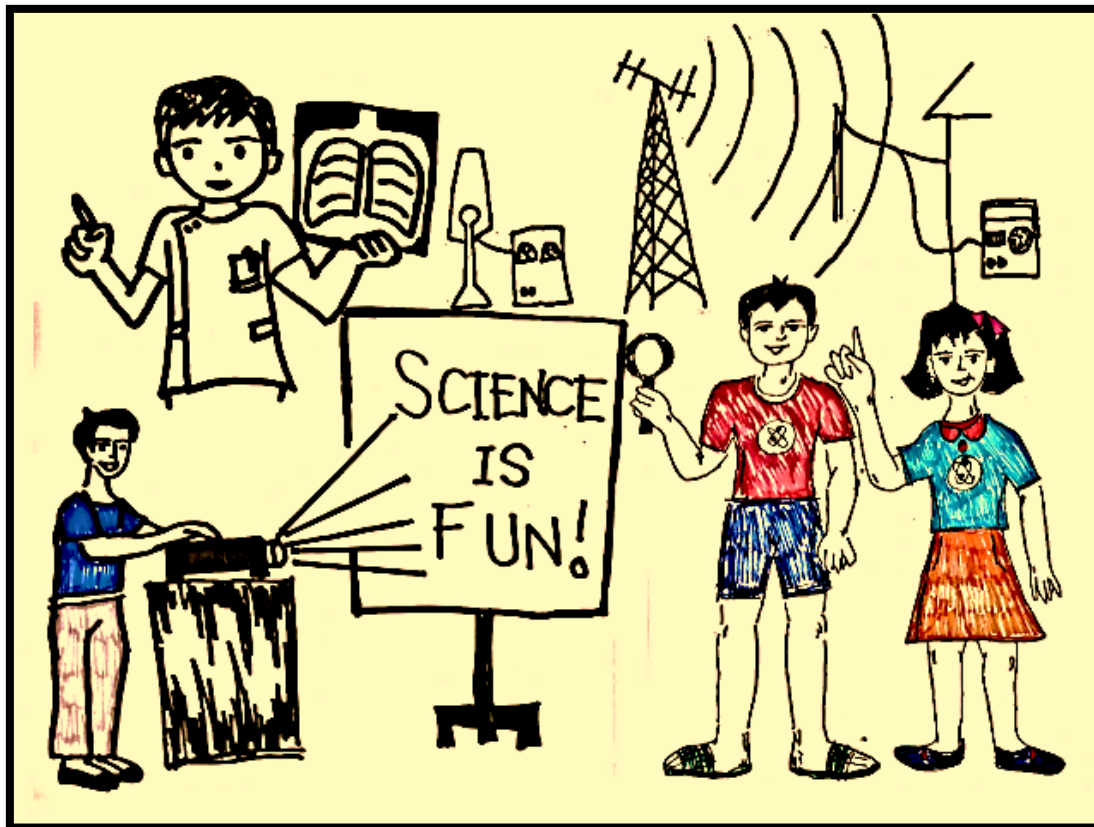


SELF- LEARNING KIT IN SCIENCE 10

PIONEERS OF ELECTROMAGNETIC THEORY



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Santiago City National High School

SCIENCE 10
Self- Learning Kit
Quarter 2 Module 1: PIONEERS OF ELECTROMAGNETIC THEORY
First Edition, 2024

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FOREWORD

This Self-Learning Kit aims to guide Grade 10 students on citing the contributions of scientists and inventors on the development of electromagnetic theory.

The history of electromagnetic (EM) theory begins with ancient measures to understand atmospheric electricity, in particular lightning. People then had little understanding of electricity and were unable to explain the phenomena. Scientific understanding into the nature of electricity grew throughout the eighteenth and nineteenth centuries through the work of researchers such as Coulomb, Ampère, Faraday and Maxwell.

The different activities in this kit will enable students to explore the comparison of the relative wavelengths of different forms of electromagnetic waves as perceived and discovered by the pioneers of EM Waves. The activities also provide students analytical thinking while doing their given tasks.

SCIENCE 10

PIONEERS OF ELECTROMAGNETIC THEORY

CONTENT STANDARD

The learners demonstrate an understanding of the different regions of the electromagnetic spectrum.

PERFORMANCE STANDARD

The learners should be able to perform differentiated activities on electromagnetic waves.

MOST ESSENTIAL LEARNING COMPETENCY

Compare the relative wavelengths of different forms of electromagnetic waves.

Code: (S10FE-IIa-b-47)

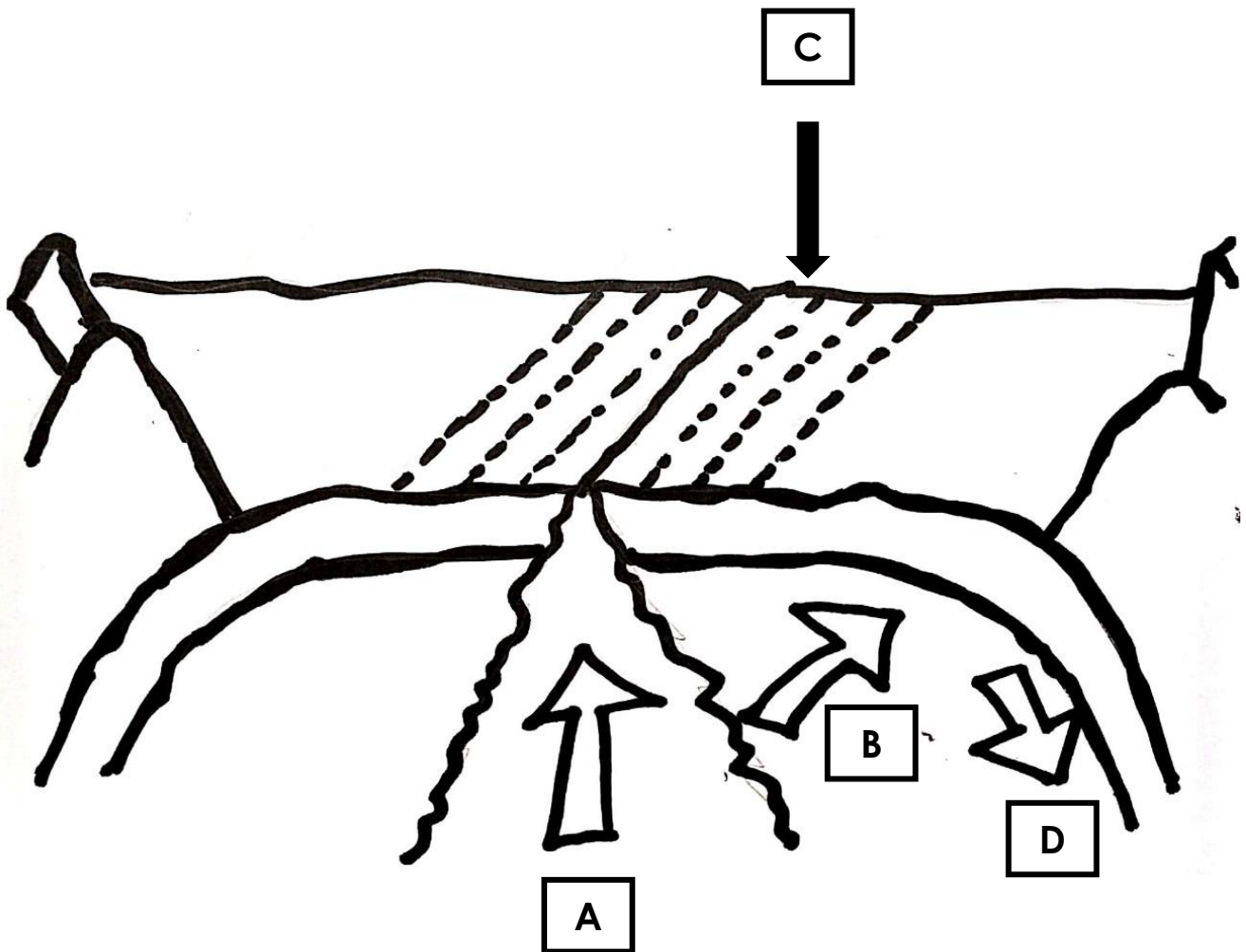
SPECIFIC OBJECTIVE

Cite the contributions of scientists and inventors on the development of electromagnetic theory.

WHAT HAPPENED?

UNSTABLE SEAFLOOR

DIRECTIONS: Study the following diagram of the seafloor. Then match the letters to the statements below. Write the letter of your answer on the space provided.



- _____ 1. Molten rock flows onto the seafloor and hardens as it cools.
- _____ 2. Hot, molten rock is forced upward toward the seafloor at mid-ocean ridge.
- _____ 3. New seafloor moves away from the ridge, cools, becomes denser and sinks.
- _____ 4. Molten rock pushes sideways in both directions as it rises, moving the mantle with it.

PRE- TEST

DIRECTIONS: Write the letter of your answer on the space before the number.

- ____ 1. He discovered that electric currents can create magnetic fields. Who is this Danish physicist and chemist?
a. Andre Marie Ampere
b. James Clerk Maxwell
c. Hans Christian Oersted
d. Michael Faraday
- ____ 2. Who is this French physicist and mathematician who contributed in classical electromagnetism and managed to call it “electrodynamics”?
a. Andre Marie Ampere
b. James Clerk Maxwell
c. Hans Christian Oersted
d. Heinrich Rudolf Hertz
- ____ 3. Which of the following is/are **NOT** a discovery of Michael Faraday?
I. electric generator II. Electromagnetic generator
III. RADAR IV. Wireless telegraphy
a. I and II
b. I and III
c. II and IV
d. III and IV
- ____ 4. His achievement includes classical theory of electromagnetic radiation. Who is he?
a. Michael Faraday
b. James Clerk Maxwell
c. Hans Christian Oersted
d. Heinrich Rudolf Hertz
- ____ 5. Which of the following is/are discovery of Heinrich Rudolf Hertz?
I. Dipole antenna II. EM Induction
III. Radio transmitter IV. Unit Ampere
a. I and II
b. I and III
c. II and III
d. II and IV
- ____ 6. Ampere was one of the founders of the science of classical electromagnetism in which he managed to refer it to as _____.
a. Electrodynamics c. Thermodynamics
b. Aerodynamics d. Gyro dynamics
- ____ 7. Oersted believed that electric field can produce _____ field.
a. Gravitational c. Changing
b. Magnetic d. EM wave
- ____ 8. Aluminum was discovered by Oersted in what country?
a. France c. Denmark
b. England d. Scotland
- ____ 9. Faraday has been a great to the study of electromagnetism and _____.
a. Electrochemistry c. Physics
b. Biochemistry d. Paleontology
- ____ 10. Magnetic field and electric field when combined can form EM _____?
a. Wavelength c. Frequency
b. Particle d. Wave

WHAT TO LEARN?

PIONEERS OF ELECTROMAGNETIC THEORY

ANDRE-MARIE AMPERE

- ✓ He was born on January 20, 1775 and died June 10, 1836.
- ✓ His parents were Jean-Jacques Ampere and Jeanne Antoinette Desutieres-Sarcey.
- ✓ He was a French physicist and a mathematician
- ✓ He was also one of the founders of the science of classical electromagnetism in which he managed to refer it to as **“electrodynamics”**.
- ✓ His name still exists in our everyday life in the **ampere**, the unit for measuring electric current.



<https://www.sciencephoto.com/media/223143/view/andre-marie-ampere-french-physicist>

HANS CHRISTIAN OERSTED



<https://www.aps.org/publications/apsnews/200807/physics/history.cfm>

- ✓ He was born on August 14, 1777 and died March 9, 1851.
- ✓ He was a Danish physicist and a chemist who discovered that **electric currents create magnetic fields**. It has been the first connection found between **electricity and magnetism**.
- ✓ He is known today for the Oersted's Law.
- ✓ He managed to discover aluminum in Denmark by the year of 1825.

JAMES CLERK MAXWELL

- ✓ He was born on June 13, 1831 and died November 5, 1879.
- ✓ He was a Scottish scientist in the mathematical physics field.
- ✓ His achievement was formulation of the **classical theory of electromagnetic radiation** that brings together for the first-time electricity, light and magnetism as different manifestations of the same phenomenon.
- ✓ He noticed that **electrical fields and magnetic fields can couple together to form electromagnetic waves**.



<https://physicsworld.com/a/james-clerk-maxwell-a-force-for-physics/>

HEINRICH RUDOLF HERTZ



https://commons.wikimedia.org/wiki/File:PSM_V45_D304_Heinrich_Hertz.jpg

- ✓ He was a German physicist that managed to prove the existence of electromagnetic waves that has been predicted by James Clerk Maxwell's electromagnetism equations.
- ✓ He was born on February 22, 1857 and died on January 1, 1894.
- ✓ He invented the following things that are still being used up until today:

Radar Dipole antenna
Wireless telegraphy
Radio transmitter

MICHAEL FARADAY

- ✓ He was an English scientist that has been a great contribution to the study of electromagnetism and electrochemistry.
- ✓ He was born on September 22, 1791 and died on August 25, 1867.
- ✓ He has a lot of discoveries and to name a few are: **Principles underlying electromagnetic induction, Dimagnetism and Electrolysis.**



<https://diyhomeschooler.com/free-science-studies-michael-faraday-electricity/>

- ✓ Due to his efforts, **electricity** became a practical use in technology.

Examples of his inventions were:

- ✓ **First electric motor**
- ✓ **He discovered the phenomenon of electromagnetic induction**
- ✓ **First electromagnetic generator and dynamo**

The history of electromagnetic (EM) theory begins with ancient measures to understand atmospheric electricity, in particular lightning. People then had little understanding of electricity and were unable to explain the phenomena. Scientific understanding into the nature of electricity grew throughout the eighteenth and nineteenth centuries.

In our modern society, electromagnetic wave is essential in almost every piece of equipment. Electronic gadgets, electric power is used to light, operate, and heat our homes, AM and FM radio stations, radar, x-rays and medical equipment to treat cancer cells are all application of electromagnetic wave.

WHAT HAVE YOU LEARNED?

ACTIVITY 1 EM WAVE CONFERENCE WITH THE PIONEERS

DIRECTIONS: Using the information you gathered previously, make a comic strips of the contributions of the following pioneers of Electromagnetic Theory.



Michael



**James
Clerk**



**Heinrich
Rudolf**



**Hans
Christian**



**Andre
Marie**

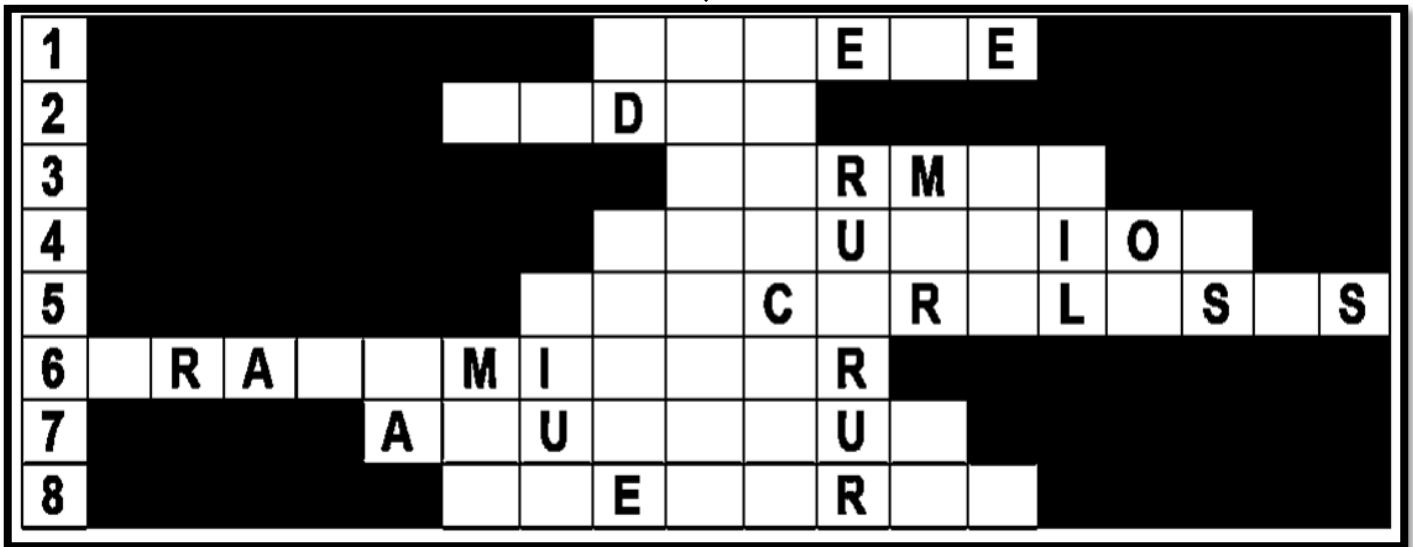
**Adopted: <https://www.storyboardthat.com/pt/storyboards/gwynn/the-development-of-em-waves-theory>*

ACTIVITY 2

UNLOCK THE HIDDEN EM THEORY MESSAGE

Directions: Complete the letters in each box by answering what is being asked. A mystery word is hidden on the boxes.

MYSTERY WORD

1. Unit of current
2. Invention of Heinrich Hertz
3. Nationality of Heinrich Hertz
4. Electromagnetic _____ - principle behind generator and motor
5. One discovery of Faraday
6. Radio _____ - another discovery of Hertz
7. Element discovered by Oersted
8. _____ and magnetic fields can produce EM waves

MYSTERY WORD:

ACTIVITY 3

MULTIPLE CHOICE WITH A TWIST

Directions: Write the letter of your answer on a separate sheet of paper.

1. Ampere was one of the founders of the science of classical electromagnetism in which he managed to refer it to as _____.
P. Electrodynamics Q. Thermodynamics
R. Aerodynamics S. Gyro dynamics
2. Oersted believed that electric field can produce _____ field.
G. Gravitational H. Changing
I. Magnetic J. EM wave
3. Aluminum was discovered by Oersted in what country?
N. France O. Denmark
P. England Q. Scotland
4. Faraday has been a great to the study of electromagnetism and _____.
N. Electrochemistry O. Physics
P. Biochemistry Q. Paleontology
5. Magnetic field and electric field when combined can form EM _____?
B. Wavelength C. Frequency
D. Particle E. Wave
6. Heinrich Hertz important invention related to communication technology.
B. Satellite C. Antennae
D. Transistor E. Telegraphy
7. His achievement is related to classical theory of electromagnetic radiation.
P. Ampere Q. Oersted
R. Maxwell S. Faraday

HERE IS THE TWIST:

Combine your answers from numbers 1 to 7, what word is produced?

My Answer: _____

POST- TEST

DIRECTIONS: Write the letter of your answer on the space before the number.

- ____ 1. Which of the following is/are discovery of Heinrich Rudolf Hertz?
I. Dipole antenna II. EM Induction
III. Radio transmitter IV. Unit Ampere
a. I and II
b. I and III
c. II and III
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- ____ 9. Heinrich Hertz important invention related to communication technology.
a. Satellite c. Antennae
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- ____ 10 His achievement is related to classical theory of electromagnetic radiation.
a. Ampere c. Oersted
b. Maxwell d. Faraday

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Illustrations

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<https://www.aps.org/publications/apsnews/200807/physicshistory.cfm>

<https://www.sciencephoto.com/media/223143/view/andre-marie-ampere-french-physicist>

ANSWER KEY

What Happened?
1. B 2. A 3. D 4. C

Pre-Test
1. c, 2. a, 3. d, 4. b, 5. b
6. a, 7. b, 8. c, 9. b, 10. d

Post-Test
1. b, 2. c, 3. b, 4. a, 5. d
6. c, 7. a, 8. d, 9. c, 10. b

Activity 1

Answers may vary

Activity 2

1. Ampere 2. Radar
3. German 4. Induction
5. Electrolysis 6. Transmitter
7. Aluminum 8. Electric
Mystery Word: MAGNETIC

Activity 3

1. P 2. I 3. O 4. N
5. E 6. E 7. R
My Answer: PIONEER

SYNOPSIS

The history of electromagnetic (EM) theory begins with ancient measures to understand atmospheric electricity, in particular lightning. People then had little understanding of electricity and were unable to explain the phenomena.

Scientific understanding into the nature of electricity grew throughout the eighteenth and nineteenth centuries through the work of researchers such as Ampère, Oersted, Faraday, Maxwell and Hertz.

In our modern society, electromagnetic wave is essential in almost every piece of equipment. Electronic gadgets, electric power is used to light, operate, and heat our homes, AM and FM radio stations, radar, x-rays and medical equipment to treat cancer cells are all application of electromagnetic wave.

ABOUT THE AUTHOR



MARIO JAMES S. DELA CRUZ, Master Teacher I, is an Advanced Physics and Science 10 teacher at Santiago City NHS. In 2020, he was awarded Most Outstanding Secondary Teacher in the Schools Division of Santiago City and a Finalist during the 2020 Regional STARS Awards.

In 2021, he received an international recognition as Luminary Excellence in Education and Research Award- Outstanding Educator in Science.

His work as Science teacher also appreciated in Region 02 and gave him the award Most Outstanding Secondary Teacher and Outstanding Employee Award.

He was awarded as the Grand National Champion in SIM Making at the National Science and Technology Fair in 2020. Recently, he was awarded Grand National Champion in SIM Making spearheaded by the Salindunong Review and Research Center.

He is a Regional Learning Activity Sheet writer and Content Editor. He is a Strategic Intervention Material (SIM) and Self- Learning Kit (SLK) writer.

He continues to contribute to Science Education as a Science Club adviser, academic coach, resource person, lecturer and evaluator at various seminars, conferences and Science fairs.