



Drexel-SDP GK-12 ACTIVITY

Activity

Subject Area(s): *Measurement, Comparison, Conversion*

Associated Unit: *Nanotechnology and Electricity*

Associated Lesson: *Powered by Fruit, Battery Charge, Ohm's, Binary, Moore's*

- **Activity Title** : *Nanoreisen: Adventures beyond the decimal.*



Grade Level: (6-8)

Time Required: 60-90 minutes

Group Size: Classroom

Summary: *Students learn to measure and convert everyday lengths such as their heights and classroom size and convert them into nanometers. A visit to www.nanoreisen.com allows students to virtually tour the realm of the nano and micro world, developing a key fundamental basis for future lessons in nanotechnology*

Engineering Connection: *Nanoreisen is a funny word. It comes from "nano" meaning one billionth in greek and "reisen", meaning trip in german. Before you start your trip, it is important to realize the scale of things within in the world. Let's start with one meter, or about 3 ft. A nanometer would compare to the size of a meter as one peanut would compare to the size of the whole earth.*

Keywords: *Measurement, Comparison, Conversion*

Educational Standards: [PA] 2.1.8ABF, 2.28AB, 2.38D, 3.1.7D, 3.2.7B, 3.4.7A,
3.7.7BC

Materials List: *Nanoreisen worksheet, Measuring tape, Calculator(s)*
Computers (enough at least share into small teams of 2-3)

Introduction/Motivation:

Procedure:

1. It is important for the teacher to take 5 minutes and review the second paragraph of the worksheet with the students, that is, to ensure that scientific notation and the decimals are understood.

2. Students are then asked to use the measuring tape to find out how tall they are, as well as the size of the classroom. These numbers are recorded into the worksheet.

3. Students then may use a calculator to convert their height from inches into centimeters and nanometers. For fun you can ask who is tallest, shortest, etc. The kids love telling that they're many nanometers tall.

- **Extended Activities:** Go to www.nanoreisen.com and help the students navigate the website. It is completely flash and has great animations of the nanotechnological world.

Assessment: How many nanowires fit onto a computer chip? This fictitious problem allows the students to prove their abilities to not only convert from one measurement unit to another, but also multiply and divide within a given area.

Attachments: Nanoreisen Worksheet

References: www.nanoreisen.com

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Nanoreisen is a funny word. It comes from "nano" meaning one billionth in greek and "reisen", meaning trip in german. Before you start your trip, it is important to realize the scale of things within in the world. Let's start with one meter, or about 3 ft. A nanometer would compare to the size of a meter as one peanut would compare to the size of the whole earth.

It is important to know scientific notation, as it makes understanding your answers a bit easier. For example, if you are 830000 nanometers tall, you can count all the zeroes behind the 3, or $83 \times 10^4 \text{ nm}$. 10^4 just means $10 \times 10 \times 10 \times 10$. You can also have notation for decimals. A nanometer is .000000001 meters. If you start from the right of the 1 and count the number of spaces you move until you get to the decimal point, that's the number of 10's you need. Since it's a decimal, you need a negative number. In the case of nanometers, you would need 9 spaces or $1 \times 10^{-9} \text{ m}$. Let's write your height out in this notation:

Your height: inches centimeters nanometers

Classroom: inches centimeters nanometers

Ok, now we need to figure out how much storage space we have in an iPod nano. Let's say the wires I make are 100 nanometers in width and 10000 nanometers in length. How many wires could I fit into the area of the chip shown below the iPod, or:



