

**“Electricity and Magnetism”****Teacher’s Guide/Rubric****Standards****VT Framework**

Inquiry: 7.1 aa, bb, cc, dd

Space, Time, Matter: 7.12 ee. ff.

**Grade Cluster Expectations****Inquiry: 7.1****S: 1****Evidence of Understanding:**

Students demonstrate their understanding of **SCIENTIFIC QUESTIONING** by distinguishing between observational, experimental, and research questions.

**S: 2**

Students demonstrate their understanding of **PREDICTING AND HYPOTHESIZING** by using logical inferences derived from evidence to predict what may happen or be observed in the future;

and

by providing an explanation (hypothesis) that is reasonable in terms of available evidence.

**S: 3**

Students demonstrate their understanding of **EXPERIMENTAL DESIGN** by writing a plan related to the question and prediction that includes:

- a. A list of materials needed that specifies quantities.
- b. A procedure that lists significant steps sequentially and describes which variable will be manipulated or changed and which variables will remain the same. (“Fair Test”)
- c. An appropriate format for recording data.
- d. A strategy for conducting multiple trials. (“Fair Test”)

**S:4**

Students demonstrate their ability to **CONDUCT EXPERIMENTS** by

1. choosing appropriate measurements for the task and measures accurately;
2. collecting data and records accurate and complete data from multiple trials;

**S: 5**

Students demonstrate their ability to **REPRESENT DATA** by

1. determining an appropriate representation (line graph in addition to prior examples) to represent their findings accurately.
2. selecting a scale that is appropriate for range of data to be plotted, labels units, and presents data in an objective way.
3. using correct scientific terminology to label representations.
4. including necessary keys and symbols that are clearly labeled

**S: 6**

Students demonstrate their ability to **ANALYZE DATA** by identifying relationships of variables based upon evidence.

**S: 7**

Students demonstrate their ability to **EXPLAIN DATA** by

1. considering all data when developing an explanation/conclusion
2. explaining data using correct scientific terminology.
3. using experimental results to support or refute original hypothesis.
6. preparing a conclusion statement/summary.

**Grade Cluster Expectations****Physical Science: 7.12****S : 23**

Students demonstrate their understanding of **HEAT Energy** by identifying real world applications where heat energy is transferred and by showing the direction that the heat energy flows.

**Science Concepts:**

- a. Heat energy only moves from more heat energy to less heat energy in order to reach equilibrium (same temperature).
- b. Heat can move from one object to another by conduction

**S : 25**

Students demonstrate their understanding of **MAGNETISM** by identifying real world objects that demonstrate and utilize magnetic force acting over a distance;

and

By distinguishing between objects by magnetic force and objects affected by other non-contact forces.

**S : 27**

Students demonstrate their understanding of **ELECTROMAGNETIC Forces** by investigating and building devices that demonstrate the magnetic effects of electricity;

and

By recognizing the relationship between the device and the magnetic effect it produces.

**Teacher Directions**

Materials for the Electricity and Magnetism task are straight forward and easily obtained from instructional kits or local vendors. Using batteries for electro magnets will weaken them quickly. Use fully charged batteries and have several extra batteries on hand. Caution students that the battery-wire-nail circuit will get hot. They should disconnect the battery from the wire when they are not experimenting in order to conserve the charge and avoid over heating.

**Score Guide:**

1. Describe your observations here.

**Key Elements:**

- Description identifies that the nail will attract paper clips, confirming Tom and Jetta's discovery.

2. Write an investigation question for the variable that you choose.

**Key Elements:**

- Question aligns with the variable chosen.

3. Write a testable prediction for your question. Explain your thinking for that outcome.

**Key Elements:**

- Question includes a cause and effect relationship that reflects the variable that the student chose to test.
- Rationale for the hypothesized effect reflects an understanding that moving electric charges produce a magnetic force.

4. Design an experiment that tests your prediction. In the space below, write the steps of your plan. Use the space in the box if you would like to draw a diagram of your plan.

**Key Elements:**

- Materials and quantities needed.
- Significant steps listed sequentially- Plan must be repeatable.
- Identifies which variable will be manipulated and at least one variable that will be controlled.
- Identifies data that will be observed as evidence and the format that will be used for recording.
- Plan includes multiple trials.

5. Use this space to record the data and observations from your experiment.

**Key Elements:**

- Data and observations align with the evidence cited in the Experimental Design.

6. In the space below, choose and construct the best way to organize your observations and represent your data so that they are clear and show any important patterns or trends

*The variables selected in this task should lead students to choose quantitative observations (number of paper clips) as evidence of effect. Students should choose a table or a graph to represent this quantitative data.*

**Key Elements: Table**

- Both labels—Variable and Number of Clips present.
- Table format contains both rows and columns.
- Data entered correctly. Only one entry for each cell in the row or column.

**Key Elements: Bar or Line Graph**

- Label both axes.
- Accurate range and interval for both axes.
- Accurately plots data.

7. Do the results of your experiment support your prediction? Explain why or why not.

**Key Elements:**

- Response indicates whether the prediction is supported or not supported.
- Response identifies the relationship or the variables based on the evidence collected.

8. Use your understanding of electricity and magnetism to explain the observations and data you collected in your investigation.

**Key Elements:**

- Adjusting the variable in the experiment increased, decreased or had no effect on the magnetic force that was produced by the electric circuit.

9. Tell whether the event below is an example of a magnetic force, a gravitational force, electrostatic force or a contact force. Write the word **magnetic**, **gravitational**, **electrostatic**, or **contact** next to the event.

**Key Elements:**

- a. G
- b. M
- c. C
- d. C
- e. E
- f. M

10. In this experiment, energy was transferred from electrical energy to heat energy as the wire became hot. The heat energy was conducted from the wire into your finger.

Choose another example of heat energy being conducted. Draw a diagram of the example and include:

- a. The objects through which the heat is conducted.
- b. The direction that the heat energy flows.
- c. The relative temperatures when the system reaches equilibrium.

**Key Elements:**

- Response correctly identifies conduction from one material to another.
- Response identifies the direction of heat flow from more heat to less heat.
- Response recognizes that temperatures in both materials will be the same when equilibrium is reached.