**Teacher’s Guide-**

**Sticker Origami**

INTRODUCTION: In this activity, students will revisit the origami cubes made in Lesson 2.1. Now, they will use stickers to represent “Binding Sites,” or areas in which chemical reactions may occur. This activity is designed for use with the same groups as Lesson 2.1.

OBJECTIVE:

Students will understand-

* Chemical reactions take place at a specific location on a molecule
* Objects with more surface area have more sites for chemical reactions to occur (or Binding Sites)

TIME: 45 min

MATERIALS (per group):

* 1 Large paper cube
* 8 Small paper cubes
* Sticker set (1 inch stickers are best, but ½ inch stickers work as well)
* “Sticker Origami” Student Sheet, Lesson 2.3a (1 per student)

PROCEDURES:

1. Have students complete a 1-2 minute quickwrite on the question: Why don’t nails rust in the middle? After 1-2 minutes, students should share with a partner or with the whole class.
2. Remind students that chemical reactions occur at a specific place on a substance or molecule, including rusting. For example, when a nail rusts, oxygen molecules react with iron (or other metal) atoms on the surface of the nail. The metal atoms on the outside of a nail can react with oxygen, but those in the middle are surrounded and are therefore unavailable to react. The more atoms of a particular substance are exposed to another, the more opportunities exist for a reaction to occur. (See diagram below)



1. Hold up the cubes from Lesson 2.1. Ask students which they think will have more opportunities for chemical reactions- the one large cube, or 8 small cubes? Allow students to form hypothesis, but do not answer the question. Tell students that today’s activity will enable them to answer this question for themselves.
2. Regroup students into their teams from Lesson 2.1 and distribute supplies. They will work with the cubes they made during that lesson.
3. Tell students that they will be attaching “Binding Sites” or potential chemical reaction sites to each cube. They will use these to decide which set- one large cube or 8 small cubes- will have more potential to react quickly and completely.
4. Circulate as students work through the activity, offering guidance when necessary.

NAME\_\_\_\_\_KEY\_\_\_\_\_\_\_\_\_

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

*In this activity, you will identify “binding sites” on your origami cubes in order to predict which type (small or large cube) will produce more chemical bonds.*

QUESTION: Assuming an equal total volume, which will produce more chemical bonds- one large cube, or several smaller cubes?

VOCABULARY:

**Binding Site-** A region on a molecule or compound in which specific chemical bonds may form

**Chemical Bond**- an attraction between atoms

MATERIALS:

* 1 Large paper cube
* 8 Small paper cubes
* Sticker set (binding sites)

PREDICTION:

Examine your cubes and discuss with your group the following question, keeping in mind the trends you identified in the previous lessons.

1. Which set of cubes- 1 large cube or 8 small cubes- would produce more chemical bonds? Explain your prediction.

Answers will vary, but should include a rationale.

DIRECTIONS:

1. Cover the surface of each cube with as many stickers as possible without overlapping any stickers. These stickers represent “Binding Sites,” or regions where a chemical bond may form.
2. Count the number of binding sites on the large cube and record in the table below.
3. Count the total number of binding sites on the 8 small cubes and record in the table below.
4. The volumes and surface areas calculated in the previous activity are provided.

DATA:

|  |  |  |  |
| --- | --- | --- | --- |
| Type of Cube | Number of Binding Sites | Total Volume | Total Surface Area |
| 1 Large Cube (5cm x 5cm)  | 24(With 1 inch stickers) | 125 cm3 | 150 cm2 |
| 8 Small Cubes (2.5cm x 2.5cm)  | 48(With 1 inch stickers) | 125 cm3 | 300cm2 |

ANALYSIS:

1. Compare the number of stickers on the large cube with that on the set of small cubes. What do these stickers represent?

The large cube holds ½ the number of stickers as the small cubes (and has ½ the surface area.) These stickers represent binding sites, so few stickers means fewer opportunities for a chemical reaction.

TAKE HOME POINT:

Using *evidence* from your work above, construct a *claim* that addresses the question, assuming an equal total volume, which will produce more chemical bonds- one large particle, or several smaller particles?

Answers will vary, but should include:
Claim- Several smaller particles will produce more chemical bonds than one large particle.

Evidence- Students should use data from this activity, such as number of stickers or surface area, to support their claim. Students should explain how that specific evidence supports their claim.