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| **TEAM Lesson Plan Template** |
| Teacher: Dr. Jason Alexander |
| Subject/Grade: 8th grade science |
| Lesson Title: Investigating Magnetism |
| **STANDARDS** | **Identify what you intend to teach.** State, Common Core, ACT College Readiness Standards and/or State Competencies; Enduring Understandings and Essential Questions. |
| 8.PS2.1 Design and conduct investigations depicting the relationship between magnetism and electricity in electromagnets, generators, and electrical motors, emphasizing the factors that increase or diminish the electric current and the magnetic field strength. This lesson emphasizesScience and Engineering practice: Planning and carrying out controlled investigationsCCC: Cause and effectLearning performance: Students will conduct an investigation to observe magnetic field strength and to depict the relationship between magnetism and electricity emphasizing cause and effect.  |
| **OBJECTIVE(s)/Sub-Objectives** | **Connect prior learning to new learning.** Clear, Specific, Observable, Demanding, High Quality, Measurable, Aligned to Standard(s), and Integrated with other subjects, build on prior student knowledgeStudent-Friendly (I Can Statement) |
| I can study magnetic fields using a magnet and a compass. I can build an electromagnet. I can safely use wire and nails. [The wire may get hot when connected to the battery. The ends are pointy. Do not sling them around, and do not get them near anyone’s eyes.]  |
| **MATERIALS AND RESOURCES**  | **Content-related:** Clearly supports lesson objective(s); rigorous & relevant; Incorporates multimedia & resources beyond the textbook.  |
| **Activities & Materials** **Per student or group**: Bar magnet, sheet of paper, pencil, pen or colored pencil, small compass, 1.5 V battery holder with wires, a 1.5V battery, a length of insulated wire, a nail, “Investigating a Magnetic Field” worksheet. **What if the technology is not working?** Get new batteries. **Routine for distributing materials:** Have two equipment stations at the front of the room. At one, have magnets, paper, and colored pencils or pens. At the other, have wire, wire cutters, compasses, battery holders and batteries. When the activity begins, have the Compass Movers come get magnets, paper, and pencils. Have Winders come cut wire to 1 meter lengths, strip ends, and get wire, compasses, battery holders, and batteries.  |
| **ACCOMMODATIONS/ADAPTATIONS** | **Learning styles and interests.** Anticipate learning difficulties, regularly incorporate student interests & cultural heritage; differentiate instructional methods. |
| **Modifications/Plans for Diverse Learners *(NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)*****Differentiation****\_\_x\_\_ Process** It may be appropriate to prepare the electromagnet for some students, that is, wrap the wire and connect the battery. **Accommodations****\_\_\_ Preferential Seating \_\_\_ Extended Time \_\_\_ Small Group \_\_\_ Peer Tutoring** **\_\_\_ Modified Assignments \_\_\_ Other** **Early Finishers:** Early finishers should study the effects on the magnetic field caused by using 1) more wire (and thus more loops around the nail), 2) Linking batteries in series, and 3) Linking batteries in parallel.  |

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| **MOTIVATING STUDENTS/ANTICIPATORY SET** | **“Hook”: Engage students’ attention and focus on learning.** Personally meaningful and relevant. |
| Remind students that wire ends are pointy. They should take care not to get the ends near anyone’s eyes. The wire may get hot when connected to a battery. Be careful touching the wire. Ask students what they know about attraction. After discussion, mention that today we will conduct an investigation of a magnetic field, the region where a magnet is attractive (or repulsive).  |
| **INSTRUCTIONAL PROCEDURES** | **Step-by-Step Procedures-Lesson Sequence: Basic to Complex.** Lesson includes visuals, modeling, logical sequencing and segmenting (beginning, middle, ending); essential information; concise communication; grouping strategies; differentiated instructional strategies to provide intervention & extension; seamless routines; varied instructional strategies; key concepts & ideas highlighted regularly. |
| ***Introductio*n**Arrange students in groups, pass out worksheets, and have students count off to identify group roles. Have Compass movers and Winders move to equipment stations and pick up equipment. Point out to readers that the questions they have to answer are in bold type. Have the Readers record names and inventory the equipment. When the group has all of its equipment, the Reader should read the instructions so that the group can complete the tasks. **Middle**Monitor students as they complete the activity and record results on the worksheet. Ask questions to prompt them as necessary. **End/Closure**:  Have students return their equipment to a central location. Discuss the observations in terms of cause and effect: As a compass moves farther from the magnet, does it experience a stronger or a weaker magnetic field? Is the nail a magnet by itself? How can we know? Why does any of this matter? Has anyone heard of an MRI? The M stands for Magnetic, in Magnetic Resonance Imaging. These scanners are large, powerful electromagnets, and they are one of our most powerful medical diagnostic tools. **Motivating Students** \_x\_ Relate to Real World Mention MRI scanners, electric motors, generators.  \_x\_ Verbal Reinforcement The teacher will monitor students’ work throughout the activity to provide reinforcement. **Presenting Instructional Content** \_x\_ Discussion There is a brief discussion at the beginning and the end to ensure that students know the term “magnetic field” and can understand some real-world applications of electromagnets. \_x\_ Hands on \_x\_ Guided Practice The worksheet provides guided steps for students to complete the hands-on activity. ***Instructional strategies:*****Modeling and Guided Practice *–*** The worksheet lays out steps for students. The teacher will monitor their work and ask questions to prompt them if they are stuck.  **Check for Understanding (CFU) –** ***What am I doing for students that progress at different rates?*** Encourage students to help each other within their groups. If one group is significantly ahead of another, ask one group to help the other. If necessary, provide help with the first couple of compass placements and/or winding the wire around the nail and/or the initial placement of the electromagnet on the paper. ***What do I do if they get it?*** If students handle the activity smoothly, ask them to build additional electromagnets. Using the same nail, either wrap more wire around it, or remove the wire and wrap a longer wire around it. Alternatively, keep the same wire wrapped around the nail, but connect two batteries in series. Second Alternative, keep the same wire wrapped around the nail, but connect two batteries in parallel. Have them compare the strength of the magnetic field as indicated by field lines in each case. ***What do I do if they don’t get it?*** Ensure that the compasses are actually working; sometimes the needles get stuck. If compasses are working and students are still struggling, consider showing them a completed field map such as the one here: <http://www.justscience.in/articles/magnetic-field-and-magnetic-field-lines/2017/06/30> |
| **QUESTIONING/THINKING/PROBLEM SOLVING (embedded throughout)** | **Balanced mix of question types.** Utilizes Blooms Taxonomy/Webb’s Depth of Knowledge; high frequency; purposeful & coherent; require active responses; balance based on volunteers/non-volunteers, ability, & gender; lead to further inquiry & self-directed learning.  **Implement four types of thinking (Analytical, Practical, Creative, & Research-based) & Teach/Reinforce problem-solving types**. Provide opportunities for students to generate ideas & alternatives; analyze, evaluate & explain information from multiple perspectives& viewpoints. |
| **Questioning** These questions will occur throughout the activity as prompts based on groups’ or individual students’ progress. **Knowledge:**Are the ends of the magnet aligned with the labels on the paper? Do any of the field lines cross each other? If we place the compass in the center of the North pole end of the magnet, which way does the compass (and thus the field line) point? **Comprehension:** If we place the compass in the center of the North pole end of the magnet, which way does the compass (and thus the field line) point? In what sense does the field line point toward the South pole? **Application:**Does the magnetic field strength increase or decrease with increasing distance from the magnet? **Analysis:** For the electromagnet, does an increased number of windings of wire increase the magnetic field strength? For the electromagnet, does an increased voltage (keeping the number of windings of wire fixed) increase the magnetic field strength? **Synthesis:****Evaluation:** **Thinking****\_x\_ Practical –** Placing, sketching, and labeling the magnet are practical tasks. Construction of the electromagnet is also practical; it is a simplified version of windings used to make electric motors. **\_x\_ Creative–** Students should be allowed to study fields created when two magnets (or three) are in close proximity. What if we bring the bar magnet back close to the electromagnet and study the field then? **\_x\_ Analytical –** Students compare how close magnetic field lines are to each other at different places around the magnets. Students compare the fields and field strengths of the bar magnet and electromagnet.  **\_x\_ Research-based –** Students explore results from two different types of magnets. **\*What am I going to do to give Students an opportunity to?** **1. Generate variety of ideas:** **2. Analyze problems from multiple viewpoints:** **Problem Solving *Note: Teach 2 or more types of problem solving (NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)*****\_x\_\_** **Drawing conclusions** Where is the magnetic field the strongest? What happens to magnetic field strength as the compass moves further from the magnet? **\_x\_\_ Predicting Outcomes** What happens if we swap the wires from + to – on the battery with the electromagnet? |

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| **GROUPING** | **Maximize student understanding & learning** Varied group composition (race, gender, ability, & age); clearly understood roles, responsibilities & group work expectations; accountability for group & individual work; student opportunities for goal setting, reflection & evaluation of learning. |
| * Heterogeneous groups of three or four
* Roles. Reader/recorder (reads instructions and writes answers to questions); Compass mover (places magnet, moves compass); Marker (marks ends of compass needle); Winder (winds wire around nail, connects battery, and holds the battery out of the way when the group studies the field of the electromagnet )
* The teacher will have students count off within groups. Student 1 becomes the reader/recorder, student 2 becomes the compass mover, etc. The compass mover can also be the marker in a group of 3.
* Transition. Students should begin class in their groups and remain in the groups throughout.
* Product. Students will complete a worksheet.
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| **ASSESSMENT** | **Formative and/or summative assessment.** A variety of assessments, including rubrics, measure achievement of objectives and informs instruction.  |
| ***Assessments: aligned with state stds; measurement criteria; measure student performance in more than 2 ways (project, experiment, presentation, essay, short answer, multiple choice test) (NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)*****\_\_x\_ Worksheet** Students will submit the worksheet for assessment. *\****Students should achieve \_\_\_\_\_% mastery of this objective: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **CLOSURE** | **Reflection/Wrap Up.** Summarizing, reminding, reflecting, restarting, connecting. |
| * ***Review/Summary: wrap up what has been learned and accomplished in the lesson (even if they are in the middle of an exercise, it is still important to summarize to the point where they are now). Ideally involve students in this synthesis.***
* ***Preview for next lesson:***.
* ***Upcoming assignments: remind them of any upcoming assignments.***

***Today we…. Turn to your partner and…. Let’s review our I Can statements……*** **Here is your exit ticket for today**: **Follow-up Activities/Extension *These may be designed to create a longer or more intense lesson. For example, if the class is able to cover the material in a lesson much faster than expected, extensions may prove helpful. Extensions may also be useful in various parts of a lesson where the teacher (and class) decides they should spend more time on a skill or topic.******Reflection: You must reflect on every lesson you teach.*** |

**NOTES:**

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