Electricity Program of Study Timeline

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GIsML Electricity Program of Study

Cycle	GIsML Investigations[1]	Concepts
1 1st-hand	Making a circuit with a wire and battery Lighting a bulb ¥ construct a circuit with one bulb, one battery, one wire ¥ construct a circuit with one bulb, one battery, two wires	complete circuit introduce current as language to use to describe the flow of electricity in a circuit
2 1st-hand	Modeling the interior of a light bulb ¥ construct (hypothesize) a model of the interior of a light bulb ¥ evaluate one another s models for accuracy in accounting for the evidence (e.g., where a bulb can and needs to be touched to light)	complete circuit continuous path of material that conducts electricity
3 2nd-hand	Flashlights **[notebook text]** *This notebook text focuses on the investigation of aspects of the circuit in two different flashlights: one powered by two batteries and the other powered by three batteries. The investigative contexts range from simple visual observation to measurement of the amount of voltage in circuits with different configurations of batteries. The measurements provide the opportunity to observe unseen aspects of a circuit: The data also provide the opportunity to illustrate the knowledge construction process in science, working from data to claims about the relationships in the data. The connection with the previous investigations have to do with having a complete circuit. Thus, it is important to have students determine with the circuit is in the flashlights..*	complete circuit continuous path of material that conducts electricity voltage — potential energy of the battery voltage of batteries in series is the sum of the voltages of the individual batteries voltage-brightness relationship — as voltage increases, so does the brightness of a light bulb certain amount of voltage needed to light a light bulb
4 1st-hand	Controlling the Flow of Electricity ¥ determining patterns in the nature of materials that conduct electricity (allow it to flow) and those that do not (insulators) ¥ using a switch to control when electricity flows (closed vs. open circuit), and using the concept of conductivity to explain how switches work (include understanding that the air is an insulating material)	open vs. closed circuit continuous path of material that conducts electricity insulators do not allow electricity to flow (*their molecular structures do not have free electrons that can move in response to an electric field*)

[1] In all GIsML first-hand investigations, students have the task of identifying and evaluating claims and evidence. In 2nd-hand investigations, students have the task of evaluating the claims and evidence of the scientist.

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Cycle	GIsML Investigations[1]	Concepts
5 1st-hand	Modeling the Direction of the Flow of Electricity ¥ develop a hypothesis about the direction of current in a simple circuit ¥ develop a test of the hypothesis using a diode, make a prediction of what would be observed if the hypothesis were correct, observe what actually happens with the diode (s) in place in the circuit ¥ revise the hypothesis as needed, develop a new test and prediction as needed, and observe again as needed	Current is unidirectional (*it does not flow in more than one direction*). Current flows from the positive to the negative pole of the battery (*despite the fact that electrons are attracted to and move toward the positive pole of the battery*).
6 2nd-hand	Light Bulbs **[notebook text]** *In this notebook text, light bulbs that look identical externally are found to have filaments that differ in thickness. Circuits with bulbs of each type are found to have different amounts of current, and these data are used to develop an explanation of the behavior of electricity drawing upon the water flow model that is used by scientists to think about electric current.*	light bulbs can have filaments of different thickness, the thinner the less light. current-brightness relationship — thinner filament, less current and less light use of a water flow model to explain the relationship between filament size, current, and the brightness of light from a bulb
7 1st-hand	Explaining Brightness Differences When Light Bulbs of the Same Type are Added to a Circuit ¥ develop a hypothesis about current in a circuit with multiple light bulbs (as opposed to a single bulb) ¥ predict what the light bulbs would look like if the hypothesis were correct, and observe what occurs ¥ develop an explanation for what is observed	series circuits brightness decreases as light bulbs are added to a series circuit electrical energy is shared by the resistances in a series circuit, the resistances add and the less current in the circuit for each bulb (current-resistance relationship)