

Food Energy

Food contains stored energy:

- Carbohydrates have 4 Calories per gram
- Protein has 4 Calories per gram
- Fat has 9 Calories per gram

The energy content of food can be measured using **Calorimetry**, which means burning the food and measuring how much energy is released. The energy is measured by looking at the temperature change of whatever is absorbing the energy. We use water (in a pop can) in our calorimetry.

$$E = mc\Delta T = \text{cal} / 1000 = \text{Cal}$$

Energy absorbed mass 1.0 cal/g°C change in temp

→ specific heat constant has changed from petroleum unit.

- When you want to calculate Joules, $c = 4.184 \text{ J/g}^\circ\text{C}$
- When you want to calculate calories, $c = 1 \text{ cal/g}^\circ\text{C}$

Example Calculations:

- You burn 12 Cooler Ranch Doritos.
- The energy is absorbed into 5 L (5000 g) of water.
- The water temperature starts at 20°C.
- Starting mass of the Doritos is 28 g.
- Mass of the chips after burning (i.e. their charred remains) is 23 g.
- Final temperature of the water is 50 °C.

A) How much energy was absorbed by the water?

$$E = mc\Delta T$$

$$E = (5000 \text{ g})(1 \text{ cal/g}^\circ\text{C})(30^\circ\text{C})$$

$$E = 15,000 \text{ cal} = 15 \text{ kcal} = 15 \text{ Cal} \quad (1000 \text{ cal} = 1 \text{ Cal})$$

B) How much energy per gram is released by burning Doritos?

Answer is Cal per g (Cal / g).

So you have to take Calories ÷ grams.

$$E = 15 \text{ Cal.}$$

$$\text{mass burned} = 28 \text{ g} - 23 \text{ g} = 5 \text{ g}$$

$$\text{energy per gram} = 15 \text{ Cal} \div 5 \text{ g} = 3 \text{ Cal / g.}$$

This means that for every gram of Cheetos burned, 3 Cal of energy would be released.