Republic of the Philippines
Department of Education
Region IV (A) – CALABARZON
City Schools Division Office of Antipolo
District I – A

ANTIPOLO CITY SENIOR HIGH SCHOOL
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STUDENT's ACTIVITY SHEET FOR GENERAL PHYSICS 2
SAS #2 MELC10,12,13,14 (MODULAR MODALITY)

TITLE/LESSON: ELECTRIC POTENTIAL

I. OBJECTIVES: At the end of the lesson, you are expected to:

a. relate the electric potential with work, potential energy, and electric field;
b. infer the direction and strength of electric field vector, nature of the electric field sources, and electrostatic potential surfaces given the equipotential lines;
c. calculate the electric field in the region given a mathematical function describing its potential in a region of space; and
d. solve problems involving electric potential energy and electric potentials in contexts such as, but not limited to, electron guns in CRT TV picture tubes and Van de Graaff generators.

A. Content Standard:

The learner demonstrates an understanding of Electric potential energy, Electric potential, Equipotential surfaces, Electric field as a potential gradient.

B. Performance Standard:

The learners shall be able use theoretical and experimental approaches to solve multi concept and rich-context problems involving electricity and magnetism.

C. Most Essential Learning Competency/ies:

1. Relate the electric potential with work, potential energy, and electric field; (STEM_GP12EM-IIIb-15)
2. Infer the direction and strength of electric field vector, nature of the electric field sources, and electrostatic potential surfaces given the equipotential lines. (STEM_GP12EM-IIIc-18)
3. Calculate the electric field in the region given a mathematical function describing its potential in a region of space. (STEM_GP12EM-IIIc-20)
4. Solve problems involving electric potential energy and electric potentials in contexts such as, but not limited to, electron guns in CRT TV picture tubes and Van de Graaff generators. (STEM_GP12EM-IIIc-22)

II. LEARNING RESOURCES

A. Materials/IMs Needed
B. References
C. Additional Materials and Learning Resources

III. TIME FRAME: **50 min or 1 day (30 min will be allotted for the lecture part).**

IV. INTRODUCTION/RATIONALE

The electric potential (also called the electric field potential, potential drop, the electrostatic potential) is the amount of work energy needed to move a unit of electric charge (a Coulomb) from a reference point to the specific point in an electric field with negligible acceleration of the test charge to avoid producing kinetic energy or radiation by test charge. Typically, the reference point is the Earth or a point at infinity, although any point can be used. More precisely it is the energy per unit charge for a small test charge that does not disturb significantly the field and the charge distribution producing the field under consideration.

What I Need to Know

This activity sheet was designed and written with you in mind. It is here to help you master the Electric Potential. The scope of this activity sheet permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary of students. The lessons are arranged to follow the standard sequence of the course.

This activity sheet is compromised only of one lesson:

- ELECTRIC POTENTIAL

After going through this activity sheet, you are expected to:

1. Relate the electric potential with work, potential energy, and electric field;
2. Infer the direction and strength of electric field vector, nature of the electric field sources, and electrostatic potential surfaces given the equipotential lines;
3. Calculate the electric field in the region given a mathematical function describing its potential in a region of space; and
4. Solve problems involving electric potential energy and electric potentials in contexts such as, but not limited to, electron guns in CRT TV picture tubes and Van de Graaff generators.

What I Know

Activity 2.1 Express Me! (3 minutes)

Directions: Write the meaning of the following.

a. work
b. potential energy
c. magnetic field
d. electric field

What's In

Activity 2.2 Illustrate Me!

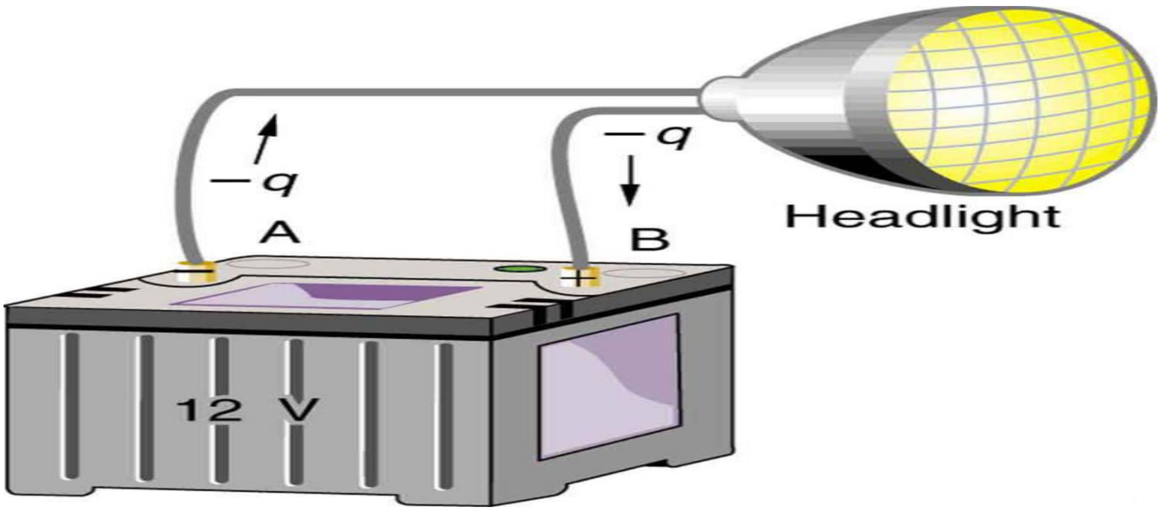
Directions: Fill in the table below. (3 minutes)

Electric Potential	
Denoted by	
Dimension:	
General formula	
SI Unit	

What's New

Activity 2.3 Check Your Understanding!

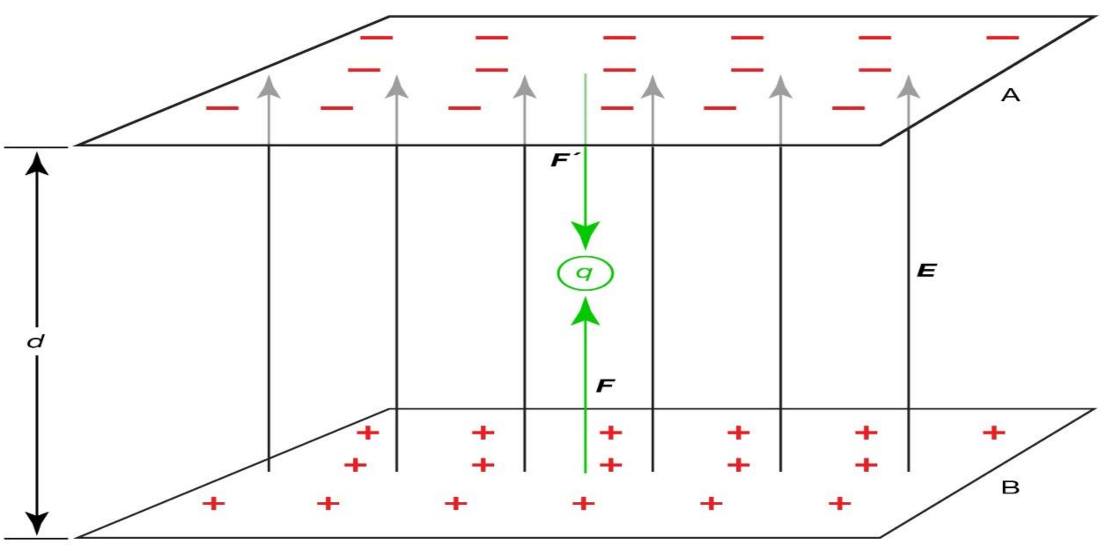
Directions: Analyze the figure below. (3 minutes)
Describe the potential energy of the battery in the figure below.



What is It

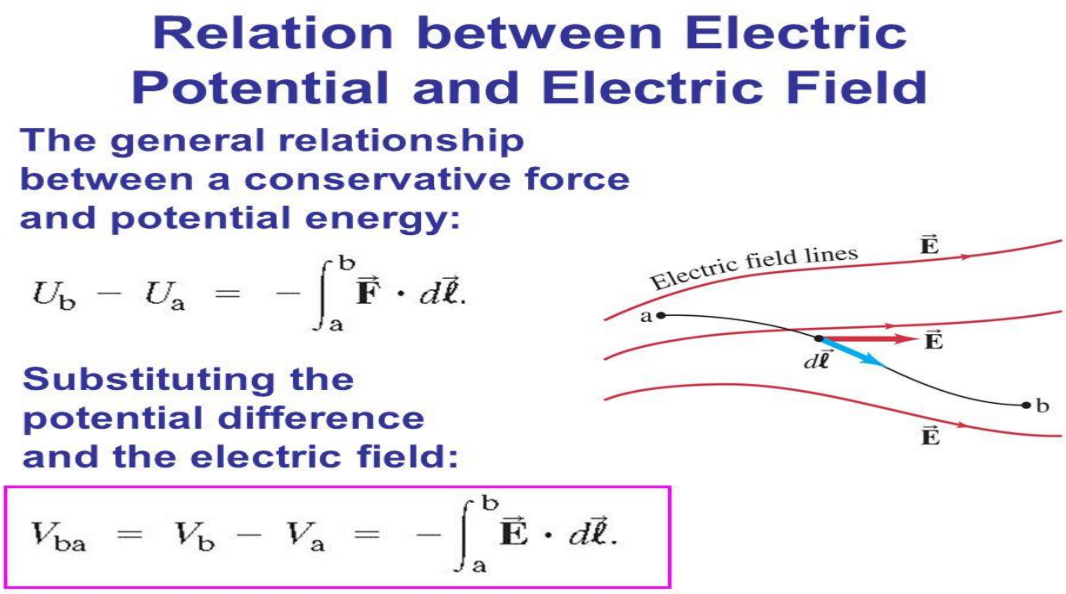
Electric potential, the amount of work needed to move a unit charge from a reference point to a specific point against an electric field. Typically, the reference point is Earth, although any point beyond the influence of the electric field charge can be used.

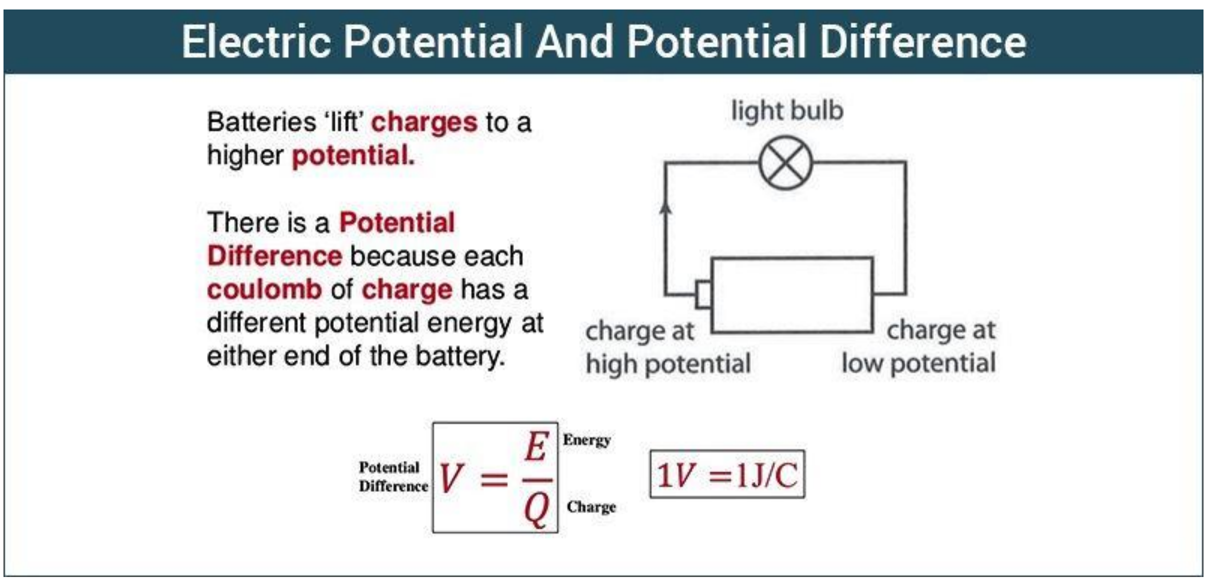
The diagram shows the forces acting on a positive charge q located between two plates, A and B, of an electric field E. The electric force F exerted by the field on the positive charge is F = qE; to move the charge from plate A to plate B, an equal and opposite force (F′ = −qE) must then be applied. The work W done in moving the positive charge through a distance d is W = F′d = −qEd.



The potential energy for a positive charge increases when it moves against an electric field and decreases when it moves with the electric field; the opposite is true for a negative charge. Unless the unit charge crosses a changing magnetic field, its potential at any given point does not depend on the path taken.

Although the concept of electric potential is useful in understanding electrical phenomena, only differences in potential energy are measurable. If an electric field is defined as the force per unit charge, then by analogy an electric potential can be thought of as the potential energy per unit charge. Therefore, the work done in moving a unit charge from one point to another (e.g., within an electric circuit) is equal to the difference in potential energies at each point. In the International System of Units (SI), electric potential is expressed in units of joules per coulomb (i.e., volts), and differences in potential energy are measured with a voltmeter.





The work done per unit charge in moving a charge between two points in an electric field is known as the electric potential difference, (V). The units of electric potential are volts, where a volt is equal to 1 Joule per Coulomb. Therefore, if you did 1 Joule of work in moving a charge of 1 Coulomb in an electric field, the electric potential difference between those points would be 1 volt. This is given by:

$$V = \frac{W}{q}$$

Sample Problem:

A potential difference of 10.0 volts exists between two points, A and B, within an electric field. What is the magnitude of charge that requires 2.0 × 10–2 joule of work to move it from A to B?

$$V = \frac{W}{q}$$

$$q = \frac{W}{V}$$

$$q = \frac{(2*10^{-2} J)}{10V} = 2*10^{-3} C$$

What's More

Activity 2.4 Put Your Best!

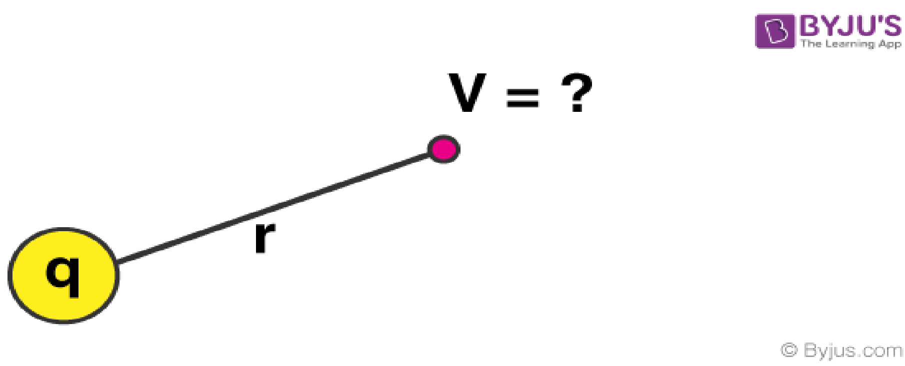
Directions: Answer the following questions: **(3 minutes)**

1. What is the potential energy of an electric field?
2. What is electric potential difference?
3. Is electric potential energy a vector or scalar?

What I Have Learned

Activity 2.5 Highlights Zone!

Directions: Refer to the figure below to answer the question. (3 minutes)



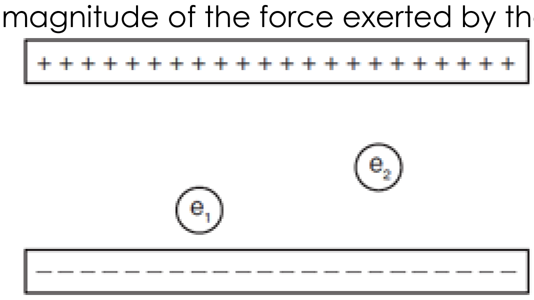
Question: Use Coulombs law to explain the electrostatic potential between two arbitrary charges q1and q2.

What I Can Do

Activity 2.6 A Job for Me!

Directions: Refer to the situation below. (3 minutes)

Situation: The diagram represents two electrons, e1 and e2, located between two oppositely charged parallel plates. Compare the magnitude of the force exerted by the electric field on e1 to the magnitude of the force exerted by the electric field on e2.

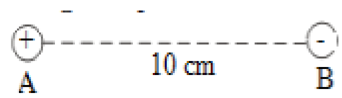


Assessment

Quiz #2

Directions: Solve the following problems: **(5 minutes)**

1. A charge of 2 x 10^{-3} C is moved through a potential difference of 10 volts in an electric field. How much work, in electron-volts, was required to move this charge?
2. Two-point charges are separated by a distance of 10 cm. Charge on point A =+9 μC and charge on point B = -4 μC. k = 9 x 109 Nm2C−2, 1 μC = 10−6 C. What is the change in electric potential energy of charge on point B if accelerated to point A?



Additional Activities

Activity 2.7 A Time to Shine!

Directions: Analyze the situation below. (**3 minutes)**

You'll note that with the potential difference V in volts, and the distance between the plates in meters, units for the electric field strength are volts per meter [V/m]. Previously, we stated that the units for electric field strength were newtons per Coulomb [N/C]. It is easy to show that these units are equivalent:

$$\frac{N}{C} = \frac{N*m}{C*m} = \frac{J}{C*m} = \frac{J/C}{m} = \frac{V}{m}$$

Question: Which electrical unit is equivalent to one joule?

1. volt / meter
2. ampere * volt
3. volt / Coulomb
4. Coulomb*volt

V. REFLECTION: (5 minutes)

Base on the activity/ies conducted, complete the phrases stated below:

- ✓ I understand that

____
____.

- ✓ I realize that

____
____.

References:

https://en.wikipedia.org/wiki/Electric_potentia

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