Science Bowl 2021

Water, Water Everywhere—Even in My Food!

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PERCENT: Parts per 100

- **Meaning of Percent:** Percent tells the ratio of each part of something to 100 of the whole thing. For example, to say that 15% of a piece of meat is fat means that there are 15 grams of fat for every 100 grams of meat.

- **Calculating Percent:** In order to calculate a percent, the quantities of both the part and the whole must be measured in the same units. To perform the actual calculation, the quantity of the part is divided by the whole quantity, and the result multiplied by 100%.
Why Percent is Important:

Percent is important to a chemist in a number of ways, but especially as a means of providing information about chemical compounds. Chemical compounds are pure substances composed of two or more elements. The chemical composition of a compound tells the percentage by mass of each element in the compound. For example, water is composed of the elements hydrogen and oxygen. The composition of the water is 11% hydrogen and 89% oxygen. This means that in every 100-gram sample of water, there are 11 grams of hydrogen and 89 grams of oxygen.
Activity Description:

- In this activity you will be able to determine the percentage of water in a vegetable such as a tomato, potato, cucumber, pepper, or squash.
Experimental Design

- You will be planning and designing an experiment in which you will gently warm/heat a vegetable (or more than one) to remove the water in the vegetable.
- How you perform the experiment depends on the equipment you have available at school and at home.
Materials

- Source of heat:
  - Air fryer (can use as dehydrator)
  - Food dehydrator
  - Toaster oven
  - Oven on kitchen stove (DO NOT USE A MICROWAVE OVEN or heat on a burner or hot plate—that is too much concentrated heat and the food will burn—a chemical reaction which you don’t want to happen)

- Vegetable of choice: (you may want to do two of them, but don’t need to more than one)
  - Tomatoes
  - Green peppers
  - Cucumbers
  - Squash
  - Potatoes (white or sweet)

- Other:
  - Balance
  - Aluminum foil, or aluminum pie plate
  - Knife to cut up the vegetable
The Veggies

The Balance
My Dehydrator – Air Fryer
After 10 hours...

Cucumber        Pepper     Yellow Squash
Procedure

- Wash and thoroughly dry vegetable
- Determine/record mass of veggie in grams
- Determine/record mass of container, empty
- Slice/chop veggie and determine/record mass of both veggie and container before heating
- Using preferred method, gently heat the samples until they appear dry
- Determine/record mass after it has cooled
- Reheat and reweigh
Data Table and Calculations Table

- TRIAL 1
  - Mass of empty container (g)
  - Mass of container plus food substance before heating (g)
  - Mass of container plus food substance after heating (g) first time
  - Mass of container plus food substance after heating (g) second time
  - Mass of container plus food substance after heating (g) last time

- TRIAL 1
  - Beginning Mass of vegetable (g)
  - Mass of water lost (g)
  - % of water in the vegetable
Questions to Answer

• What was the percentage of water in your vegetable?

• How does that compare with other vegetables in your class?

• What is the “correct” percentage of water in your food?

• How did your results compare with those accepted values?
Where to find accepted values?

Resources:


https://www.berkeleywellness.com/healthy-eating/food/article/how-much-water-your-food

https://www.myfooddata.com/articles/vegetables-high-in-water.php#vegetables-high-in-water
Percentage Calculations

- **Calculating percentage of a whole that is a certain kind**—for example: If a gardener plants 30 plants and 6 of them are tomato plants, what percentage of the plants are tomatoes?
- **Calculating a number of items of a total if you know the percentage breakdown**—for example, If 30% of the 20 chairs in a room are yellow, how many yellow chairs are there in the room?
- **Going from percent to decimal and from decimal to percentage**—for example- Write the decimal 0.34 as a percentage or write 15% as a decimal.
- **Calculating a total if a percentage and number that represents are known**—for example, the vet reported that 10% of the dogs tested had heartworms. If 20 dogs had heartworms, how many dogs were tested?
- **Percentage increase/decrease from a previous measurement**—for example: The cost of a medication is going to increase by 5% next year. This year it is $25. How much will it be next year?
- The cost of a pound of candy last year was $5.00. This year it is $6.00. By what percentage did it increase?
Percent meaning

\[
\begin{align*}
3\% &= \frac{3}{100} \\
10\% &= \frac{10}{100} \\
25\% &= \frac{25}{100} \\
75\% &= \frac{75}{100}
\end{align*}
\]
0.13 = 13%
Twenty-five percent of 20 = 5
Percent of Increase and Decrease (1)

8 \rightarrow 13 \quad \text{Increase percent of change}

7 \rightarrow 5 \quad \text{Decrease percent of change}

P\% = \frac{5}{8}

\sqrt{5.00} = \frac{1.0}{40} = 0.25

P\% = \frac{\text{Amount of Inc. or Dec.}}{\text{Original}}
Questions in general about water and its properties, as well as other topics about water in the environment and the human body and its importance to society.
General Questions about water supply

• The percentage of water on the earth
• The percentage of water that is fresh water
• The percentage/number of people without access to clean water
• The reading passage will be about water resources as well.
Over 1 Billion People!

NEARLY ONE BILLION PEOPLE LACK A SOURCE OF CLEAN, SAFE DRINKING WATER.

TOGETHER, WE CAN CHANGE THAT.

Learn more.
Distribution of water on Earth

- Oceans 97%
- Freshwater 3%
- Ice caps & Glaciers 79%
- Groundwater 29%
- Accessible Surface Freshwater 1%
- Lakes 52%
- Water within living organisms 1%
- Soil moisture 38%
- Water vapor 8%
- Rivers 1%
Properties of Water

- Surface tension
- Capillary action
- Being a good solvent
- Solute/solvent
- Adhesion
- Cohesion
- Evaporation
- Condensation
- Sublimation
- boiling
- freezing
- melting
- Boiling point/ freezing point temperatures (Celsius)
- Density
- Calculations of percentage concentrations of solutions
- Shape and separation of charge on water molecule (polarity)
- Composition of water molecule (2 Hydrogen atoms - 1 oxygen atom)
- Water cycle
Capillary Action Terms

2. Capillary action
   1. A forces created by adhesion and cohesion of water
   2. Adhesion = forces between water molecules
      Cohesion = forces between water molecule and xylem wall
   3. Water move upward continuously, within xylem, due to capillary action

Adhesion and cohesion force → capillary action → Enable water to move upward along the narrow column of xylem
Phase change relationships
The Water Cycle

- Very simple diagram for water cycle. Nothing very detailed
- But need to know terms:
  - Condensation
  - Transpiration
  - Precipitation
  - Evaporation
  - Accumulation
  - Runoff