Chapter One

Scientific Notation

Day One:

Today, your child should complete the readings and practice problems for the week.

Your "grocery list" for this week's lab will be:

1 box Duncan Hines Yellow Cake Mix (with butter)
1 package of cream cheese
1 stick of butter
1 egg
2 tsp. vanilla

Powdered sugar (for topping on the finished cookies)
Plastic wrap
Baking sheet
Knife
Ruler

National Science Education Standards covered this week:

12ASI1.4 Formulate and revise scientific explanations and models using logic and evidence. Student inquiries should culminate in formulating an explanation or model. Models should be physical, conceptual, and mathematical.

Definitions

scientific notation	method of writing large and small numbers in shorthand using a system of coefficients (1-9.9) multiplied by exponents by factors of 10. For example, 1224578 would be written as 1.224578×10^6
coefficient	the number used within scientific notation between 1 and 9.9 to be multiplied by an exponent
exponent	a factor of ten. Used within scientific notation to represent large or small numbers.
precision	how close a series of measurements are to each other
accuracy	how close a measured value is to the real value of the object

Sample questions to ask your child after completing the weekly reading.

What is the difference between precision and accuracy?

Precision is how close a series of measurements are to each other.

Accuracy is how close a measured value is to the real value of the object.

What does size have to do with the difficulties of chemistry?

Because of their small size, nobody has ever seen an atom before.

What range of numbers must a coefficient be between in order to write out a number in scientific notation?

The coefficient must always be a number between 1.0 and 9.9

When converting a number between standard form (i.e. 102,000) and the scientific notation (i.e. 1.02×10^5), what happens to the exponent if the conversion requires the number to get smaller or larger?

If the coefficient needs to get smaller during a conversion, the exponent will need to get bigger, and vice versa.

Day Two:

Your child should check their work on the practice worksheets today with the answer key below.

Answer Key for Practice Problems

1) 4.57×10^{4}
2) 9×10^{-3}
3) 2.3×10^{1}
4) 9×10^{-1}
5) 2.4212×10^{7}
6) 6.65×10^{-4}
7) 2.19×10^{1}
8) 3.32×10^{-3}
9) 3.21×10^{2}
10) 1.19×10^{-1}
11) 1.492×10^{3}
12) 2.713×10^{-1}
13) 3.14159×10^{5}
14) 6.022×10^{3}
15) 1.2011×10^{-1}
16) 3,825
17) 63,000
18) 0.023
19) 0.00000444
20) 7,121,000,000
21) 0.12
22) 180
23) 0.00081
24) 670,000
25) 34,000,000
26) 3.4×10^{-5}
27) 6.5×10^{4}
28) 3.60×10^{14}
29) 5.49×10^{2}
30) 4.03×10^{7}
31) 8.2×10^{-10}
32) 2.05×10^{-10}
33) 2.18×10^{-3}
34) 9.73×10^{5}
35) 7.0×10^{-6}
36) 3.621471×10^{3}
37) 3.7526×10^{3}
38) 4.5683×10^{2}
39) 2.15×10^{2}
40) 4.28×10^{-2}
41) 5.673×10^{-5}
42) 9.0×10^{-9}
43) 3.9256×10^{-5}
44) 1×10^{-8}
45) 3.7004×10^{-3}
46) 2×10^{-3}
47) 8×10^{-6}
48) 3.6×10^{-6}
49) 1.56×10^{-1}
50) 4.5×10^{-5}

Day Three: Kitchen Chemistry Lab

Make certain your child has read through this weekly lab and that you have collected all of your supplies for the activity.

The ingredients for this week's lab are:

1 box Duncan Hines Yellow Cake Mix (with butter)
1 package of cream cheese
1 stick of butter
1 egg
2 tsp. vanilla

Powdered sugar (for topping on the finished cookies)
Plastic wrap
Baking sheet
Knife
Ruler

Mr.Q's favorite cookie (thanks Mom!)

In terms of accuracy, these cookies couldn't be more precise.

The topics of accuracy and precision will be demonstrated in this activity.

Ingredients:

1 box Duncan Hines Yellow Cake Mix with butter
1 package of cream cheese
1 stick of butter
1 egg
2 tsp. vanilla
Powdered sugar (for topping on the finished cookies)

Other materials:
Plastic wrap
Baking sheet
Knife
Ruler

Recipe:

1) Whip the cream cheese and butter together until they are creamy.
2) Add the remaining ingredients and mix together.
3) Roll the dough into the shape of a tube and wrap with plastic wrap.
4) Let it rest overnight in the refrigerator.
5) Before baking, place the ruler next to the dough and accurately cut 1 inch slices.
6) Be certain to remove the plastic wrap and bake for ~12 minutes at 350°F.
7) Top with powdered sugar when done.

The initial measurement of your uncooked dough is very important within this activity. Once you have completed baking your cookies, each should have an identical length. To test this concept, follow this procedure:

1) Measure the length of two cookies chosen at random. Are they the same length?
2) Measure the height of these same two cookies. Are their highest points the same?

If your measurement of the cookie dough as you cut the slices was precise, every cookie should be the same size; however, it is unlikely this will be the case no matter how many times you measure various pairs of cookies.

Explanation:

From your reading, you've learned the definitions of accuracy and precision:

Precision is how close a series of measurements are to each other.
Accuracy is how close a measured value is to the real value of the object.

After comparing the length of your pairs of cookies, you may have discovered that several (if not all) of the pairs were not identical. Despite the fact that you accurately followed the recipe and produced cookies that are (I'm certain) delicious – they are not exactly alike! This means all of your cookies are not precisely like each other.

But what if all of your cookie pairs are nearly the identical length? This would mean that your cooking ability is both accurate and precise!

Is it possible to be neither accurate nor precise during your cooking this week? Yes! What if your oven does not cook properly and burns the cookies on the outside edge of the sheet while leaving several cookies in the center undone? This batch of cookies would not be very precise (since some cookies were properly cooked and others would still be raw) or accurate (since none of the cookies ended up as they were supposed to.)

Accuracy and precision are the two fundamental goals for all chemists in their experiments. However, we are human and we do make mistakes – lots of them! Even the most careful chemist in the world cannot be 100% accurate and 100% precise in her experiments. That is why all of your cookies are a little different from each other. I'm sure you did your best, but that's simply how chemistry works.

(I'm trying hard not to say, "That's the way the cookie crumbles." Yeah... I know it's a bad pun.)

Your goal in the remaining lab activities is to follow the procedures as accurately as you can so that your results will be as precise as possible. I'm certain you can do it! So now it's on to Chapter 2!