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| **Course:** Introduction to Engineering | | | | | | |
| **Unit:** Investigating Magnets, Electromagnetism, and Induction with PHET | | | | **exercise:** PHET Investigation | | **Time Frame:** 2 Hours |
|  | Preparation: *Summary of “to do’s” that the teacher should understand and prepare before bringing this lesson to the classroom.* | | | | | |
| **Information:**  Before starting this activity, students should have an understanding of material covered in:   * Presentation: Introduction to Electromagnetism and Induction   **Materials:**   * Student PHET worksheets “Magnets and Electromagnets” and “Faraday’s Electromagnetic Lab”   **Tools:**   * PHET online simulation software at PHET.Colorado.edu/ | | | | | | |
|  | Safety: *Summary of safety strategies in the lesson.* | | | | | |
| There are no safety strategies for this exercise. | | | | | | |
|  | Desired Results: | | | | | |
| Established Goals: | |  | Transfer: | | | |
| *Problem Solving Techniques and Applications Standards:* | | *Students will be able to independently use their learning to…*   * Use computer simulation software to help understand difficult science and technical content. | | | |
| Meaning: | | | |
| Understandings  *Students will understand that...*   * When current travels through a conductor, a magnetic field is created * When a magnetic field passes by a conductor, voltage is induced in the conductor | | Essential Questions  *Students will keep considering...*   * Other ways in which electricity interacts with magnets and conductors * How electromagnets can be used to better peoples’ lives | |
| Acquisition OF KNOWLEDGE AND SKILL: | | | |
| *Students will know...*   * Properties of electric and magnetic fields * Computer simulation resources for education and problem-solving | | *Students will be skilled at...*   * Running computer simulations of various STEM situations * Discuss and communicate findings obtained by simulation | |
|  | Evidence: | | | | | |
| Evaluative Criteria: | |  | Assessment Evidence: | | | |
| * Completed | | | *Performance Task(s):*  **Investigating Magnets, Electromagnetism, and Induction with PHET**  In this activity, students will run various computer simulations to discover characteristics of magnets, electromagnetism, and induction. | | | |
| * Completed * Completed | | | *Other Evidence:*   * Magnets and Electromagnets Worksheet * Faraday’s Electromagnetic Lab Worksheet | | | |
|  | Learning Plan: *Summary of Key Learning Events and Instruction* | | | | | |
| **Outline:**   1. **Set Introduction**   Go through with students how to get to online PHET Simulations   * 1. Go to PHET.Colorado.edu   2. For the Magnets and Electromagnets Simulation go to PHET.Colorado.edu/en/simulation/magnets-and-electromagnets   3. For the Faradays Electromagnetic Lab Simulation go to PHET.Colorado.edu/en/simulation/faraday  1. **Worksheets**   Pass out student worksheets to guide students through simulations.   1. **Student Work Time**   Give students work time to complete simulations.   1. **Regroup**   Meet back in class to discuss. Have a student bring up the simulation and walk through it as the students discuss each answer.   1. **Discussion**   Discussion points should include:   * 1. Different poles of a magnet   2. Number of rotations of compass needle moving around a magnet   3. What does increasing the number of coils do to current induction?   4. Does the magnetic field in a coil have to move to induce current?  1. **Check**   Have students check their own worksheets and make any changes necessary.  **Progress Monitoring:**   * The instructor will need to monitor the classroom, check students’ work, and ensure students are on task and following directions. * Ensure students store their projects at the end of class and leave all materials in the room. * At the end of the activity, post student projects in the room and provide appropriate feedback. | | | | | | |
|  | Differentiation: *Summary of Key Differentiation Techniques* | | | | | |
| Please use this space to insert your differentiation techniques. Depending on the needs of students, various techniques might be needed in a classroom, therefore use the information below and experts in the area needed to design your plan for differentiation.  The ASCD Study Guide for Integrating Differentiated Instruction and Understating by Design: Connecting Content and Kids.  by Carol Ann Tomlinson, Jay McTighe  Integrating Differentiated Instruction and Understating by Design: Connecting Content and Kids.  by Carol Ann Tomlinson, Jay McTighe  ISBN-13: 978-1416602842  ISBN-10: 1416602844  Differentiating Reading Instruction  *by Laura Robb.*  ISBN13: 9780545022989  A Teacher's Guide to Differentiating Instruction  The Center for Comprehensive School Reform and Improvement | | | | | | |

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|  | career Connections: *Summary of Career Opportunities Associated with this Lesson* |
| **Physicist**  Physicist can study how magnets work and affect other types of scientific entities.  **Mechanical Engineer**  Mechanical engineers need to understand characteristics of magnets and electricity to us them in designs.  **Laborer**  Laborers often work with large magnets, electromagnets, and electrical induction equipment. | |
|  | Keywords: *Please Insert Keywords from this Lesson with their Definitions* |
| MAGNET – a piece of iron that has its component atoms so ordered that the material exhibits properties of magnetism  ELECTROMAGNET – a soft metal core made into a magnet by the passage of electric current through a coil surrounding it  INDUCTION – the process or action of bringing about or giving rise to something | |