Dynamic Design: A Collection Process

Enough is Enough

STUDENT ACTIVITY

In this activity you will begin to learn about product design team (PDT) work by organizing this activity into a designer's notebook. First, you will measure the mass of the sand collected on frames of different shaped wafers. In this case the sand represents solar wind particles. Second, you will investigate the amount of contamination collected with the sand by observing a sample of the sand under a microscope and counting the number of grains that are a certain color. Finally you will brainstorm ways that contamination can be kept to a minimum. Your group will then make a presentation of the problem process and solution.

PROCEDURE:

Part III: Constructing Student Wafers

1. Choose one design from the "Finding The Perfect Fit" activity to test its area and the amount of particles it can collect.

2. Use double-sided tape and cut out the shapes. Find the area of each of the wafers by using the counting squares method.

3. Apply the wafers to the background frame. Cut out the outside of the frame. Once this is done, remove the paper from the outside of the double-sided tape and measure the mass of the frame and wafers. Record the mass in grams.

4. Blow sand particles on the double-sided tape with a straw or small fan. The mass will then be measured and recorded. Using subtraction, calculate the mass of the sand that was collected.

Shape Used	Mass Without Sand	Mass with Sand	Difference (Amt. Of sand)

Part IV: Constructing Hexagon Wafers

5. Repeat the above process using the hexagon-shaped wafers similar to those that will be used by Genesis scientists. Write a problem statement that includes variables:

6. List the independent and dependent variables.

7. List the variables to be controlled.

8. Write a hypothesis using the variables.

9. Calculate the area of the collectors and the mass of the sand collected.

10. Compare the amount of particles collected using both your own shaped wafers and the hexagon-shaped wafers. Record the design phase in your notebook.

11. Write a conclusion statement that answers the problem statement and uses data to support this answer.

12. Evaluate two designs and recommend either the student design, hexagon design or another design.

Part V: Counting Contaminants

1. Use a microscope or hand lens, a representative sample from your wafer design and the one mm graph transparency to count the number of colored sand particles. The colored sand particles represent the contaminant.

2. Each student in the group should complete this procedure and then the results for the group should be averaged.

3. Brainstorm some ideas for reducing contamination. In your group, organize the ideas that you want to include. Think of reasons for including your ideas, then categorize them. Write the plan in your report.

4. Write a report to JPL that includes the following:
    1. Cover sheet (with descriptive title)
    2. Abstract or overview
    3. Introduction (problem statement and rationale for design)
    4. Body of the Report
        A. Purpose or problem statement (all parts)
        B. Variables identified (Parts II, III)
        C. Hypothesis statement (Part II)
        D. Description of the design (materials, written description, diagrams)(all)
        E. Results of the experiment (all)
        F. Conclusion and inferences from the experiment (all)
5. Conclusion section (including recommendations for controlling contamination and clean up)
6. Appendix (resources used, etc.)

The following checklist can be used to assess the “Wafer Construction” design activity final report. There will be 20 possible points. If further detail is desired, the tool may also be used as a rubric, where each item is scored on a scale of 1- 5, with "5" being full credit, making 100 possible points.

1. Introduction:
    ______ Cover sheet is included with a descriptive title
    ______ Abstract summarizes problem, experiments, and results of each section
    ______ Statement of problem is clear, concise, and understandable

2. Body of Report:
    ______Purpose statement that describes each part
    ______Independent, dependent, and control variables are identified
    ______Hypothesis including variables is clearly written
    ______Materials are listed in an organized manner
    ______Descriptions have qualitative observations
    ______Diagrams are neat and accurately represent design
    ______Formulas and calculations are appropriately displayed
    ______Quantitative data is clearly organized in chart or table form
    ______Data is interpreted and discussed
    ______Modifications made to experimental design are communicated clearly as well as analyses which led to consideration of redesign
    ______Each experiement includes a conclusion statement that summarizes the data from that experiment
    ______For each conclusion, an inference is written that explains why the event happened
    ______For Part II, a statement showing whether students support or reject their hypothesis is included

3. Conclusion:
    ______ Conclusion statement that summarizes all parts is clear and concise
    ______ Recommendations for future design tests are written in clear and concise manner
    ______ Appendix including reference books, or initial designs or future designs is included

4 Other:
    ______ Experiments were conducted in a safe manner and problems were reported to the teacher as they occurred