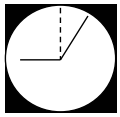
[53 minute lesson]

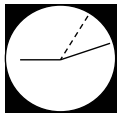
Japan Public Release Lesson 4 Lesson Graph [8th grade]



4½ minutes

Whole-Class Seatwork: Class reviews previous lesson

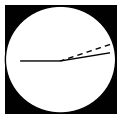
The lesson starts with a formalized greeting where all the students bow to the teacher. The teacher writes a question on the board from the previous lesson, "Will any material generate heat when an electric current flows through it?" She reminds the class that they were undivided on this issue yesterday. Students make predictions which items they think will generate heat (i.e., enamel wire, miso soup, refill lead of mechanical pencil). The teacher prepares to test these items in front of the classroom.



7 minutes

Whole-Class Practical Work: Teacher demonstrates electric current generating heat

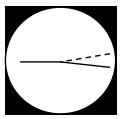
Students come to the front of the classroom to see the teacher's demonstrations, which are also projected on a larger monitor. The teacher tests the items, one at a time, by running an electric current through them and having students determine whether there was heat being generated. For the enamel wire, students see the temperature of the thermometer rising. They also see the temperature of the thermometer rising when current is running through the miso soup, but students also witness the soup "bubbling" and feel the warmth of the beaker that contains the soup. When testing a piece of steel wool and the refill lead, students observe the items burning with a red/orange glow. In each of these examples, students confirm that heat was generated. The teacher finishes these demonstrations and instructs students to return to their seats.



1½ minutes

Whole-Class Seatwork: Class discusses electric current and heat

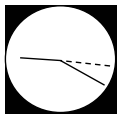
After students return to their seats, the teacher summarizes the demonstrations by stating, "Almost anything will generate heat when current flows through it." She writes this information on the chalkboard and continues with the discussion. She reminds the class about current and electrons, explaining how the electrons are bumping around and subsequently generating heat. She then introduces the objective for today's lesson, which is to measure the amount of heat that is generated as a result of electric current. She states, "Today, you will confirm through an experiment that heat generated by electric current is related to the value of voltage times current." The class then goes over the worksheet for the next activity.



2½ minutes

Whole-Class Practical Work: Teacher demonstrates procedures for specific heat activity

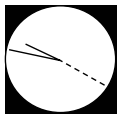
The teacher shows a transparency on the overhead projector that describes the practical activity. She explains how to set up the materials (e.g., ring stand, thermometer, polystyrol container, heating wire, ammeter in series, voltmeter in parallel, etc.). Students are to calculate the heat that is generated from an electric current running through a wire and placed in a cup of water. The teacher demonstrates how to hold the wire so that it doesn't touch the bottom of the polystyrol container (Styrofoam cup). She explains how the heat that is generated in the wire is the same as the heat that is received by the water. She announces that everyone will be using 100 grams of water.



3½ minutes

Whole-Class Seatwork: Teacher goes over instructions for specific heat activity

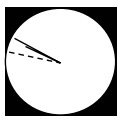
The teacher continues going over the instructions for the activity. She talks about the data table, telling the class that they will read the current values for specific voltages. She assigns two voltage values to different groups and has them write their values in the two columns of the data table. The teacher then summarizes the procedures as she talks through the data table. She tells the class when they have finished they will need to graph their values on an overhead transparency sheet. She announces, "This graph is to record the relationship between the value of voltage times current and the number for increased temperature of the water." The class will put all the transparencies together and see "nice dots," thus allowing them to infer a relationship. The teacher asks if students have questions before getting started.



27 minutes

Independent Practical Work: Students work on specific heat activity

Students retrieve their materials from the front of the classroom. They begin setting up the activity, working in groups of four. Students are to set the voltmeter to their assigned voltage, then read and record the current value in amperes. After five minutes, they are to record the temperature increase, then calculate the amount of heat that was generated (=mass of water X temperature increase). Some groups, however, experience problems because they incorrectly connect their voltmeter and ammeter. The teacher helps them correct this as she walks around to the different groups. Groups plot their values on the overhead transparency sheet.



2½ minutes

Whole-Class Seatwork: Class discusses results from specific heat activity

The teacher stacks the groups' transparencies together on the overhead projector so that multiple data points are shown. Both graphs fall in a straight-line pattern, which the teacher highlights by tracing with a ruler. She asks the class, "What can we say from this?" They conclude that (1) heat energy is proportional to the increase in temperature and (2) heat energy is proportional to the product of voltage and current. The teacher writes this on the chalkboard. She then poses a question about circuits. She sticks two large cards on the chalkboard. One card has a drawing of a parallel circuit with large and small resistances. The other card has a drawing of a series circuit with large and small resistances. She asks the class to apply their knowledge about the relationship between heat energy and the product of voltage and current to these circuits. She asks which of the two resistances, in each circuit, produces more heat (i.e., the large resistance or the small resistance). She gives students time to think independently, telling them she will call on groups for their predictions.

1 minute

Independent Seatwork: Students make predictions

Students are given think-time to consider the questions posed by the teacher.

2 minutes

Whole-Class Seatwork: Class discusses heat generated in the two circuits

The class discusses the heat that is generated by the large and small resistances in a parallel circuit. The teacher calls on multiple groups. They report that the small resistance will produce more heat in a parallel circuit because there is more current that flows. The teacher confirms this, adding that the voltage in a parallel circuit is the same everywhere so the more current that flows, the greater the heat that is generated. She writes this information on the chalkboard. She asks about the series circuit, acknowledging the lack of time since the bell had already rung. She gives the class a hint, asking what stays the same in a series circuit (current). She tells them to think about this issue; they will discuss it in the next lesson.

1 minute

Science Organization: Students prepare to leave

Students stand and bow to the teacher. They put away their materials and prepare to leave.