

Body Mass Index Activity

Overview

In this activity, students develop a clear understanding of body mass index, BMI, and how to calculate it. The BMI virtual instrument, VI, is used in performing and checking calculations as well as building a conceptual understanding of the relationships between BMI and a person's height and weight.

Two extensions are available to further explore BMI. The first asks students to associate ranges of BMI to weight categories. The second asks students to survey their friends, calculate BMI, and record their findings.

Objectives

Students will be able to:

- Calculate a person's BMI given their height and weight.
- Describe the relationship between BMI and a person's height and weight.

Standards (TEKS)

Biology 11C

Algebra b1ABCDE

Activity

A person's body mass index, or BMI, is a ratio of the person's weight to the square of their height. That is, $BMI = \frac{W}{h^2}$. This ratio establishes a standard scale for people of various heights and weights to determine if they are over, under, or normal weight.

The units of BMI are typically kg/m^2 . There are two things to note about this. The first deals with weight versus mass. When weight is referenced, we are really discussing mass, which can be measured in kilograms. The other thing to note is this activity will use metric units for height and weight.

In the US, height is usually measured in feet and inches and weight is measured in pounds. Of course, there are 12 inches in a foot. One foot is about 0.3408 meters. One inch is about 0.0254 meters. One pound is about 0.4536 kilograms. For converting units, it may be helpful to note:

$$1 = \frac{0.3408 \text{ m}}{1 \text{ ft}} = \frac{0.0254 \text{ m}}{1 \text{ in}} = \frac{0.4536 \text{ kg}}{1 \text{ lb}}$$

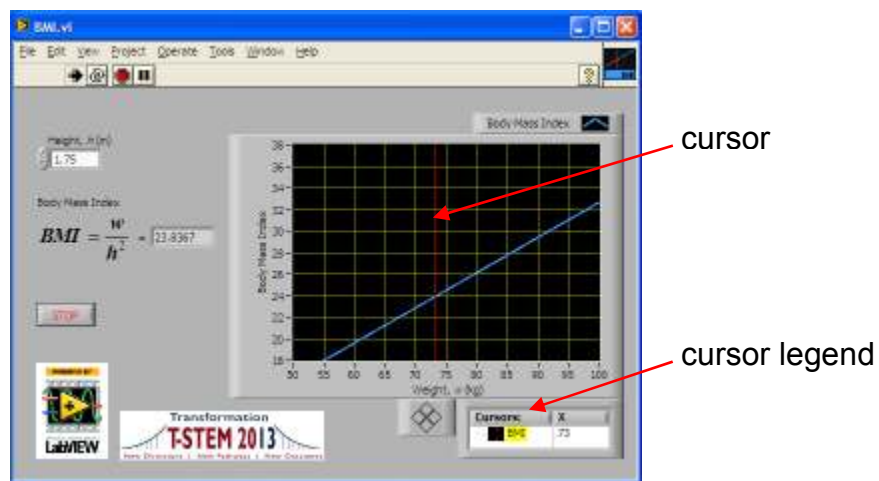
Let's start with an example, a fictitious person named Sam. Sam is 5'6" and weighs 130 pounds.

- 1) Calculate Sam's BMI.
 - a) Convert weight of 130 pounds to kilograms.
 - b) Convert height of 5'6" to meters.
 - c) Use the formula, $BMI = \frac{W}{h^2}$ to calculate Sam's BMI to the nearest tenth.

Now, let's use the BMI virtual instrument, VI, to get a sense of what happens to BMI when weight or height change.

- 2) Open and run the BMI virtual instrument, VI.

The BMI VI has a control for entering a person's height in meters. The graph has a blue line indicating the body mass indices over multiple weights for the given height. In the graph, there is a red vertical line on the graph called a cursor.



The position of the cursor controls the weight, in kilograms, used to calculate and display the BMI shown to the left of the graph. You can click and drag on the vertical line of the cursor to control selected weight. A particular value for weight can be set using the cursor legend below the graph. Simply double-click on the number displayed and set it to the desired weight.

- 3) Use the VI to calculate Sam's BMI.
 - a) Enter the height you calculated in meters for Sam.
 - b) Use the cursor legend to set the weight you calculated in kilograms for Sam.
 - c) To the nearest tenth, what does the VI display for Sam's BMI?
- 4) Just looking at the graph, what happens to Sam's BMI if Sam's weight
 - a) Increases?
 - b) Decreases?
- 5) Check out your hypotheses.

- a) Use the cursor to increase and then decrease the selected weight.
 - b) Does the BMI change as expected?
- 6) From the equation, $BMI = \frac{W}{h^2}$, what happens to BMI if Sam's height
- a) Increases?
 - b) Decreases?
- 7) Use the VI to check your hypotheses.
- a) Set the weight back to what you calculated for Sam's weight
 - b) Start with 1.65 m for the height
 - c) Slowly increase the height one-hundredth of a meter at a time.
 - d) Fill in the table with your findings. Sam's weight is the same for each row.

Sam's Weight	Height	BMI

- 8) Summarize your findings about the relationship between BMI and height.
- 9) Stop the VI. You are done.

Extension 1

Each weight category, like overweight or underweight, is associated with a particular range of body mass indices. This information can be found on several Internet sites.

- 10) Find a reliable source for information on the relationship between BMI and weight categories.
- 11) Complete the following table.

BMI	Weight Category
	Underweight
	Normal
	Overweight
	Obese

- 12) Calculate the range of weights, in pounds, for each range of BMI for a person who is 5'6". (Hint: Be ready for unit conversions.)
 - a) For example, for adults, a BMI of 18.5 is the cutoff between underweight and normal weight, use the formula for BMI and some algebra to calculate how much a 5'6" person would weigh to have a BMI of 18.5.
 - b) Fill in the following table with your findings.

Height	Weight	BMI	Weight Category
5'6"			Underweight
			Normal
			Overweight
			Obese

Extension 2

Surveys are a great way to collect specific data about people. Use a survey to collect the data you need to calculate a person's BMI. Other data may be interesting to collect as well. Maybe there are correlations to be found between BMI and a person's age, shoe size, favorite dessert, et cetera.

- 13) What does your survey need to ask in order for you to calculate BMI?
- 14) What else will you find out in your survey?
- 15) Anonymously survey at least 9 of your friends. You might use an online survey site, like SurveyMonkey.com, to collect your data.
- 16) Complete the following table with your data.
 - a) Include yourself in your survey.
 - b) Calculate each person's BMI.
 - c) If you collect other data, label the column where it is recorded.

	Height	Weight	BMI		
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

- 17) What conclusions do you have from your survey?
- 18) Were there any trends with the extra information you collected?
- 19) What else would you ask if you were to survey people again?