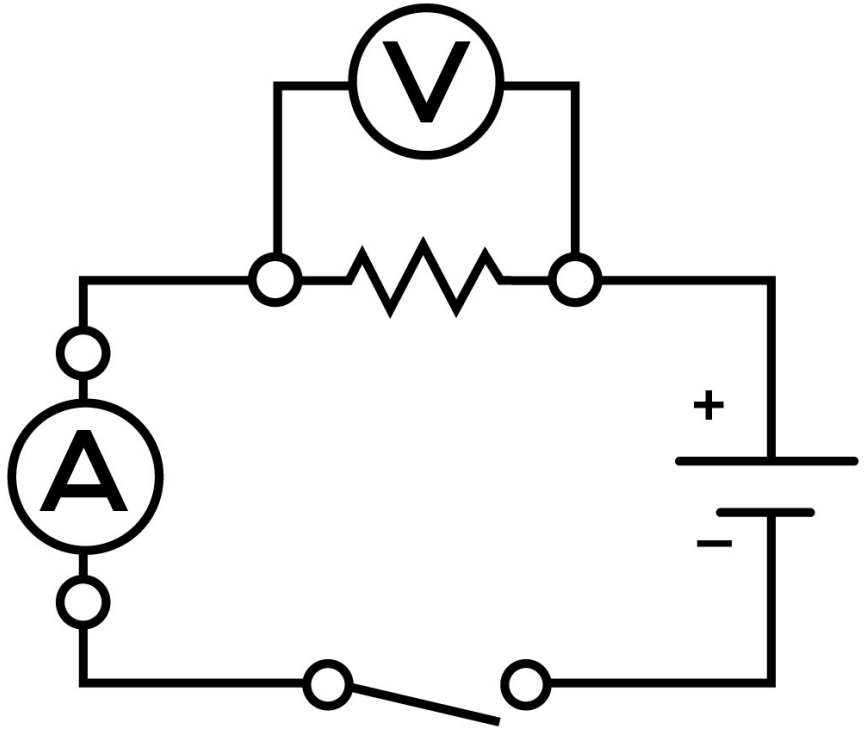


Joule Heating

Teani White

Introduction

Joule heating - the process of passing an electrical current through a conductor to produce thermal energy, in the form of heat.

Specific heat capacity - the energy (heat) required to make one unit of substance one degree warmer is known as specific heat. The higher the capacity the more resistant the substance is to undergoing a change in temperature. The specific heat of water: 4.186 J/g*Cº; which is higher than most other common substances.

Power - the rate at which work is done and the product of the electric current and voltage across the battery

Thermal energy - a rise in temperature causes atoms and molecules to collide and move around faster, increasing energy and releasing heat as a result.

Materials:

- 2 D-Cell batteries & battery holders
- 2 Bulbs & Bulb Holders
- Insulated wire
- Knife switch
- Ammeter
- Voltmeter
- Thermometer
- 40 mL & 50 mL water

Purpose:

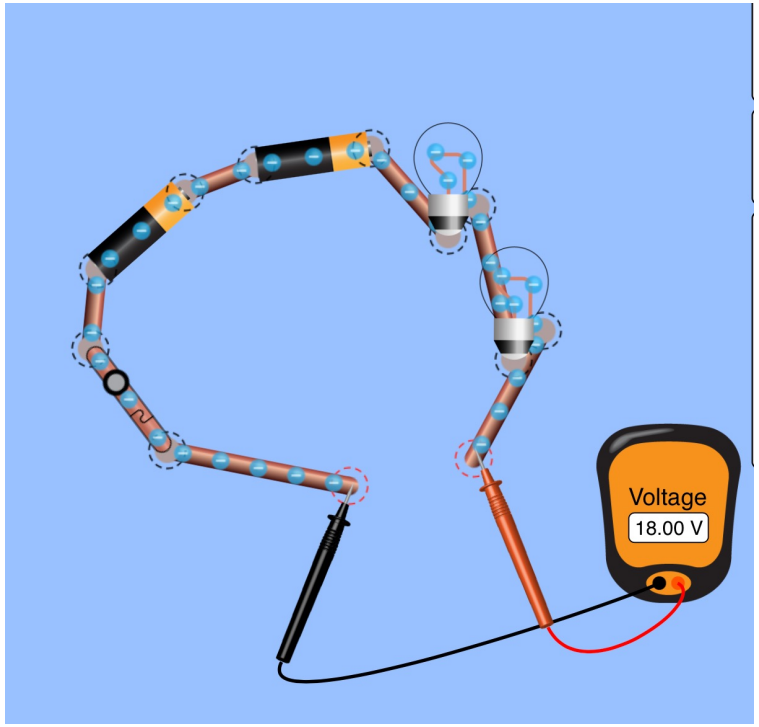
Distinguish the effects of Joule heating on water, considering its known specific heat capacity

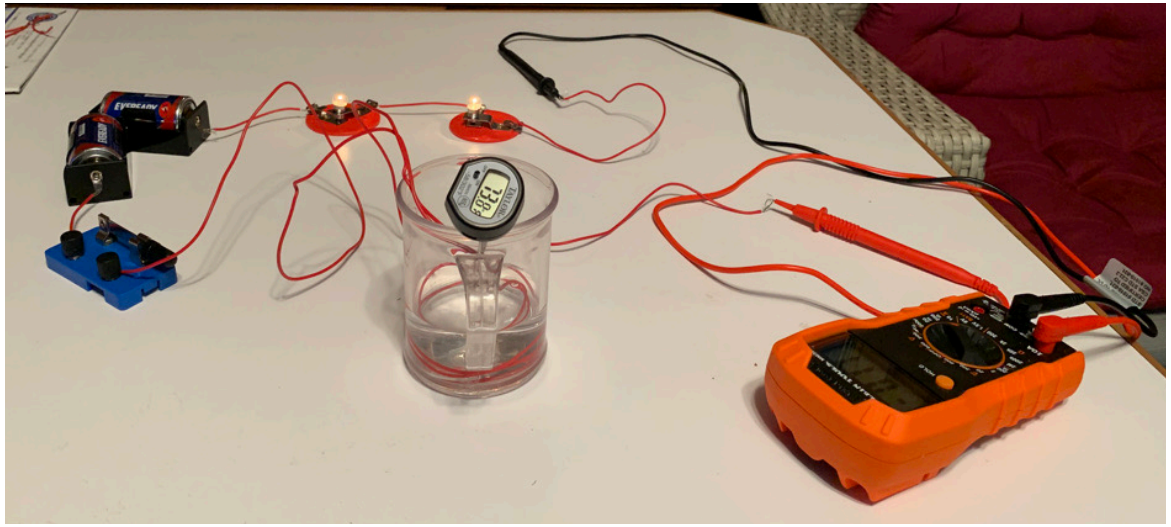
Determine the relationship between thermal energy and mass of substance

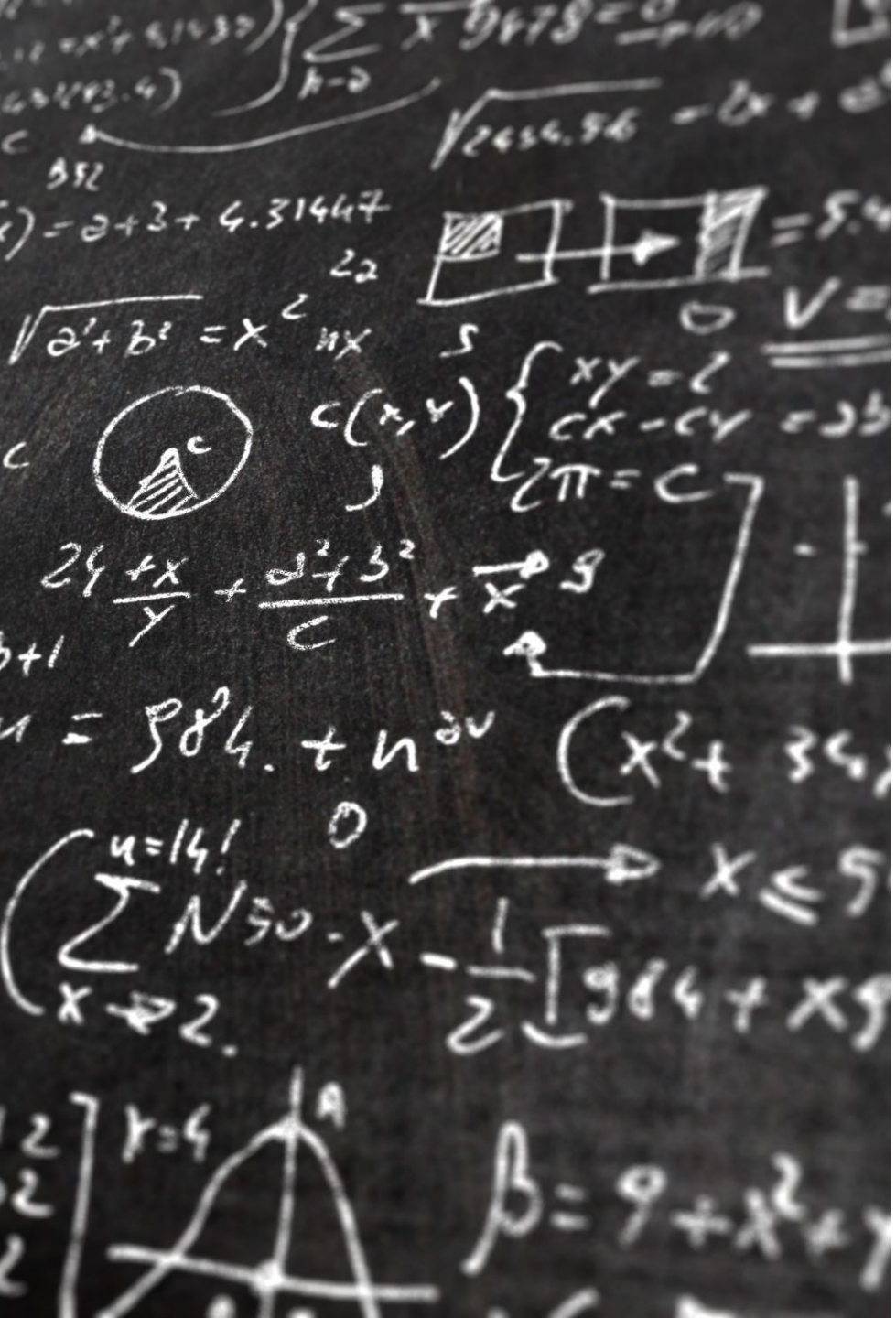
Circuit Set-up & Simulation

- Series circuit
- 180 mins total with

  measurements every 10 minutes



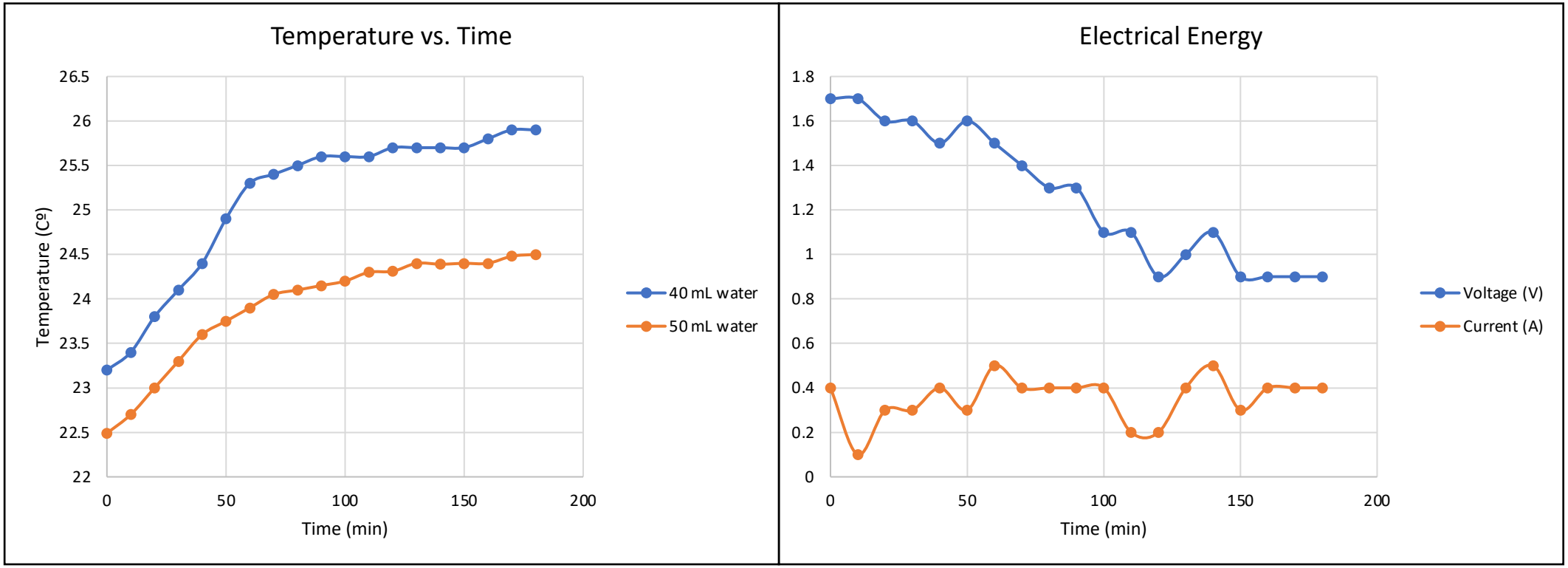




Equations & Predictions

- Ohm's Law: Power= IV = (0.4 A)(1.26V)= 0.504 W
  - the rate that energy is supplied or dissipated by another source to produce electrical power
- Thermal Heat: $Q=mC\Delta T$
  - m= mass of water (.05 kg)
  - C= specific heat of water (4186 J/kg/K)
  - ΔT= change in temperature (K)
- t= $\frac{Q}{P}$: time predictions based on thermal heat and power

Results: Data Table & Graphs



	ΔT (Cº)
50 mL	2.01
40 mL	2.7

Conclusion

This experiment supports the notion that batteries do store energy and will produce heat when placed in a circuit as a result of electric currents passing through a conductor.

Directly proportionate relationship between the mass of a substance and the thermal energy required to heat that substance

Possible discrepancies:

1.) Thin wires dissipate heat so the resistance of the wire becomes disproportionate.

2.) The specific heat of water is high and the water took such a long time to heat up, energy was lost from the thermal interaction of the water with its surroundings such as evaporation since the cup of water was not covered.

Nonetheless, the change in thermal energy of the water is consistent with the energy produced by the battery and directly proportionate to the mass.

Thank you!