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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/
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|  | 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.
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| 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
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| 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
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|  | 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
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|  | 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.
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|  | 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 McTigheIntegrating Differentiated Instruction and Understating by Design: Connecting Content and Kids.by Carol Ann Tomlinson, Jay McTigheISBN-13: 978-1416602842 ISBN-10: 1416602844Differentiating Reading Instruction*by Laura Robb.*ISBN13: 9780545022989A Teacher's Guide to Differentiating InstructionThe 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 magnetismELECTROMAGNET – a soft metal core made into a magnet by the passage of electric current through a coil surrounding itINDUCTION – the process or action of bringing about or giving rise to something |