Teacher’s Guide-

Surface Area and Size: Why do Small Things have Big Impacts?

INTRODUCTION:

In this lesson, students will examine and derive the relationship between surface area, volume and size. The point of this activity is to demonstrate to students that multiple smaller cubes will have a greater surface area than a larger cube with the same total volume. This will lead into later lessons that demonstrate the effect of surface area on the reactivity of a substance and ultimately the idea of binding sites as the driver behind the tendency of a substance to react. This activity is designed for groups of 3-5. It can be done in smaller groups, but the cube-folding portion can become tedious for small groups or partners.

Necessary Prior Knowledge:

* Students understand that nanoparticles are unique because they are extremely small.
* Students should also have some familiarity with the concepts of volume and surface area, as these are not extensively defined within this lesson plan.
* Students should have an understanding of the claim-evidence-reasoning format for supporting arguments or claims.

OBJECTIVES:

Students will recognize that-

* As objects increase in size, their volume increases more quickly than surface area.
* As objects decrease in size, their surface area decreases less quickly than volume.
* The ratio of surface area to volume is larger in small objects than in large ones.

TIME: 50 Min

MATERIALS (per group):

* 1 large cube net (5 cm per side)
* 8 small cube nets (2.5 cm per side)
* Ruler
* Tape
* Scissors (1 per student)
* “Surface Area and Size” Student Sheet, Lesson 2.1 (1 per student)

PROCEDURE:

1. Divide the class into groups of 3-5 students and distribute supplies.
2. Explain to students that they will be investigating surface area and volume in origami cubes. Remind students what the terms “surface area” and “volume” meaning, stressing the distinction between the two.
3. Students may also benefit, depending on prior knowledge, from a reminder of how to calculate surface area and volume with a brief explanation of why the formulas work. A sample problem may be beneficial, or students can work through any issues in their groups.
4. Circulate and offer guidance as students work through the assignment.
5. As groups finish, be sure to collect their cubes and store for later lessons. It will also be helpful to write down groups so that students can meet in them again for Lesson 2.3a

OTHER TIPS/OPTIONS:

It may be helpful to construct an open-top, 5 cm x 5 cm cube for the students to physically place the smaller 2.5x2.5 cm cubes in. This serves as visual proof that the cumulative volume of the small cubes is equal to that of the larger cube. As a follow up, you could also place all the faces of the smaller cubes over the flat net of the larger cube, showing that the surface area of the small cubes is in fact greater than that of the large cube.