

Calorimetry (430 only)

If we attach the ends of a heating coil to a battery and place the coil itself into a well-insulated container filled with water, we can safely assume that the heat from the coil will be transferred mostly to the water.

Since the energy of the heater is given by

$$E = VIt$$

And since the quantity of heat absorbed by the water is given by

$$Q = mc\Delta T$$

If E is absorbed as Q, $E = Q$, so

$$m c \Delta T = V I t$$

Recall

- m = mass in *grams*
- c = specific heat
- ΔT = change in temperature
- V = voltage of the battery or power source
- I = current
- t = time in *seconds*.

Example 1

How long will it take for *six* heating coils of a 240 L tank to warm up water from 20 to 40°C if a 2.0 A current flows through each element? Assume $V = 110V$.

240 L = 240 000mL = 240 000 g because the density of water = 1g/mL

$$m c \Delta T = V I t$$

$$240\,000(4.19)(40 - 20) = 110(2)t * 6 \text{ (because there are 6 coils)}$$

$$t = 15236 \text{ s}$$

$$= 15236/3600 = 4.23 \text{ hours.}$$

