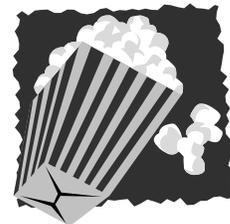
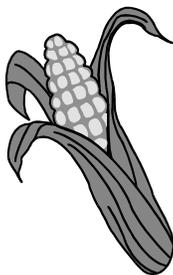
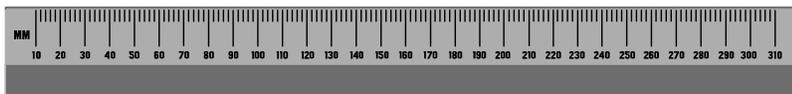




# POPCORN MATH



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# Popcorn Math

## Unit Overview

This unit provides students with the opportunity to conduct mathematical investigations using popcorn. They will measure length and volume of popped and unpopped kernels along with the mass. They will compare and contrast their data from three types of popcorn, and calculate the average, ratio, percent, and probability. Temperature readings will be taken and graphed, and scatter and stem and leaf plots will be created to represent student results. The mathematical skills emphasized in Popcorn Math are measuring, collecting data, calculating for average, ratio, percent and probability, and graphing.

## Scheduling

This unit may take from a day, if you choose to use only one of the math activities, to the entire year to complete, depending on the goals of the teacher and the interests of the students.

### Materials to be

#### obtained locally:

Please make **one** student activity book for **each** student.

Glue

Oven

Water

Shallow pan

Graph paper

## About the Format

Each learning experience is numbered and titled. Under each title is the objective for the learning experience.

Each learning experience page has two columns. The column on the left side of the page lists materials, preparations, basic skill processes, an evaluation strategy, and vocabulary. The evaluation strategy is for the teacher to use when judging the student's understanding of the learning experience.

The right column begins with a "Focus Question" which is typed in italicized print. The purpose of the "Focus Question" is to guide the teacher's instruction toward the main idea of the learning experience. The "Focus Question" is not to be answered by the students. The learning experience includes directions for students, illustrations, and discussion questions. These discussion questions can be used as a basis for class interaction.

## **Background Information**

### **Popcorn**

Popcorn's ability to pop lies in the fact that the kernels have a hard outer shell and contain a small amount of water (moisture) stored inside the soft starch. When the water is heated to a high enough temperature, it changes to steam. The steam creates pressure within the kernel until, eventually, the hard outer casing gives way and the kernels explode. The popping allows the moisture to escape as steam, therefore turning the kernels inside out.

### **Ratio**

A ratio is a comparison of two numbers. We generally separate the two numbers in the ratio with a colon (:). Suppose we want to write the ratio of 8 and 12. We can write this as 8:12 or as a fraction  $\frac{8}{12}$ , and we say the ratio is *eight to twelve*.

### **Probability**

Probability is the chance or likelihood that a certain event will happen. Mathematical probability is usually expressed as a ratio. If it is equally likely that an even may happen in  $h$  ways and fail to happen in  $f$  ways, where  $h + f = n$ , then the probability that the even will occur may be expressed as the ratio  $\frac{h}{n}$ , and the probability that it will fail to occur may be expressed as the ratio  $\frac{f}{n}$ . The fraction that denotes the number of favorable outcomes divided by the total number of possible outcomes represents that probability that an event will happen. The fraction that denotes the number of ways an event will fail to happen divided by the total number of possible outcomes represents the probability that an even will fail to happen.

### **Percent (%)**

Percent literally means "per hundred". If 20 out of 100 gumballs are red, 20 percent (%) are red.

# Learning Experience 1: Getting Started

**Objective:** Students will solve various math word problems about popcorn as an introduction to the unit and measure the volume and length of a specified amount of kernels from three (3) types of popcorn.

## **Materials:**

### **For each group of three students:**

3 Popcorn Math Student Activity Books

25 ml graduated cylinder

3 3 x 5 index cards

Metric ruler

50 kernels of the type of popcorn students will be testing

### **For the class:**

2 large Ziploc bags marked "Dried" and "Moistened" popcorn.

Glue\*

Oven\*

Water\*

Shallow pan\*

\*provided by teacher

## **Preparation:**

Follow the directions on the labels of each bag of popcorn and prepare ahead of time. **Do not throw away popcorn bags!** They will be used in Learning Experience #5.

### **To dry kernels:** Preheat oven to 180°.

Spread the entire bag of popcorn labeled "popcorn to dry" in a single layer in a shallow pan. Bake for approximately 90 minutes. Allow kernels to cool and seal in the plastic bag marked "Dried Popcorn". Keep popcorn in sealed plastic bag until ready for use.

**To moisten kernels:** Pour popcorn from bag labeled "popcorn to be moistened" into a large Ziploc bag labeled "Moistened Popcorn". Add 50 ml of water to the bag and seal for 24 hours. Keep in sealed bag until ready for use.

## **Evaluation Strategy:**

Students will solve word problems accurately and make comparisons of volume and length of the three popcorn types.

## **Vocabulary:**

length      volume      compare

As an introduction to this unit, ask students to answer the math word problems on the activity sheet for Learning Experience #1 in the Popcorn Math Student Activity Book. These questions introduce students to some statistics on popcorn which is used to collect and analyze data in this unit.

In this unit, students will be comparing three (3) types of popcorn: regular, dried, and moistened. Students begin the comparison of these by finding the volume, through water displacement, of 50 kernels of corn they are given. Then they will determine the length of 10 kernels and predict the lengths with greater amounts of popcorn.

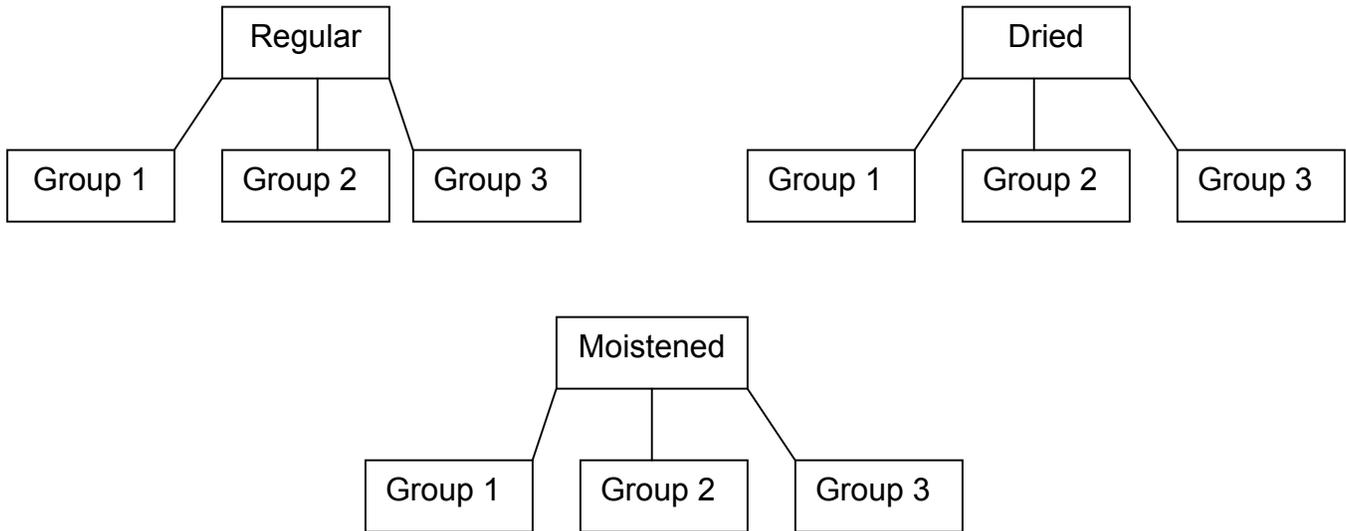
To determine which students get which type of popcorn, we suggest placing students in groups of three, and numbering them in groups of 1, 2, or 3. There should be three sets of group 1, three sets of group 2, and three sets of group 3, but this will vary depending on the number of students in your class. Then give each of the Group 1 teams a different type of popcorn and do the same for the Group 2 teams and the Group 3 teams. The distribution of the popcorn is diagramed on the next page.

# Learning Experience 1 continued

## Page 2

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### Suggested Popcorn Distribution:



By giving at least 350 kernels of popcorn to each group in this format, you will be assured that there will be three groups of data for the regular popcorn, three groups of data for the dried popcorn, and three groups of data for the moistened popcorn. If you have fewer students, only have two students in each group instead of three.

## Learning Experience 2: Popped vs. Unpopped

**Objective:** Students will collect temperature readings of the popcorn popper in two different situations – with and without the popcorn tub underneath the spout. They will find the mass of popped and unpopped kernels and the number of popped and unpopped kernels.

### **Materials:**

**For each group of three students:**

3 Popcorn Math Student Activity Books

Styrofoam tray

300 kernels group type popcorn

9 oz clear plastic tumbler

Graph paper\*

### **For the class:**

Measuring cup

Popcorn popper

Electronic balance scale

Stopwatch

Popcorn tub

Digital thermometer

Cork

\*provided by teacher

### **Preparation:**

Find a location in the room for the popcorn popper. Place the digital thermometer through the hole in the cork and slide it down into the hole on the top of the popcorn popper. Give the student groups their predetermined type of popcorn.

### **Evaluation Strategy:**

Students will find the mass of popped kernels and kernels left unpopped and find the number of kernels that popped and that did not.

### **Vocabulary:**

mass	ratio
average	proportion
graph	trials

### **Session 1:**

Ask student groups to count out a specific number of kernels so that when all the groups' kernels are put together they equal 300. Use the measuring cup to add popcorn to the popcorn popper.

As a class, place the digital thermometer, with the cork for support, in the hole on the top of the popcorn popper. Take an initial temperature reading of the cold popcorn popper and have the students record the temperature, in degrees Fahrenheit, in Data Table 1 on page 1 of the Popcorn Math Student Activity Book. **Without** the popcorn tub under the spout, turn on the popcorn popper, start the stopwatch, and record the temperature every 30 seconds for five (5) minutes. Have the students record each reading in the Data Table 1. Turn off the popcorn popper and let it cool down a few minutes before the next step. It helps to remove the spout. **With** the popcorn tub under the spout, turn on the popcorn popper, start the stopwatch, and record the temperature every 30 seconds for five (5) minutes. Have the students record each reading in the Data Table 1. Once this data is collected, the students will plot the data on a line graph.

### **Session 2:**

As a class, find the mass of a plastic tumbler using the electronic balance scale. Students should record this on page 2 of Learning Experience #2 in the Popcorn Math Student Activity Book.

## Learning Experience 2 continued

### Page 2

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Students will follow the directions on the same page to find the mass of 300 of their type of popcorn kernels and they will pop them. Then they find the mass and numbers of the popped and unpopped kernels recording all their data in the Data Table 2 on page 2 of Learning Experience #2 in the Popcorn Math Student Activity Book.

**Note:** We suggest having the students count only the unpopped kernels and subtracting that from the original 300 hundred kernels. However, if students want to count the popped kernels any pieces that have broken off the main kernel **should not** be counted as a popped kernel, but should be added to the whole popped kernels when they determine the mass because they were once part of the whole popped kernel.

# Learning Experience 3: Math Using Regular Popcorn

**Objective:** Students will contribute their data gathered in Learning Experience #2 to the Master Data Table and compare the results of the popped and unpopped corn. They will use the data for the regular popcorn to average, find the ratio, percentage, and probability.

**Materials:**

**For each group of three students:**

3 Popcorn Math Student Activity Books

**For the class:**

Master Data Tables

**Preparation:**

11 x 17 inch copies of the Master Data Table for mass and number have been provided in the kit. Place them somewhere where the students will have access to them.

**Evaluation Strategy:**

Students will find the ratio and percentage for the regular popcorn and calculate probability and compare results.

**Vocabulary:**

control  
mass  
average  
experiment

Students will use the data they gathered on their type of popcorn in Learning Experience #2 and add it to the Master Data Tables for mass and number. Then they will copy the rest of the group's data onto their own Master Data Tables found on page 1 of Learning Experience #3 in their Popcorn Math Student Activity Books.

Using the class data, students will use only the data for the regular popcorn to find the ratio of popped/unpopped kernels to total mass for each trial and the percentage of popped kernels and kernels left unpopped for each trial. They will also calculate the probability for various situations.

## Learning Experience 4: Math Using Dried and Moistened Popcorn

**Objective:** Students will contribute their data gathered in Learning Experience #2 to the Master Data Table and compare the results of the popped and unpopped corn. They will use the data for the dried and moistened popcorn to average, find the ratio, percentage, and probability.

**Materials:**

**For each group of three students:**

3 Popcorn Math Student Activity Books

**For the class:**

Master Data Tables

**Preparation:**

11 x 17 inch copies of the Master Data Table for mass and number have been provided in the kit. Place them somewhere where the students will have access to them.

**Evaluation Strategy:**

Students will find the ratio and percentage for the dried and moistened popcorn and calculate probability and compare results.

**Vocabulary:**

control  
mass  
average  
experiment

Using the class data, students will use only the data for the dried and moistened popcorn to find the ratio of popped/unpopped kernels to total mass for each trial and the percentage of popped kernels and kernels left unpopped for each trial.

Students will compare their findings and determine where the differences lie between the dried and moistened popcorn and explain why.

# Learning Experience 5: Graph Nutritional Data

**Objective:** Students will record the nutritional data of various brands of snack foods and create scatterplots and stem-and-leaf plots with the data.

**Materials:**

**For each group of three students:**

3 Popcorn Math Student Activity Books

**For the class:**

Popcorn bags

**Preparation:**

A mini-lesson on the creation of a scatter plot and stem-and-leaf plots may be necessary before completing this learning experience.

**Evaluation Strategy:**

Students will create a stem and leaf plot and scatterplot, read and analyze nutritional data, and answer questions based on that data.

**Vocabulary:**

scatterplot  
positive correlation  
negative correlation  
no correlation  
stem-and-leaf plot  
calories  
nutrition  
fat  
carbohydrates  
protein

Students are to look at the nutritional data on the popcorn in the kit and other brands of snack food labels provided. Students are to create a stem and leaf plot and scatterplot of some specific aspects of the nutritional data.

On the activity sheet for Learning Experience #4 in the Popcorn Math Student Activity Book, students are recording the number of fat grams/cup and number of calories/cup. Then students create a scatterplot with that data.

Then students find the fat grams/cup, carbohydrate grams/cup, and protein grams/cup and create a stem and leaf plot for each piece of data. Students then answer questions about the results.

## **GLOSSARY**

Average:	a number that can be regarded as typical of a group of numbers, calculated by adding the numbers together, then dividing the total by the amount of numbers.
Balance:	a simple mechanical device for finding the mass of objects or samples, often consisting of a pivoted horizontal beam with a pan suspended from each end. Material to be massed is put in one pan and masses of a fixed value are gradually added to the other until the beam returns to the horizontal.
Calories:	a unit of energy-producing potential in food, equal to one large calorie.
Carbohydrates:	an organic compound derived from carbon, hydrogen, and oxygen that is an important source of food and energy for humans and animals. Sugar, starch, and cellulose are carbohydrates.
Compare:	to examine two or more people or things in order to discover similarities and differences between them.
Control:	a subject taking part in an experiment or survey who is not involved in the procedures affecting the rest of the experiment, thus acting as the standard against which the results are compared.
Experiment:	to carry out a scientific test of a theory or process with the use of tests and trials in order to make discoveries.
Fat :	greasy water-insoluble solid or semisolid chemical compound that is among the chief nutritional components of food. Fats are esters of glycerol and fatty acids.
Graph:	a diagram used to indicate relationships between two or more variable quantities. The quantities are measured along two axes, usually at right angles. A graph may consist, for example, of a line joining points plotted between coordinates.

Length:	the distance along something from end to end, or a measurement taken of this distance.
Mass:	the property of an object that is a measure of the amount of matter it contains.
Percent:	Percent literally means “per hundred”. If 20 out of 100 gumballs are red, 20 percent (%) are red.
Positive correlation:	in scatter plot, as you move right, the graph slopes up.
Proportion:	a relationship or ratio between two variables that remains fixed.
Protein:	a complex natural substance that has a high molecular weight and a globular or fibrous structure composed of amino acids linked by peptide bonds. Proteins are essential to the structure and function of all living cells and viruses.
Ratio:	a quotient of two numbers or expressions arrived at by dividing one by the other.
Negative correlation:	in scatter plot, as you move right, the graph slopes down
No correlation:	no general trend found.
Nutrition:	foods, or the minerals, vitamins, and other nourishing substances that they contain.
Scatter plot:	a visual means in which to see a correlation of data that involves points plotted on a x and y axis.
Stem-and-leaf plot:	a visual means in which to see relationship between various types of data.
Trials:	done as a test or experiment.
Volume:	the size of a three-dimensional space enclosed within or occupied by an object. Volume is measured in cubic units.