**Teacher’s Guide-**

**Scale Walk: Measuring the Nano-World**

INTRODUCTION:

In this activity, you will guide students as they walk the length of several small items in order to get a sense of scale in the Nano world. Students should already be introduced, from the video and readings, to the definition of a nanometer as 1 billionth of a meter. Remind them of this before introducing the scale walk items. The items were chosen based on size and ability to find them. The activity is most powerful if the items (hair strand and larger) are provided so students can see the actual size before walking the scaled size. The scale can be easily adjusted by factors of 10 in order to suit the school environment.

PROCEDURE:

1. Mapmyrun.com is a useful resource to map distances from an exact location prior to the walk with the students. By mapping out ahead of time, you can avoid cumbersome measurement of the larger distances and streamline the activity. Items 1-5 can be efficiently walked. This walk plus the return to the starting point would then equal the distance for Item 6 (thickness of a dime.)
2. Ask students to write down everything they can think of that is small. Give them 30 seconds to complete this task.
3. Tell students that they are going to walk the distance of some of these small items as if we lived in the nano world so that we can understand how small nano really is. The first item (the carbon atom) is the scale from which students should compare the rest of the items.
4. During the walk, mark or have a student mark each item distance with chalk. Point them out on the return trip as a reminder of previous items. At the midway point (Item 5), you may talk about some of the larger items (6 and above) and how far the class would have to walk to cross them. This can also be done in the classroom when you return. By the end, students should understand that nano-scale objects are extremely small, even relative to things they conceptualize as small in everyday life.
5. Upon return to the classroom, have students write a 1-paragraph reflection of the activity. What was their experience during the walk? What item surprised them the most? Did their ideas of “small” change at all during the walk?

MATERIALS:

* Hair strand
* Light guitar pick
* Dime
* Penny
* Coffee mug
* Chalk
* Meter Stick

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|  | **Item** | **Size** | **Multiplication Factor** | **Relative Size (cm)** |
| **1.** | Carbon atom | .22 nm | 106 | .022 cm |
| **2.** | Average Silica Nanoparticle | 150 nm | 106 | 15 cm |
| **3.** | Human Brain Cell | 50000 nm | 106 | 5000cm,  50 m  (Anacapa School to Panino) |
| **4.** | Hair strand | .1mm,  100000 nm | 106 | 10000cm,  100 m  (Anacapa to Playa Azul) |
| **5.** | Light Guitar Pick | .5 mm,  500 000 nm | 106 | 50 000 cm,  500 m  (Anacapa to Courthouse on SB Street) |
| **6.** | Thickness of Dime | .1 cm,  1000 000nm | 106 | 100 000cm,  1000m  (Anacapa to Micheltorena St ) |
| **7.** | Pinky Fingernail | .9 cm,  9 000 000 nm | 106 | 90000cm  9000m,  (Anacapa to San Marcos High) |
| **8.** | Penny | 1.9 cm,  19 000 000nm | 106 | 1 900 000cm  19 000 m,  (Anacapa to Dos Pueblos High) |
| **9.** | Coffee Mug | 8.7 cm,  87 000 000 nm | 106 | 8 700 000cm  87 000 m,  (Anacapa to Solvang) |
| **10.** | Anacapa Classroom-  Sedgewick Hall Door to Window | 7 m,  7 000 000 000 nm | 106 | 700 000 000cm  7 000 000m,  (Santa Barbara to Philadelphia- as the crow flies) |

Nanometer = 10-9 Meter

107 Nanometer = 1 Centimeter