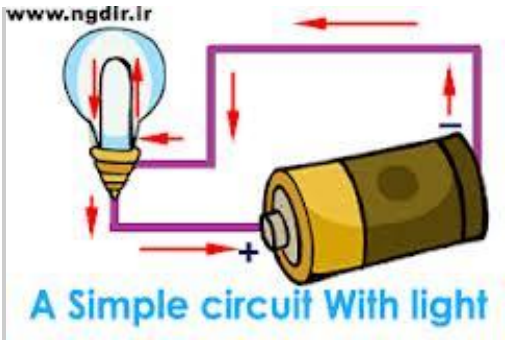
SNC1D
UNIT 3: CHARACTERISTICS OF ELECTRICITY
CHAPTER 11: ELECTRIC CIRCUITS

11.2: ELECTRIC CIRCUITS – Analogies & Characteristics

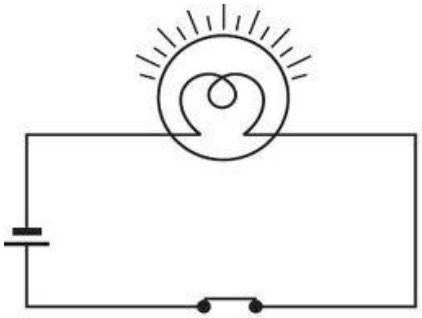
ELECTRICAL CIRCUITS **Page 447**

In order to light a bulb, a _____, _____ wires, and the bulb must be connected to form a _____ loop as shown in the diagrams below

Pictorial Diagram



Schematic Diagram



Copy the function of each of the following circuit components from your textbook

1. **Dry cell –**

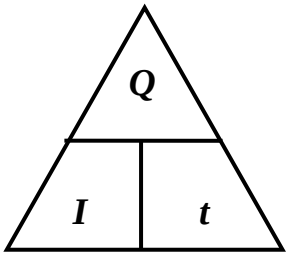
2. **Conducting wire –**

3. **Bulb –**

4. **Switch –**

ELECTRICAL CURRENT

Pages 448 – 450



An electrical current is made up of negatively charged particles called _____ flowing around an electric circuit. Current is defined as the rate of movement of electric _____.

$$I = \frac{Q}{t}$$

where:

I = **current;** measured in **_____ (A)**

Q = **total charge**; measured in **_____ (C)**

t = **_____**; measured in **_____ (s)**

$1\ C$ = _____ electrons

EXERCISE:

1. A) If 15 coulombs of electric charge passes a point in a circuit in 5.0 s, calculate the amount of current in the circuit.

   B) The current in part A is equivalent to _____ electrons.

2. A) How are a closed circuit and an open circuit similar?

   B) How are a closed circuit and an open circuit different?

3. What is the practical unit of electric charge? Why is this unit used?

4. When the switch for an appliance is closed, the appliance comes on instantaneously. What travels at the speed of light in an electric circuit? [See Figures 11.11 and 11.12]

5. When a tree is struck by lightning, a charge flows between the cloud, the air, the tree, and the ground. Is this an electric circuit? Explain your answer.

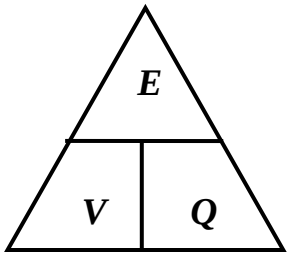
ELECTRICAL RESISTANCE **Pages 451 – 452**

The atoms and molecules of all types of material resist the _____ of _____ to some extent. This ability of materials in conductors to resist is called ***electrical resistance***. Even the best known conductors such as silver and copper have some electrical resistance. In other words, there are no known perfect conductors. In many circuits, a _____ is used to decrease the electric current through a component by a specific amount. The resistance to electric current varies from _____. Metals have a _____ resistance than _____.

The symbol for electrical resistance is **R** and the **unit** in which it is measured is called **ohm** and its symbol is **Ω.**

ELECTRICAL POTENTIAL DIFFERENCE or VOLTAGE **Pages 452 – 453**

Electrical potential difference, also called _____, is the difference in electrical potential energy per unit of charge between two points in a circuit.



$V = \frac{E}{Q}$ where: $\boldsymbol{V}$ = **Potential Difference**; measured in **_____ (V)**
$\boldsymbol{E}$ = **Electrical** _____ ; measured in **Joules (J)**
$\boldsymbol{Q}$ = **total** _____; measured in **Coulombs (C)**

Question:

Describe the meaning of a 1.5 V battery. [see page 453]

_____

_____

Sources of Potential Difference

Electrical Potential Difference (Voltage) results from the separation of positive and negative charges and is applicable to both static and _____ electricity. The following are some ways of producing a Potential Difference:

A cell	Electric Generator	Lightning	Wimshurst Machine	Van de Graaff Generator
 Typically generates a small voltage	 Generates thousands of volts	 Generates millions of volts	 Generates millions of volts	 Can generate millions of volts

Electrons leaving a 120 volts wall outlet have about 80 times as much energy as those leaving a 1.5 volt dry cell.

Question:

A battery converts 72 J of chemical energy into electrical energy. This places 12 C of negative charges at the negative terminal. What is the potential difference between the negative and positive terminals of the battery?

***CHECK YOUR UNDERSTANDING*:**

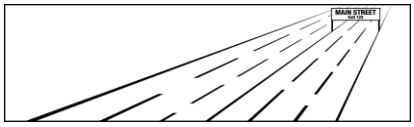
Use the table to compare the following electrical components to those found on a racing car circuit and a water circuit.

Electrical Circuit	Racing Car Circuit	Water Circuit
Current (Electrons moving along a conductor)		
Ampere (amount of charge passing a given point in one second)		
Conductor (path along which current flows)		
Potential Difference or Voltage (energy per charge used to measure the "push" of electrons around the circuit)		
Dry Cell, Battery, etc (sources of electrical energy)		
Resistance (opposition to the flow of current)		

Electricity and the Highway

We can learn something new by comparing it to something familiar. This is called making an analogy. We use analogies to help us understand complex ideas. The diagrams and explanations below draw on an understanding of highway traffic to explain various aspects of electricity.

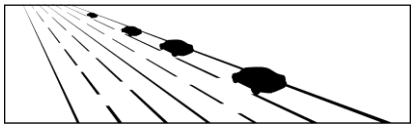
Conductor



***Definition**:* Material that allows an electric charge to move from one place to another.

***Analogy**:* Highway.

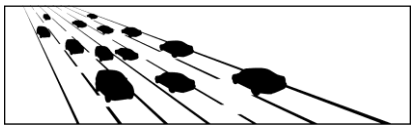
Current



***Definition**:* Electrons moving along a conductor.

***Analogy**:* Cars moving along a highway.

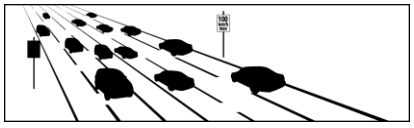
Ampere (A)



***Definition**:* Basic unit used to measure the strength of an electric current.

***Analogy**:* Unit of measure for traffic flow past a fixed point.

Coulomb (C)



***Definition**:* Unit used to measure the velocity at which one amp of current is traveling.

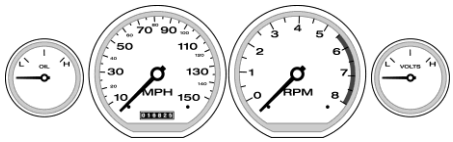
***Analogy**:* Velocity at which cars are travelling.

Potential Difference

***Definition**:* The difference in potential energy per coulomb of charge at two points in a circuit.

***Analogy**:* Gasoline provides energy.

Volt (V)



***Definition**:* Unit used to measure the "push" of an electric current (potential difference).

***Analogy**:* Energy needed to move cars.

Joule (J)

***Definition**:* Unit used to measure energy.

***Analogy**:* The amount of energy a vehicle has, or the amount of work it can do. A transport truck is using a lot more energy—and doing a lot more work—than a small car travelling at the same speed.

11.2 Review

1. Fill in the blanks.

A water tap is similar to an electrical switch because a tap controls the flow of _____while a switch controls the flow of _____.

A water tap is different than an electrical switch because when the switch is _____, electrons do not flow out of a circuit, whereas when a tap is _____, water does flow out of it.

2. **a.** Which battery cell produces the same amount of energy?

b. Which battery cell contains more electrolyte material?

c. How does the amount of electrolyte affect the battery life?

D
1.5 V

AA
1.5 V

3. The potential difference between the terminals of a cell is:

A. fixed, because it does not require energy to move electrons from the negative terminal to the positive terminal.

B. fixed, because the potential difference from the terminals depends only on the materials used to make the cell.

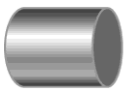
C. not fixed, because it depends on the components that are connected in the circuit.

D. not fixed, because the electric potential charge changes at the negative terminal, but remains constant at the positive terminal.

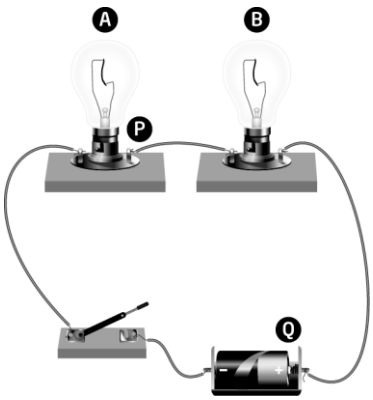
4. **a.** The units of an ampere are _____.

b. The units of a volt are _____.

5. Explain how the current through these two different conductors can be different, even though the electrons in each conductor are moving at the same speed.



6. **a.** Bulbs A and B are identical. When the switch is closed, how will the bulbs compare?

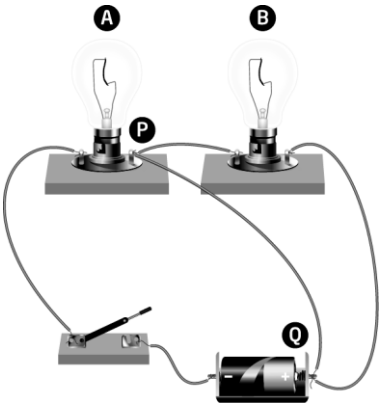


A. A will be brighter than B.

B. A will be dimmer than B.

C. A will be the same as B.

b. A wire from P is now connected to Q. When the switch is closed, how will the bulbs compare?



A. A will be brighter than B.

B. A will be dimmer than B.

C. A will be the same as B.

7. Circle examples of electric loads.

radio table television microwave paper light bulb battery switch

8. **a.** What makes a good conductor? Use a diagram to explain.

b. The potential difference between two points in a good conductor can be neglected because _____