$)
- Stopwatch/Cell phone
- DI Water
- 100 mL graduated cylinder
- Metric Ruler
- Weigh boats
- Balance
- Pair of tongs
- Stirring rod

Procedures

You are going to come up with your own investigation to answer the following question: how does surface area affect the rate of reaction? Using the materials listed above, develop an experiment that can be used to answer this question. From your experiment, collect data to support your answer to this question.

Be prepared to briefly present the experiment you developed, the results you obtained and your conclusions to the rest of the class.

Questions to Consider

1. What relationship did you observe between the surface area and the rate of reaction of aluminum with copper (II) chloride dihydrate?

2. What do you think is the reasoning behind this relationship?

3. What can you conclude about the effects of surface-area-to-volume ratio and reaction rates?

4. How does surface-area-to-volume ratio (SA/V) relate to the concept of size and scale?

5. How can you use the knowledge gained from this activity to have a better understanding of how SA/V affects reactivity of nanoscale objects?

References

http://nanosense.sri.com/activities/sizematters/properties/SM_Lesson3Student.pdf

http://community.nsee.us/lessons/Apples_to_Atoms/AtoAch5.pdf

http://www.abc.net.au/science/articles/2012/01/18/3410634.htm