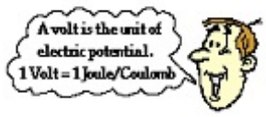
# Intermediate Science 9

## *Unit 3*: CURRENT ELECTRICITY

### WORKSHEET 2: ELECTRIC VOLTAGE

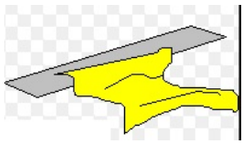
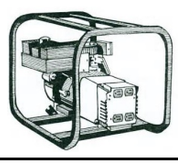
**Electric Potential Energy** refers to electric energy stored in the battery that can be given to electrons to enable them to do work within a circuit. It is measured in Joules.

**Electric Potential (Voltage)** refers to the amount of energy per unit charge. It is the amount of push given to the electrons. It is measured in Joules per Coulomb or Volts




**Electric Potential Difference** refers to the difference in voltage from one location in a circuit to another. It is also measured in volts.

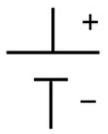
***Sources of Electric Voltage:***

| | |
|---|---|
| **Friction**  | Rubbing two materials together, such as acetate and paper, or rubber and wool, can separate charge. These separated charges now have electrical energy. |
| **Piezoelectric crystals**  | A barbecue lighter has no battery inside to produce the electric spark. The electricity comes from a tiny crystal. When certain types of crystals, such as quartz, are squeezed, positive and negative charges are separated on either side of the crystal. The prefix "piezo-"means pressure or push. |
| **Electrochemical Cells**   | electrochemical cell is a device capable of either generating electrical energy from chemical reactions. Note voltaic cell is an electrochemical cell that uses a chemical reaction to produce electrical energy |
| **Photo Cells**  | Solar panels and many calculators use photo-electrochemical cells or solar cells as a source of power. When light hits the cell, some of the light energy breaks electrons off the surface of the cell. These separated electrons now have the electrical energy needed to operate a calculator, a phone booth, or the International Space Station. |
| **Thermocouples**  | A thermocouple is a device used to transform heat energy into electrical energy. A thermocouple consists of a loop of two wires of different metals joined at both ends. If one end of the loop is heated or cooled, charge is separated and a voltage is created across the thermocouple. Individual thermocouples can produce only a small amount of electrical energy. |
| **Generators**  | The electricity that enters most of our homes is produced by a generator. Generators work on the principle that when a wire moves close to a magnet or a magnet moves close to a wire, a voltage is created across the wire. In Newfoundland and Labrador, we use hydroelectric energy, the energy of water to generate electrical energy |

**CELLS AND BATTERIES:**

Current can not be produced or electrons can not flow on their own, some force has to get the electrons moving. Another way of creating electric current is through the use of an electrochemical cell and batteries.

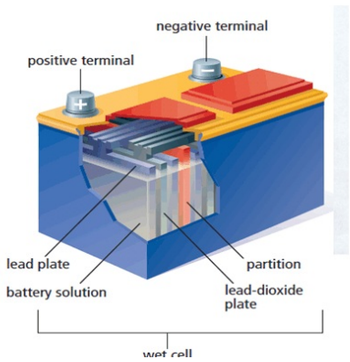
**Cell:** a device that converts chemical energy into electrical energy. Generally speaking the "batteries" that you buy in the store to run your portable appliances are chemical cells.



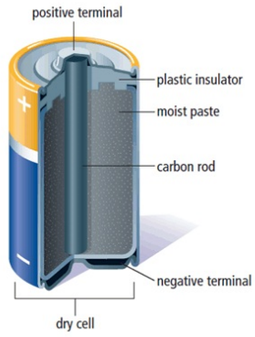

SYMBOL FOR A CELL

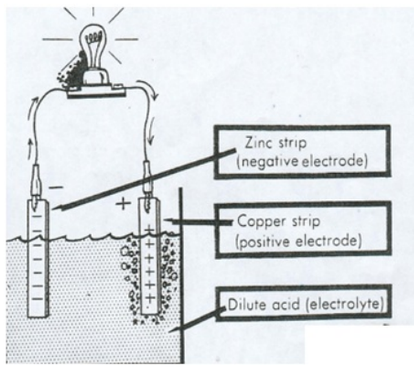
**TWO TYPES OF CELLS**

**WET CELL** **An electric cell in which the chemicals producing the current are in the form of a liquid. Used in cars, motorcycles, ski doo**




**DRY CELL** **the solution is in the form of a paste. Used in flashlights, mp3 players,**

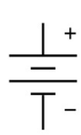



HOW DOES A CELL WORK?

- All chemical cells consist of two different metals. (Ex. Zinc and copper). These metals are called electrodes.
- In between the electrodes is a solution or moist paste called the electrolyte.
- A chemical reaction takes place within the cell causing a build up of electrons on the zinc electrode. This becomes negative terminal.
- On the copper electrode, electrons are taken away, make the carbon electrode the positive terminal.
- When a wire is connected between the two electrodes (i.e. The two terminals) electrons flow from the zinc (negative) to the copper (positive).
- This produces an electric current.

**Battery:** made up of one or more electrochemical cells that are joined together to provide an electric current.




SYMBOL FOR BATTERY

**Voltmeter:** The instrument used to measure voltage . A voltmeter can measure the increase in potential at the terminals of the dry cell, and the decrease in potential as the electrons give up their energy in the lamp. Voltmeters must be hooked up in parallel as shown below:

**PART A: MULTIPLE CHOICE**

1. What are the units for electric energy?

   (A) Ampere
   (B) Coulomb
   (C) Joule
   (D) Volt

2. Which of the following best describes voltage?

   (A) The amount of charge
   (B) The amount of energy
   (C) The amount of charge per second
   (D) The amount of joules per charge

3. What is another word for electric potential?

   (A) Charge
   (B) Current
   (C) Energy
   (D) Voltage

4. Both AA and C batteries are labeled 1.5 V. Which statement is true?

   (A) They have different potential difference and potential energy.
   (B) They have different potential difference but the same potential energy.
   (C) They have the same potential difference and potential energy.
   (D) They have the same potential difference but different potential energy.

5. What are the units for Voltage?

   (A) Ampere
   (B) Coulomb
   (C) Joule
   (D) Volt

6. Which of the following terms is used to designate electrical pressure?

   (A) Charge
   (B) Voltage
   (C) Resistance
   (D) Current

7. What is the name of the pressure that moves electrons in a closed circuit?

(A) Coulombs
(B) Voltage
(C) Amperes
(D) Joule

8. What feature of a river is most similar to potential difference in an electric circuit?

(A) The speed of water flow measured in metres per second
(B) The vertical drop between two points along the river measured in metres
(C) The volume of water moving past a point measured in litres per second
(D) The width of the river measured in metres

9. If a fluid system is compared to an electrical system, the fluid pump will correspond to a:

(A) Conductor
(B) Battery
(C) Lamp
(D) Insulator

10. What is needed for an electric charge to flow?

(A) Fluid
(B) Force
(C) Repulsion
(D) Attraction

11. A voltage will influence current only if the circuit is:

(A) Open
(B) Series
(C) Insulated
(D) Closed

12. Which of the following is not a type of energy source?

(A) Generator
(B) Thermometer
(C) Solar cell
(D) Battery

13. Which voltage source converts chemical energy to electrical energy?

(A) Voltaic Cell
(B) Piezoelectric crystals
(C) Thermocouples
(D) Photo-electrochemical cells

14. What component in a dry cell serves the same purpose as the acid in a wet cell?

(A) Electrolytic paste
(B) Negative electrode
(C) Plastic insulator
(D) Positive electrode

15. What is the function of the fluid in a wet cell?

(A) Conduct electric current
(B) Keep the cell safe to use
(C) Keep the electrodes moist
(D) Maintain a steady temperature in the cell

16. Where would you find a wet cell

(A) All terrain vehicle
(B) Fire detector
(C) TV remote
(D) Toy car

17. A voltmeter is used:

(A) In parallel with the circuit
(B) To measure current
(C) To measure coulombs
(D) In series with the circuit

18. What does a voltmeter measure?

(A) The voltage difference between two points in an electric circuit.
(B) The flow of volts in a circuit
(C) The resistance to voltage in a complete circuit
(D) The flow of electric current in a complete circuit

**PART B: WRITTEN RESPONSE**

1. Distinguish between electric potential energy and electric potential

_____

_____

_____

_____

2. A) What is a cell?

_____

_____

B) What are two groups of cells?

_____

_____

C) How is an electrode different from an electrolyte?

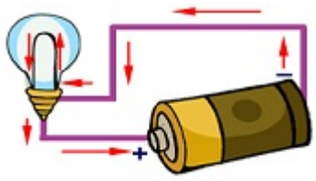
_____

_____

_____

_____

3. (A) What is the function of the battery in an electric circuit?



_____
_____
_____

(B) From which terminal of a battery are electrons pushed?

_____
_____

4. Identify the voltage source shown in each picture.

| | | |
|---|---|---|
|   |  |  |
| _____ | _____ | _____ |

5. Match each wet-cell component, as numbered above, with the names of the wet-cell and circuit components below.

Negative electrode :_____

Positive electrode: _____

Electrolyte: _____

load: _____