ENVISIONING ELECTRIC FIELDS

Part 1

How do you measure the electric field and the relationship between positive and negative charges?

SCIENCE STANDARDS

- SC.912.P.10.13 – Relate the configuration of static charges to the electric field, electric force, electric potential, and electric potential energy.
- SC.912.N.1.6 – Describe how scientific inferences are drawn from scientific observations and provide examples from the content being studied.

VISUAL ARTS STANDARDS

- VA.912.H.3.1 – Synthesize knowledge and skills learned from non-art content areas to support the processes of creation, interpretation, and analysis.
- VA.912.H.3.3. – Use materials, ideas, and/or equipment related to other content areas to generate ideas and processes for the creation of works of art.

GET STARTED:

1. With your partner, line up and tape together two pieces of graph paper to make one large set. Complete a second set for recording data.
2. Place one set of graph paper under the tub. The second set will be used by your partner to record readings in steps 11 and 12 below.
3. Fill the tub with about two inches of water.
4. Place the washer at one end of the tub at the edge of graph paper. Make note of the
5. position of the washer on graph paper.
6. Place the flat steel strap at the opposite end of the tub at the edge of graph paper. Make note of the position of the strap on graph paper.
7. Connect the positive end of the battery to the washer using a wire.
8. Connect the negative end of the battery to the flat steel strap using a wire.
9. Connect the negative end (black) of the voltmeter to the flat steel strap.
10. Use the positive end of the voltmeter as your test charge.
11. Place the positive lead (red) somewhere in between the washer and the flat steel strap. You should get different readings on the voltmeter depending on where you place the lead.
12. Place the test charge somewhere between the washer and the flat steel strap and record the location and the amount of volts (for example; 4.5 volts at G24). Then move the lead until you are able to locate the same reading again and record the point until you have a total of four readings that are the same. Draw a line using a colored pencil on the graph paper that connects the similar readings.
13. Repeat step 11 until you have 4 separate lines representing 4 different voltages. Make sure to use a different colored pencil for each line.
14. Partners switch roles and record 4 additional lines representing 4 additional voltages for a total of 8 lines.
15. With your partner, complete lab follow-up questions and record your answers on paper to be submitted.

LAB FOLLOW-UP QUESTIONS

1. Based upon your observations and the electrical field lines you have drawn, what can you infer about the electrical field produced in your experiment? Be sure to include discussion of magnitude, direction, spacing, distance and shape of electrical field lines.
2. Based upon your voltage readings, explain the relationship between the positively charged washer and the negatively charged steel strap. Describe the shape of the lines in relation to both the washer and the steel strap.
3. In the video, "The Shocking Truth about Electric Animals" you learned about electro receptive and electro genesis capable animals. Relate your observations from the lab to the unique characteristics of these animals. Provide at least two detailed examples.

EXTENSION:

Electric Charge and Electric Fields— Professor Dave Explains

Apply Coulomb's Law to the data collected in the lab and use the mathematical formula to determine the electrical force.

Part 2

How do artists create a physical work of art based on something which can be scientifically measured but otherwise cannot be seen?

OBJECTIVE:

Using the data collected from Part 1, create a 3D sculpture or model of an electric field. This project requires that students work collaboratively with their partner to create a work of art as they envision what cannot be directly seen.

1. Using the data collected from Part 1 of this project, each student will create a journal sketch of a design/model of an electric field. This must include the following additional information: 2 cited sources images (one from the list of artists provided and one student choice), materials needed, colors and themes, and at least one paragraph describing how the artwork is in response to and/or correlates to the data collected.
2. Compare your initial design sketches with your partner, and collectively decide on a final design. As a pair decide which design, or hybrid of both designs, to use. Your design must be signed off on prior to beginning work on the final project.
3. Use the materials provided to complete your final project.
4. Present and display your final project. This includes: completed collaborative artwork, artist statements, self-reflection score and graph data you collected in the first part of the project. *Each student must include an artist statement that addresses the intention behind your final work, connections made between physics data and the artistic process, and your overall experience throughout the project.

START HERE:

An engineer's paper sculptures are leading to a scientific breakthrough – Insider

KEEP IN MIND!

- Line/Implied Line
- Size & Position
- Positive & Negative Space
- Sharp & Diminishing Details
- Texture

MATERIALS:

Paper/Cardboard
String/Thread
Found Objects
Adhesive – glue, tape
Scissors
*Additional materials may be used

ARTISTS:

Jen Stark
Peter Gentenaar
Richard Long
Richard Serra
Richard Sweeney

Rubric

	4	3	2	1	Self–Reflection Score
Composition	Student artwork demonstrates strong sculptural composition skills.	Student artwork demonstrates sculptural composition skills; minimal issues related to space.	Student artwork demonstrates a basic understanding of sculptural composition; some issues with space.	Student artwork demonstrates weak sculptural composition skills; no consideration of space evident in work.	
Concept	Student idea directly relates to physics data collected and is demonstrated through unique, original construction.	Student idea relates to the physics data collected and is demonstrated through original construction.	Student idea somewhat relates to the physics data collected but lacks unique, original construction.	Student idea does not relate to the physics data collected.	
Demonstration of Physics Learning	Student conveys a clear and correct grasp of all physics principles related to this activity.	Student conveys a clear and correct grasp of some of the physics principles related to this activity.	Physics principles are conveyed in a way that demonstrates some degree of understanding. Significant aspects are discussed incorrectly.	Many assertions and explanations are discussed incorrectly.	
Artist Statement	Student clearly artic-ulates connections made between visual arts content and physics content. All explanations are described in detail.	Student able to make connections between arts content and physics content. Few aspects of artist statement need additional detail.	Student is somewhat able to make connections between arts content and physics content. Partially addresses required information needed in artist statement.	Student unable to make connections between arts content and physics content. Does not address information required in artist statement.	