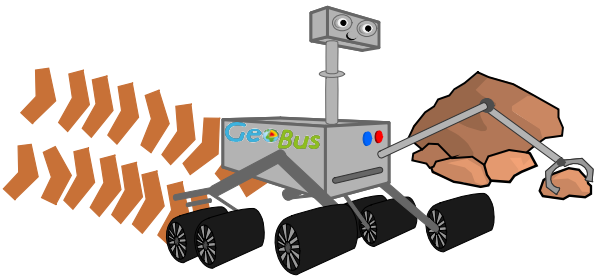
Science Fact or Fiction?

Potato Calories

Instructions



Materials:

[1] What does 200 calories look like?

Food labels showing calorie content
Scales
Plates
Examples of different foods
Data sheet showing weight of 200 calories per food (attached)

[2] How much energy does a potato contain?

20ml water *(*if using a different volume see note below)*
Boiling tubes + stands/tongs to hold
Thermometer
Potatoes
Knife (to cut potato)
Chopping board/plate
Safety equipment (i.e. goggles)
Long skewer/burning dish for Bunsen (to contain burning potato)
Bunsen burners
Scales

[3] How many potatoes to survive?

Value for calories contained per unit weight in a typical potato *(calculated from [2] or taken from data sheet)*

Calculators

Activity [1]: What does 200 calories of different foods look like?

1. For each food, try to estimate what size of portion would be equivalent to 200 calories and put this on one plate.
2. Use the scales to weigh out the right amount on another plate and compare this with your estimate. Which foods are surprisingly high or low in calories?
3. Use the food labels to consider the calorie content of other items. You can also calculate the rough calorie content by knowing how many grams of carbohydrate, protein, and fat a food contains:

   1 g carbohydrate = 4 calories
   1 g protein = 4 calorie
   1g fat = 9 calories

   Multiply the number of grams by the number of calories in a gram of that food component. If a serving of potatoes has 10 grams of fat, 90 calories are from fat - 10 grams x 9 calories per gram.

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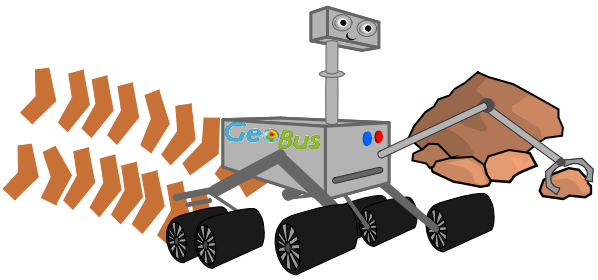

Activity [2]: How much energy is contained in a typical potato?

1. *(class)* Weigh the whole potato and make a note of the total mass
2. *(class)* Cut the potato into roughly 1cm^3 cubes (one per group)

   [each group now has a set of equipment, and a piece of potato]
3. Pour 20ml cold water in to the boiling tube & record the temperature
4. Weigh the potato cube
5. Put the potato on the burning dish/skewer & heat until it catches fire
6. Heat the water using *only* the flame from the burning food until the food is completely burned
7. Record the final temperature of the water
8. Calculate the temperature increase
9. Calculate the energy released using the equation:

ENERGY = MASS x SPECIFIC HEAT CAPACITY x TEMPERATURE INCREASE

Specific heat capacity of water = 1 (cal/g.^{o}C)
Mass of water = 20g *(*20ml water weighs 20g, adjust if you use a different volume of water)*

Therefore:

ENERGY (cal) = 20 (g) x TEMPERATURE INCREASE (^{o}C)

10. Scale up the value to represent the whole potato - if the cube (1cm^3) weighs 2g and the whole potato weighs 100g, the conversion is 100/2 = 50, so multiply the energy value by 50. A typical nutritional Calorie = 1kcal (1,000 calories) so divide your answer by 1,000.

Activity [3]: How many potatoes a day would a person need to eat to survive?

1. Calculate the number of potatoes needed to survive 550 days by a person needing 1,500 calories a day (use the value from [2] or from the sheet

1,500 CALORIES PER DAY ÷ ENERGY PER 1 POTATO = NUMBER OF POTATOES PER DAY

NUMBER OF POTATOES PER DAY X 550 = TOTAL NUMBER OF POTATOES

Potatoes are pretty high in almost everything the human body needs to survive – they are more energy-packed than any other popular vegetable, and even have even more potassium than a banana. However, they don't contain much protein, which could lead to muscle wastage over time – so like Mark Watney in The Martian, anyone trying to survive on just potatoes would need to supplement them with vitamin and mineral supplements.

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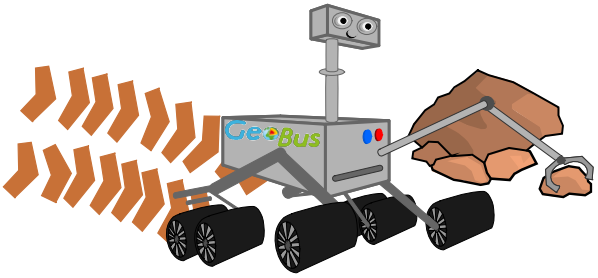
Data Sheet (200cals)



Food	Weight of 200 calories
Apples	385g
Gummy bears	51g
Doritos	41g
Cheddar cheese	51g
Plain bagel	80g
Cooked pasta	145g
Eggs	150g
Ketchup	226g
Werther's Originals	50g
Mayonnaise	28g
Lettuce	1.43kg
Banana	224g
Peanut butter	31g
Cheerios	53g
Mini peppers	740g
100 g boiled potato = approx. 80 calories A medium potato weights ~150g = 120 calories	

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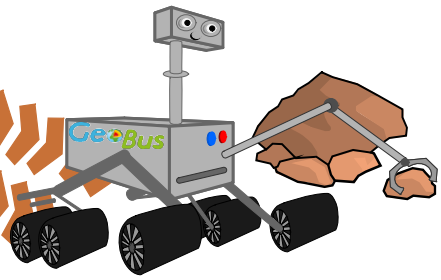

How much energy is contained in a typical potato?

1. During the experiment, measure and record the values in the tables below:

Starting temperature	
Final temperature	
Temperature increase	

Mass of potato cube	
Mass of whole potato	

ENERGY = MASS x SPECIFIC HEAT CAPACITY x TEMPERATURE INCREASE

Specific heat capacity of water = 1 (cal/g.°C) so this value can be ignored
Mass of water = 20g *(*20ml water weighs 20g, adjust for different volumes of water)*

2. Calculate the energy in nutritional Calories released by burning the cube of potato:

$$\text{ENERGY (cal)} = 20\text{g x TEMPERATURE INCREASE (°C)}$$

$$\text{ENERGY (Calories)} = \text{ENERGY (cal)} \div 1{,}000\ *$$

**divide by 1,000 because the typical nutritional Calorie is actually 1kcal (1,000 calories)*

3. Calculate the energy contained in a whole potato:

$$\text{ENERGY (whole potato)} = \text{ENERGY (cube)} \times \frac{\text{MASS (whole potato)}}{\text{MASS (cube)}}$$

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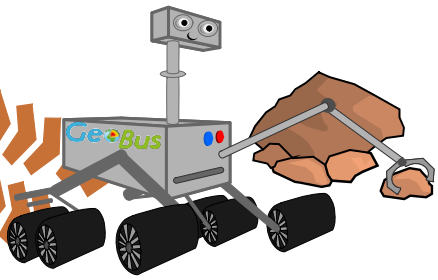

How many potatoes a day would a person need to eat to survive?

In *The Martian*, Mark Watney needed to survive for the total of 550 sols (days).

An average person needs 1,500 Calories per day to survive.

Nutritional Calorie content of an average potato

1. How many potatoes would an average person need to survive 550 days:

1,500 CALORIES PER DAY ÷ ENERGY PER 1 POTATO = POTATOES PER DAY

POTATOES PER DAY X 550 = TOTAL POTATOES

2. During the film, Mark Watney only ate 1 potato a day – would this be enough to survive on? Why might ne need fewer calories a day than an average person?

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