PSIM lesson plan

Lesson Title:

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Topic: Magnetic Field Lines

Targeted Grade Level: 8th grade, regular education and special education inclusion

Level of Inquiry: Interactive Demonstration and Inquiry lesson

Georgia Standards of Excellence:
S8P5. Obtain, evaluate, and communicate information about gravity, electricity, and magnetism as major forces acting in nature.

a. Construct an argument using evidence to support the claim that fields (i.e., magnetic fields, gravitational fields, and electric fields) exist between objects exerting forces on each other even when the objects are not in contact

c. Plan and carry out investigations to identify the factors that affect the strength of electric and magnetic forces

Student Learning Goals:

- Students will investigate the concept of magnetic field lines.
- Students will construct an argument to support the claim that magnetic fields exist between objects exerting force on each other even while not in contact.
- Students will plan and carry out an investigation to identify that factors that affect the strength of magnetic forces.

Formative and Summative Assessments

5E Model	5E Objectives
Engage	**Procedure:** The teacher will begin with several questions to engage students in thinking about magnetic fields. (This will follow introductory lessons on magnetism in general.) • What does it mean to say there is a "field" surrounding a magnet or the Earth? • Is it a "force field" like in the movies? • How can we map this field? • Do other planets have magnetic fields? Students will be instructed to discuss these questions with their table partners, then a whole class discussion will take place, led by the teacher.

	The teacher will amplify student ideas shared during this time without verifying responses as “right” or “wrong.” The teacher will then play the introduction to the Magnetic Field Lines simulation from cK-12 and instruct students that their exploration time today will center around the intriguing question: .Does the Earth have a force field? **Resources:** Questions from https://interactives.ck12.org/simulations/physics/field-lines/app/index.html?screen=sandbox&lang=en&referrer=ck12Launcher&backUrl=https://interactives.ck12.org/simulations/physics.html
Explore	**Procedure:** The teacher will give then display page two of the Field Lines handout and then students will view the tutorial video explaining the Earth’s magnetic field. After watching the video, students will work with the interactive field lines simulator to explore the magnetic fields around Mercury, Earth, Mars, & Jupiter. In addition to exploring with the simulator, the teacher will encourage students to consider other interesting questions related to magnetic fields: • Will the Earth’s magnetic field ever flip? • How to some birds know which direction is south? • What is the biggest object in the Solar System? • What causes sunspots? **Resources:** • Field Lines explanation video: https://youtu.be/Qz7KW-llQ-0 • Magnetic Fields handout, page 2 • https://interactives.ck12.org/simulations/physics/field-lines/app/?screen=rwe1 • https://interactives.ck12.org/simulations/physics/field-lines/app/?screen=rwes • https://interactives.ck12.org/simulations/physics/field-lines/app/?screen=rwes • https://interactives.ck12.org/simulations/physics/field-lines/app/?screen=rwes

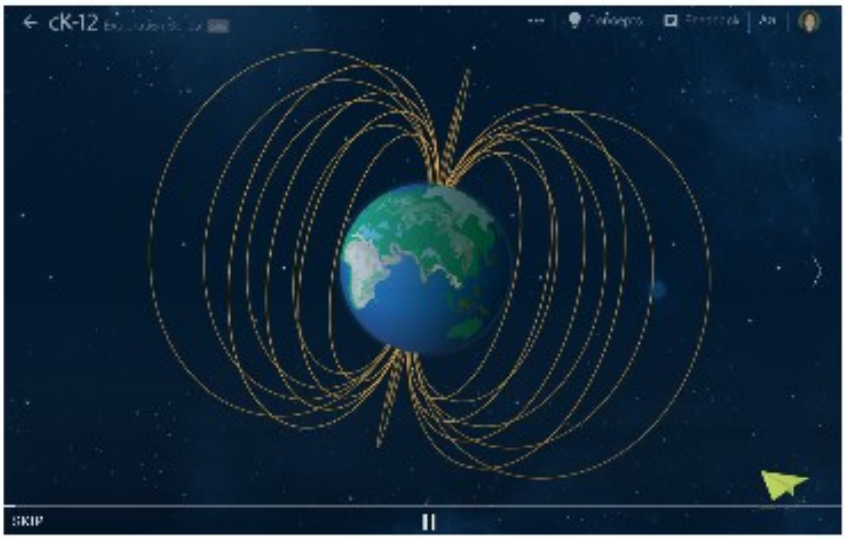
Explain	**Procedure:** As students use the simulator, they will discuss the questions from the handout. The teacher will also probe with the following questions: • Where on Earth is the magnetic field strength most intense? • Which planet has the strongest field? The weakest? • What effect does the magnetic field have for the middle latitudes for planets with stronger magnetic fields? **Resources:** • cK-12 Field Lines Simulator https://interactives.ck12.org/simulations/physics/field-lines/app/?screen=sandbox • Internet access for student research
Elaborate	**Procedure:** The teacher will now provide student groups with magnets of various strengths, several paperclips or other magnetic materials, tape, string, and several items that can be used as barriers. The teacher will instruct the students that they need to develop a procedure for testing the strength of their magnets to determine which have magnetic fields that are stronger than others. Students will discuss and plan in their groups. Once each group has formulated their plan, they must bring it to the teacher for approval. The teacher will approve all reasonable plans for the investigation. Students will record their plan and their investigation results on the Magnetic Field Strength handout attached below. Groups will share their procedures and findings with the class at the end of the investigation. **Resources:** • Magnetic Field Strength handout • Paperclips or other small magnetic materials • Tape • String • Magnets of various strengths • Objects to serve as barriers: paper, cardboard, thin pieces of wood such as rulers, books, etc.
Evaluate	**Procedure:** The teacher will pose the following question to students as a summative evaluation of the lesson: How would life on Earth differ without the magnetic field that surrounds it?

	The students will first construct their own answers independently. Then they will share their ideas in a whole class discussion. Students will then be given an opportunity to modify their explanations based on things they learned and were challenged on by their classmates. **Resources:** Evaluation question

Intriguing Question

Does the Earth have a force field?

Illustrative Video



What does it mean to say there is a "field" surrounding a magnet? Or the Earth? Is it a "force field" like in the movies? How can we map this field? Do other planets have magnetic fields? The best tool for investigating magnetic fields is the compass. A compass aligns itself with the underlying field. The field is three-dimensional in nature. The Earth's magnetic field steers high-energy charged particles toward the poles, protecting life at mid-latitudes. Some planets lack magnetic fields - human presence on those planets might be at greater risk for health hazards due to radiation.

Names: _____

Magnetic Field Strength

QUESTION: Which magnet has the strongest magnetic field?

HYPOTHESIS: _____

MATERIALS: _____

_____

_____

Investigation Procedures (List each step)

1.

2.

3.

4.

5.

6.

7.

Diagram your trial results below. Label each diagram with proper concept vocabulary.

CONCLUSIONS:

_____

_____

_____

_____

_____

_____

_____

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