PROBLEM:

Calculate the energy in calories required to change 40.0g of water by 12 degrees Celsius.

SOLUTION:

Heat capacity of water (in liquid state) is 1 calorie per 1 g and 1 degree Celsius (or Kelvin – the same):

$$c_p = 1 \frac{cal}{g \times K}$$

The value is exactly 1.0 not by accident, but because the actual definition of calorie is related to heating water – 1 gram-calorie is heat of changing 1 gram of water by 1 degree Celsius.

The formula for computing the energy required to change m grams of something by Δt degrees Kelvin (or Celsius) is:

$$E = c_p \times m \times \Delta t$$

Thus, to change 40 g of water by 12 degrees Celsius we need

$$E = 1 \frac{cal}{g \times K} \times 40\ g \times 12\ K = 480\ cal$$

480 calories.