SPECIFIC HEAT OF POTATO
How much heat does it take to raise the temperature of one gram of potato by 1°C?
Why would anyone care?

Materials
styrofoam cup
thermometer
balance
hot water (as hot as possible from tap)
potato
knife for cutting potato
waxed paper
newspaper or cardboard or cutting board (to protect work surface when cutting)

Background
Heat gained or lost by a material (e.g., water or potato) can be calculated by

$H = mc\Delta T$

    m = mass of material, in grams, g
    c = specific heat of material -- the specific heat of a substance is the amount of
      heat necessary to raise the temperature of one gram that substance by one degree
      Celsius, in calories per gram per degree Celsius, cal/g^{o}C; it takes **one calorie** to raise
      the temperature of **one gram of water** by **one degree Celsius**
    ΔT = the temperature change of the material, in degrees Celsius, ^{o}C

A sample of potato whose mass and temperature are known is placed in a sample of water whose mass and temperature are known. The potato will be approximately room temperature, and the water will be significantly warmer. Assuming that the styrofoam cup is a perfect insulator, then the heat gained by the potato will be equal to the heat lost by the water, and the two will end up at the same temperature. This is shown by the equations below.

HEAT GAIN	=	HEAT LOSS
$m_p c_p \Delta T_p$	=	$m_w c_w \Delta T_w$
heat gained by potato as it warms up		heat lost by water as it cools down

Solving for c_p :

$$c_p \quad = \quad \frac{m_w c_w \Delta T_w}{m_p \Delta T_p}$$

Procedure:
1. Weigh the styrofoam cup, and record.
2. Cut a slice of potato that is approximately 0.5cm - 1 cm thick. Cut this slice into three or four pieces, and then dice perpendicular to the cuts into thin slices approximately 1 or 2 millimeters thick. Put the diced potato on a piece of waxed paper approximately 10 cm x 10 cm. (**NOTE**: If you're using a large styrofoam cup -- approximately 12 oz rather than 6 oz -- then use TWO slices of potato.)

3. Weigh the diced potato and record. (**NOTE**: Keep the potato on the waxed paper while weighing, to avoid making a mess on the balance platform; we will assume the waxed paper's weight is negligible compared to the potato; if you want to be more accurate, you can tare a new weighing paper, and then dump the potato onto it while it's on the balance.)
4. Determine the temperature of the potato (assume it's room temperature), and record.
5. **READ THIS STEP COMPLETELY BEFORE STARTING TO DO IT.** Fill the styrofoam cup about half full of hot water (as hot as you can get from the tap). Determine the temperature of the water as quickly as possible, but without sacrificing accuracy, and record. Immediately after recording the water temperature, add the potato to the water, and use the thermometer to gently stir the potato and water mixture. When the temperature seems to stop falling (or stops falling rapidly and begins to fall very slowly) then read the temperature of the mixture and record it.
6. Weigh the cup with the water and potato in it.
7. From available data already recorded, calculate the weight of the water and record.

Data & Preliminary Calculations

mass of styrofoam cup	g
mass of potato	g
initial temperature of potato	^{o}C
initial temperature of water	^{o}C
final temperature of water and potato	^{o}C
mass of cup, water and potato	g
mass of water	g

Calculations
Fill in values for items enclosed by (   ), and make appropriate calculations.

$$c_s \quad = \quad \frac{m_w c_w \Delta T_w}{m_p \Delta T_p} \quad = \quad \frac{(\underline{\quad} g) \times \frac{1 \text{ cal}}{g\,^{o}C} \times (\underline{\quad}\,^{o}C)}{(\underline{\quad} g) \times (\underline{\quad}\,^{o}C)}$$

$$= \quad \frac{(\underline{\quad}) \text{ cal}}{(\underline{\quad}) \, g\,^{o}C} \quad = \quad \frac{(\underline{\quad}) \text{ cal}}{g\,^{o}C}$$

Conclusion
The experimental results above show that it takes _____ calories to raise the temperature of one gram of potato by $1\,^{o}C$.

Going Further
1. Who, if anyone, would be interested in the specific heat of potato? Use Google or some other search method to investigate this question.
2. In the course of your search, can you find an "accepted value" for the specific heat of potato? If so, what is the value, who did the work to obtain it, and what method(s) were used?
3. We have expressed specific heat in cal/g^{o}C. You may find it expressed in kJ/kg ^{o}C or kJ/kgK. What do these other terms mean, why are they used, and how are they related to the units we have used in this lab?
4. Would you expect the specific heat of potato to be close to that of water? Why or why not? What is a typical water content for potato?