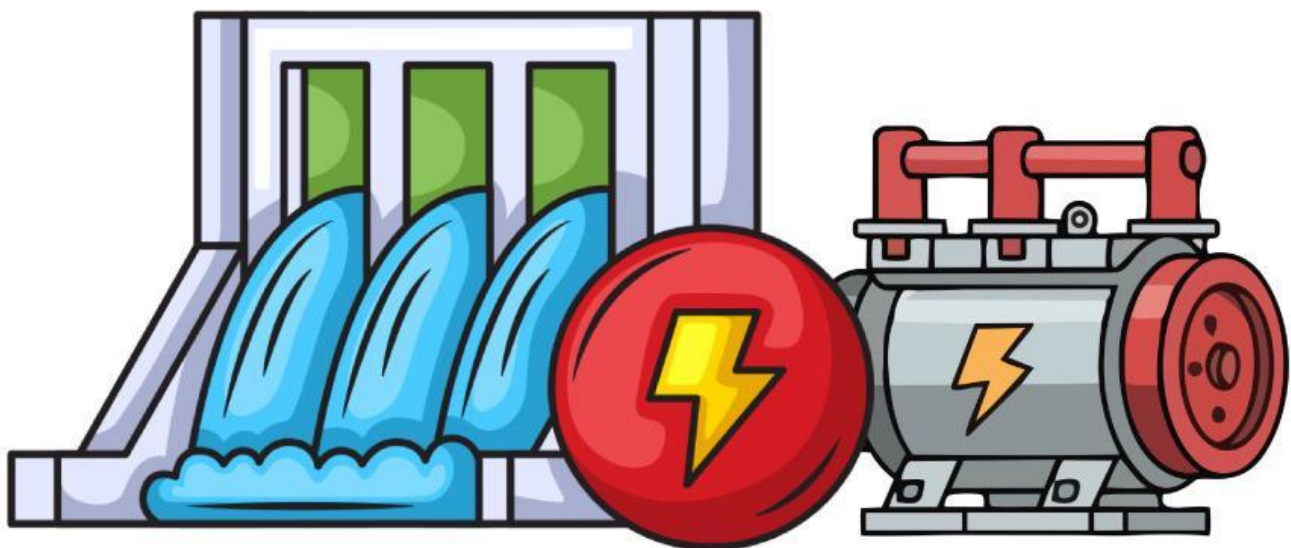


STUDENT WORKSHEET

Factors Affecting Induced EMF in Generators



Name of Group:

Class: _____

1. _____
2. _____
3. _____
4. _____

12th Grade High School

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Experiment Objective

1. Investigate the effects of rotational speed, the number of coil turns, and magnetic field strength on the magnitude of the induced EMF in a simple generator.
2. Explain the operating principle of a simple generator based on the results of the investigation.



Syntax 1: Problem Orientation



Fig 1. Saguling Hydroelectric Power Plant

Electricity is one of the essential needs of daily life, and it is generated, among other ways, by hydroelectric power plants. In a hydroelectric power plant, the flow of water is used to turn a turbine connected to a generator, thereby converting mechanical energy into electrical energy. However, the amount of electricity generated is not always the same. When the water flow increases, the amount of electricity generated tends to be greater, whereas during the dry season, electricity production often decreases due to reduced water flow. This phenomenon indicates that there is a relationship between the generator's rotation and the electrical energy produced. To identify the factors that influence the magnitude of the induced EMF in the generator, conduct an investigation using the PhET Faraday's Electromagnetic Lab simulation.



Syntax 2: Formulate the Problem

Based on the phenomenon you've read about, formulate a question that you will investigate using a PhET simulation!



Syntax 3: Formulate a Hypothesis

Write down your preliminary hypothesis based on the research question you have formulated.

Scan the QR code below or click the link to open the PhET Faraday's Electromagnetic Lab simulation.



https://phet.colorado.edu/sims/html/faradays-electromagnetic-lab/latest/faradays-electromagnetic-lab_all.html



Syntax 4: Collecting Data

Activity 1. Investigating the Effect of Water Flow Rate on Induced EMF

Procedure:

1. Open the Generator simulation on PhET.
2. Set the number of turns to 2 and the magnet strength to 75%.
3. Set the water valve opening to 25%, then observe the generator's RPM, the condition of the light bulb, and the movement of the electrons. Record the results.
4. Change the valve opening to 50%, then make your observations again.
5. Change the valve opening to 100%, then record your observations.
6. Compare the results of your observations under these three conditions.

Table 1. Investigating the Effect of Water Flow Rate on Induced EMF

No.	Turning on The Faucet	RPM	Light Condition	Electron Motion
1.	25%			
2.	50%			
3.	100%			

Activity 2. Investigating the Effect of the Number of Windings on Induced EMF

Procedure

1. Set the water faucet to 75% open.
2. Set the magnet strength to 75%.
3. Set the number of coils to 1, then observe the RPM, the condition of the light, and the movement of the electrons. Record the results.
4. Change the number of turns to 2, then make observations again.
5. Change the number of turns to 3, then record the results of your observations.
6. Compare the results of your observations for each number of turns.

Table 2. Investigating the Effect of the Number of Windings on Induced EMF

No.	Number of Turns	RPM	Light Condition	Electron Motion
1.	2			
2.	3			
3.	4			

Activity 3. Investigating the Effect of Magnetic Strength on Induced EMF

Procedure

1. Set the water faucet to 75% open.
2. Set the number of coils to 2.
3. Set the magnet strength to 25%, then observe the RPM, the condition of the light, and the movement of the electrons. Record the results.
4. Change the magnetic strength to 50%, then repeat the observations.
5. Change the magnetic strength to 100%, then record the results of your observations.
6. Compare the results of your observations for each magnetic strength.

Table 3. Investigating the Effect of the Number of Windings on Induced EMF

No.	Magnetic Strength	RPM	Light Condition	Electron Motion
1.	25%			
2.	50%			
3.	100%			



Syntax 5: Data Analysis

1. Based on the experimental results, what factors influence the magnitude of the induced EMF in a generator?

2. What is the relationship between water flow rate, the number of turns, and magnetic strength and the magnitude of the induced EMF?

3. Of these three factors, which one is easiest to adjust in a hydroelectric power plant to increase electrical energy? Explain.

4. Do the experimental results match your hypothesis? Give reasons.

5. Explain how a hydroelectric power plant's generator works based on the results of the experiment.



Syntax 6: Draw Conclusions

Write down the conclusions of the investigation that has been conducted!
