
ATOM AND ITS FORCES

What is electricity? Electricity is defined as "the flow of electrons through simple materials and devices" or "that force which moves electrons." Scientists think electricity is produced by very tiny particles called electrons and protons. These particles are too small to be seen, but exist as subatomic particles in the atom. To understand how they exist, you must first understand the structure of the atom.

- EO 1.1 DESCRIBE the following terms:**
- a. Electrostatic force**
 - b. Electrostatic field**
 - c. Potential difference**
 - d. Electromotive force (EMF)**
 - e. Ion charge**
-

The Atom

Elements are the basic building blocks of all matter. The atom is the smallest particle to which an element can be reduced while still keeping the properties of that element. An atom consists of a positively charged nucleus surrounded by negatively charged electrons, so that the atom as a whole is electrically neutral. The nucleus is composed of two kinds of subatomic particles, protons and neutrons, as shown in Figure 1. The proton carries a single unit positive charge equal in magnitude to the electron charge. The neutron is slightly heavier than the proton and is electrically neutral, as the name implies. These two particles exist in various combinations, depending upon the element involved. The electron is the fundamental negative charge (-) of electricity and revolves around the nucleus, or center, of the atom in concentric orbits, or shells.

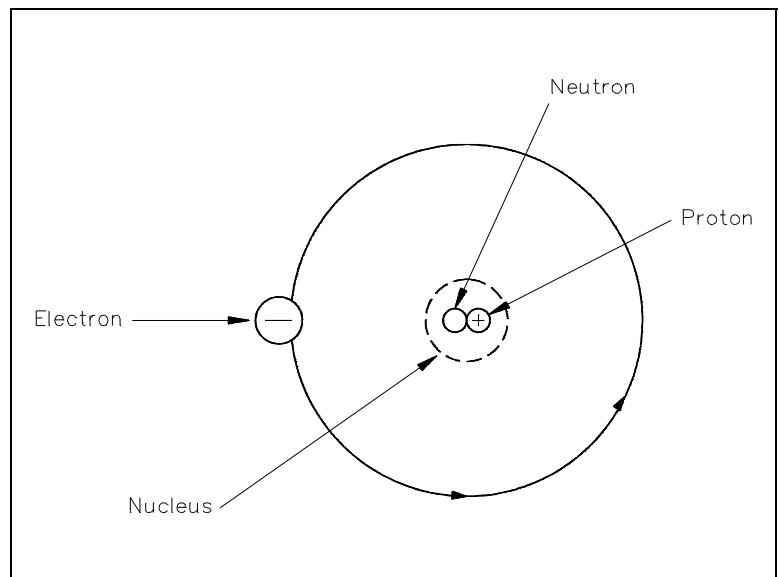


Figure 1 The Atom

The proton is the fundamental positive charge (+) of electricity and is located in the nucleus. The number of protons in the nucleus of any atom specifies the atomic number of that atom or of that element. For example, the carbon atom contains six protons in its nucleus; therefore, the atomic number for carbon is six, as shown in Figure 2.

In its natural state, an atom of any element contains an equal number of electrons and protons. The negative charge (-) of each electron is equal in magnitude to the positive charge (+) of each proton; therefore, the two opposite charges cancel, and the atom is said to be electrically neutral, or in balance.

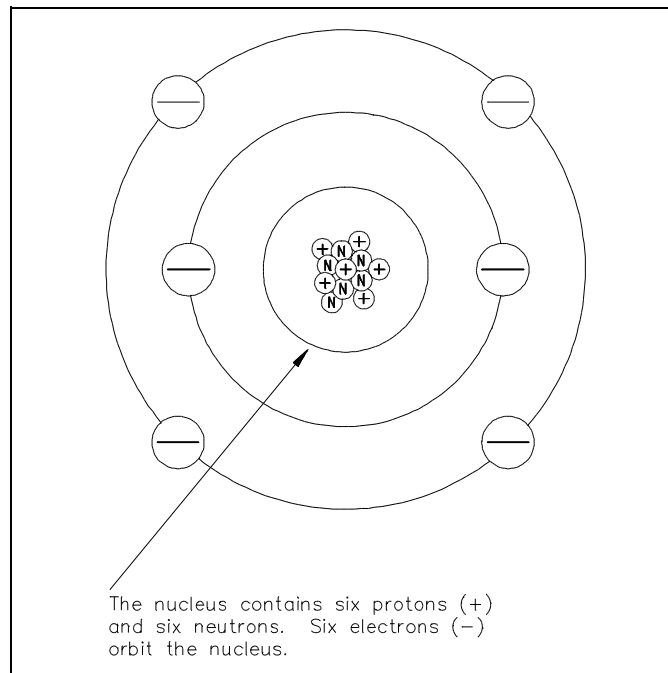


Figure 2 The Carbon Atom

One of the mysteries of the atom is that the electron and the nucleus attract each other. This attraction is called *electrostatic force*, the force that holds the electron in orbit. This force may be illustrated with lines as shown in Figure 3.

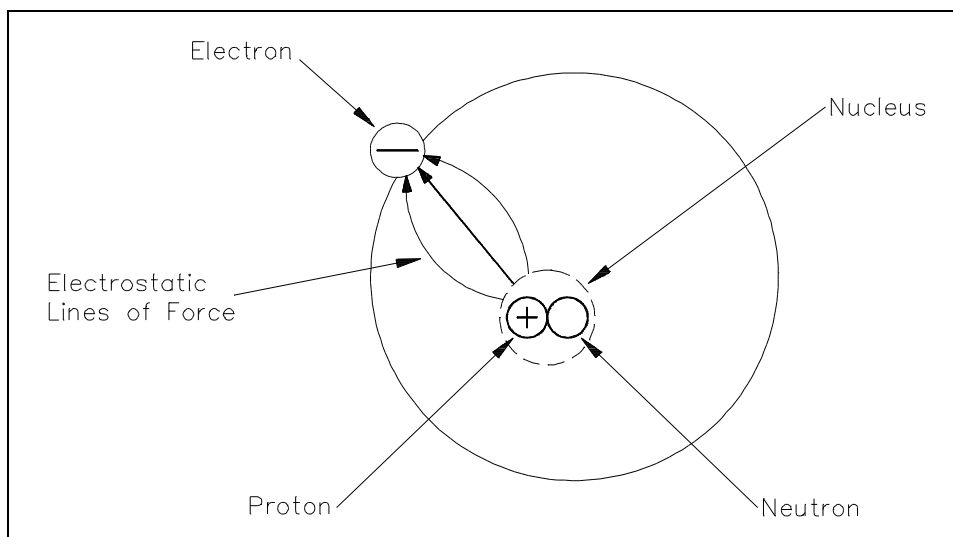


Figure 3 Electrostatic Force

Without this electrostatic force, the electron, which is traveling at high speed, could not stay in its orbit. Bodies that attract each other in this way are called charged bodies. As mentioned previously, the electron has a negative charge, and the nucleus (due to the proton) has a positive charge.

The First Law of Electrostatics

The negative charge of the electron is equal, but opposite to, the positive charge of the proton. These charges are referred to as electrostatic charges. In nature, unlike charges (like electrons and protons) attract each other, and like charges repel each other. These facts are known as the *First Law of Electrostatics* and are sometimes referred to as the law of electrical charges. This law should be remembered because it is one of the vital concepts in electricity.

Some atoms can lose electrons and others can gain electrons; thus, it is possible to transfer electrons from one object to another. When this occurs, the equal distribution of negative and positive charges no longer exists. One object will contain an excess of electrons and become negatively charged, and the other will become deficient in electrons and become positively charged. These objects, which can contain billions of atoms, will then follow the same law of electrostatics as the electron and proton example shown above. The electrons that can move around within an object are said to be free electrons and will be discussed in more detail in a later section. The greater the number of these free electrons an object contains, the greater its negative electric charge. Thus, the electric charge can be used as a measure of electrons.

Electrostatic Field

A special force is acting between the charged objects discussed above. Forces of this type are the result of an *electrostatic field* that exists around each charged particle or object. This electrostatic field, and the force it creates, can be illustrated with lines called "lines of force" as shown in Figure 4.

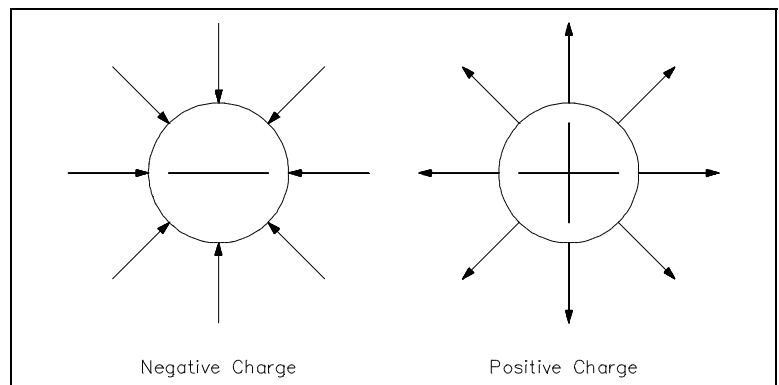


Figure 4 Electrostatic Field

Charged objects repel or attract each other because of the way these fields act together. This force is present with every charged object. When two objects of opposite charge are brought near one another, the electrostatic field is concentrated in the area between them, as shown in Figure 5. The direction of the small arrows shows the direction of the force as it would act upon an electron if it were released into the electric field.

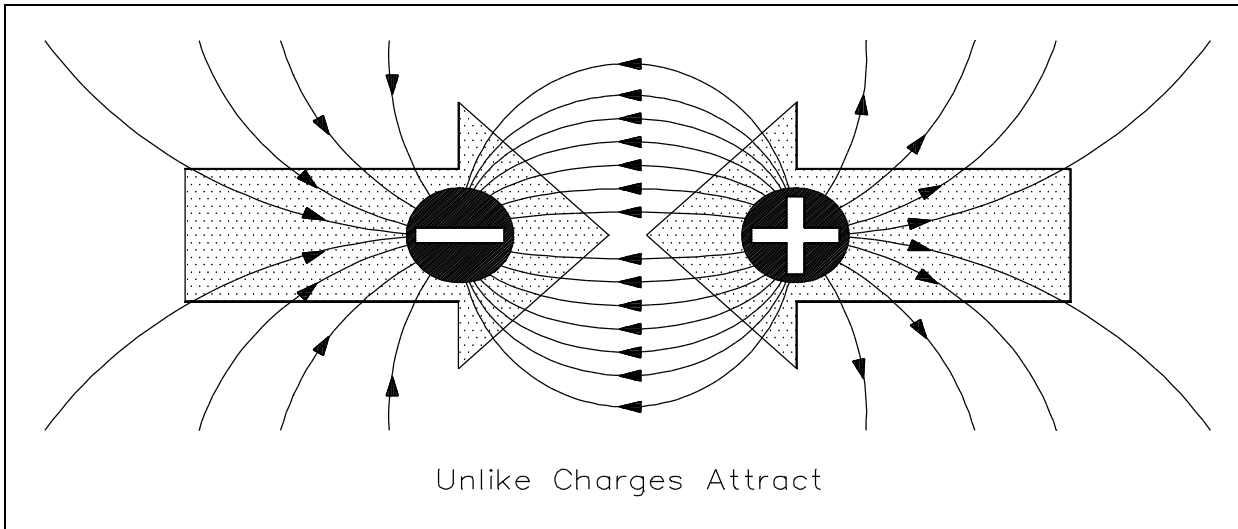


Figure 5 Electrostatic Field Between Two Charges of Opposite Polarity

When two objects of like charge are brought near one another, the lines of force repel each other, as shown in Figure 6.

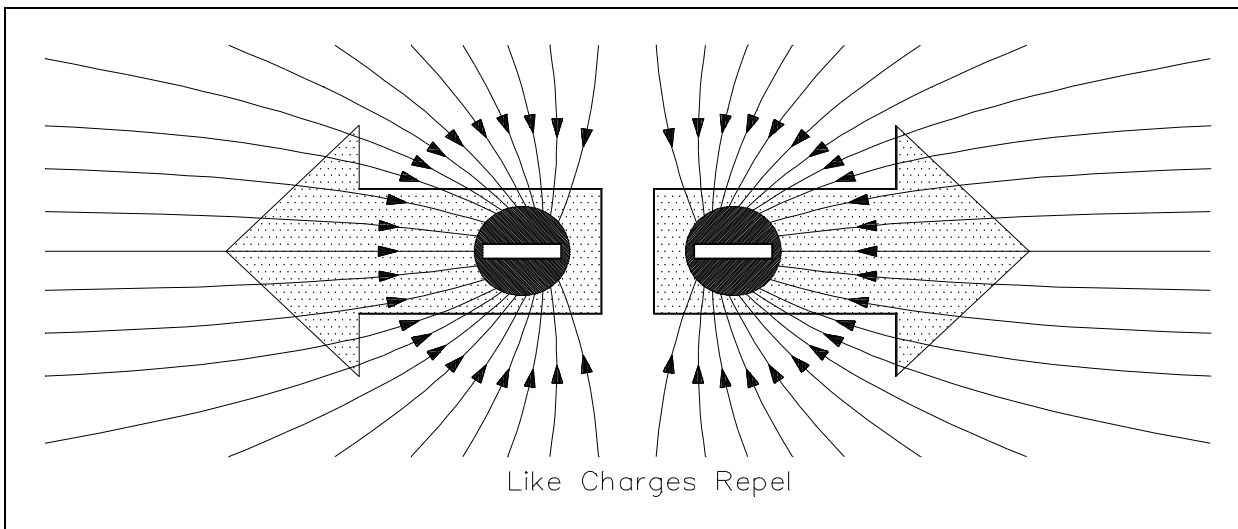


Figure 6 Electrostatic Field Between Two Charges of Like Polarity

The strength of the attraction or of the repulsion force depends upon two factors: (1) the amount of charge on each object, and (2) the distance between the objects. The greater the charge on the objects, the greater the electrostatic field. The greater the distance between the objects, the weaker the electrostatic field between them, and vice versa. This leads us to the law of electrostatic attraction, commonly referred to as Coulomb's Law of electrostatic charges, which states that the force of electrostatic attraction, or repulsion, is directly proportional to the product of the two charges and inversely proportional to the square of the distance between them as shown in Equation 1-1.

$$F = K \frac{q_1 - q_2}{d^2} \quad (1-1)$$

where

- F = force of electrostatic attraction or repulsion (Newtons)
- K = constant of proportionality (Coulomb²/N-m²)
- q₁ = charge of first particle (Coulombs)
- q₂ = charge of second particle (Coulombs)
- d = distance between two particles (Meters)

If q₁ and q₂ are both either positively or negatively charged, the force is repulsive. If q₁ and q₂ are opposite polarity or charge, the force is attractive.

Potential Difference

Potential difference is the term used to describe how large the electrostatic force is between two charged objects. If a charged body is placed between two objects with a potential difference, the charged body will try to move in one direction, depending upon the polarity of the object. If an electron is placed between a negatively-charged body and a positively-charged body, the action due to the potential difference is to push the electron toward the positively-charged object. The electron, being negatively charged, will be repelled from the negatively-charged object and attracted by the positively-charged object, as shown in Figure 7.

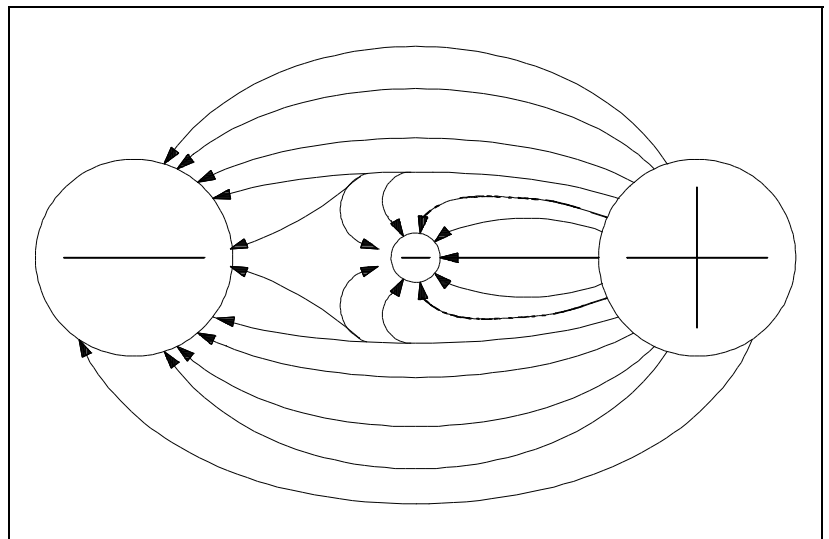


Figure 7 Potential Difference Between Two Charged Objects

Due to the force of its electrostatic field, these electrical charges have the ability to do work by moving another charged particle by attraction and/or repulsion. This ability to do work is called "potential"; therefore, if one charge is different from another, there is a potential difference between them. The sum of the potential differences of all charged particles in the electrostatic field is referred to as *electromotive force* (EMF).

The basic unit of measure of potential difference is the "volt." The symbol for potential difference is "V," indicating the ability to do the work of forcing electrons to move. Because the volt unit is used, potential difference is also called "voltage." The unit volt will be covered in greater detail in the next chapter.

Free Electrons

Electrons are in rapid motion around the nucleus. While the electrostatic force is trying to pull the nucleus and the electron together, the electron is in motion and trying to pull away. These two effects balance, keeping the electron in orbit. The electrons in an atom exist in different energy levels. The energy level of an electron is proportional to its distance from the nucleus. Higher energy level electrons exist in orbits, or shells, that are farther away from the nucleus. These shells nest inside one another and surround the nucleus. The nucleus is the center of all the shells. The shells are lettered beginning with the shell nearest the nucleus: K, L, M, N, O, P, and Q. Each shell has a maximum number of electrons it can hold. For example, the K shell will hold a maximum of two electrons and the L shell will hold a maximum of eight electrons. As shown in Figure 8, each shell has a specific number of electrons that it will hold for a particular atom.

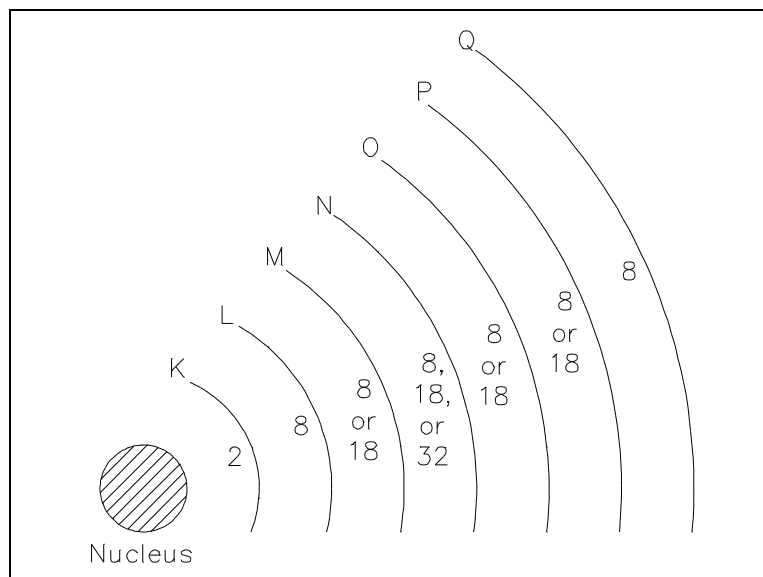


Figure 8 Energy Shells and Electron Quota

There are two simple rules concerning electron shells that make it possible to predict the electron distribution of any element:

1. The maximum number of electrons that can fit in the outermost shell of any atom is eight.
2. The maximum number of electrons that can fit in the next-to-outermost shell of any atom is 18.

An important point to remember is that when the outer shell of an atom contains eight electrons, the atom becomes very stable, or very resistant to changes in its structure. This also means that atoms with one or two electrons in their outer shell can lose electrons much more easily than atoms with full outer shells. The electrons in the outermost shell are called *valence electrons*. When external energy, such as heat, light, or electrical energy, is applied to certain materials, the electrons gain energy, become excited, and may move to a higher energy level. If enough energy is applied to the atom, some of the valence electrons will leave the atom. These electrons are called *free electrons*. It is the movement of free electrons that provides electric current in a metal conductor. An atom that has lost or gained one or more electrons is said to be *ionized* or to have an *ion change*. If the atom loses one or more electrons, it becomes positively charged and is referred to as a *positive ion*. If an atom gains one or more electrons, it becomes negatively charged and is referred to as a *negative ion*.

Summary

The important information contained in this chapter is summarized below.

Forces Around Atoms Summary

- Electrostatic Force - force that holds an electron in orbit around a nucleus
- Electrostatic Field - force acting between charged objects that causes them to repel or attract
- Potential Difference - measures how large the electrostatic force is between two charged objects. According to Coulomb's Law, charged bodies attract or repel each other with a force that is directly proportional to the product of their charges and is inversely proportional to the square of the distance between them.
- Electromotive Force (EMF) - sum of the potential differences of all charged particles in an electrostatic field
- Ion Charge - dependent on the loss or gain of free electrons (if an atom gains an electron - negative ion charge; if an atom loses an electron - positive ion charge)

ELECTRICAL TERMINOLOGY

Knowledge of key electrical terminology is necessary to fully understand principles in electrical science.

- EO 1.2** **DEFINE the following terms:**
- a. Conductor**
 - b. Insulator**
 - c. Resistor**
 - d. Electron current flow**
 - e. Conventional current flow**
 - f. Direct current (DC)**
 - g. Alternating current (AC)**
 - h. Ideal source**
 - i. Real source**
-

Conductors

Conductors are materials with electrons that are loosely bound to their atoms, or materials that permit free motion of a large number of electrons. Atoms with only one valence electron, such as copper, silver, and gold, are examples of good conductors. Most metals are good conductors.

Insulators

Insulators, or nonconductors, are materials with electrons that are tightly bound to their atoms and require large amounts of energy to free them from the influence of the nucleus. The atoms of good insulators have their valence shells filled with eight electrons, which means they are more than half filled. Any energy applied to such an atom will be distributed among a relatively large number of electrons. Examples of insulators are rubber, plastics, glass, and dry wood.

Resistors

Resistors are made of materials that conduct electricity, but offer opposition to current flow. These types of materials are also called *semiconductors* because they are neither good conductors nor good insulators. Semiconductors have more than one or two electrons in their valence shells, but less than seven or eight. Examples of semiconductors are carbon, silicon, germanium, tin, and lead. Each has four valence electrons.

Voltage

The basic unit of measure for potential difference is the *volt* (symbol V), and, because the volt unit is used, potential difference is called *voltage*. An object's electrical charge is determined by the number of electrons that the object has gained or lost. Because such a large number of electrons move, a unit called the "coulomb" is used to indicate the charge. One coulomb is equal to 6.28×10^{18} (billion, billion) electrons. For example, if an object gains one coulomb of negative charge, it has gained 6,280,000,000,000,000,000 extra electrons. A volt is defined as a difference of potential causing one coulomb of current to do one joule of work. A volt is also defined as that amount of force required to force one ampere of current through one ohm of resistance. The latter is the definition with which we will be most concerned in this module.

Current

The density of the atoms in copper wire is such that the valence orbits of the individual atoms overlap, causing the electrons to move easily from one atom to the next. Free electrons can drift from one orbit to another in a random direction. When a potential difference is applied, the direction of their movement is controlled. The strength of the potential difference applied at each end of the wire determines how many electrons change from a random motion to a more directional path through the wire. The movement or flow of these electrons is called *electron current flow* or just *current*.

To produce current, the electrons must be moved by a potential difference. The symbol for current is (I). The basic measurement for current is the ampere (A). One ampere of current is defined as the movement of one coulomb of charge past any given point of a conductor during one second of time.

If a copper wire is placed between two charged objects that have a potential difference, all of the negatively-charged free electrons will feel a force pushing them from the negative charge to the positive charge. This force opposite to the conventional direction of the electrostatic lines of force is shown in Figure 9.

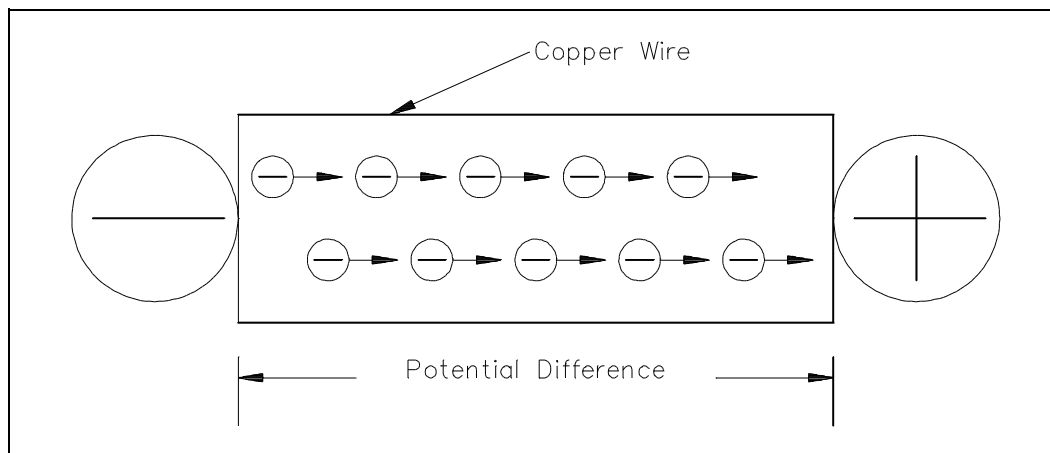


Figure 9 Electron Flow Through a Copper Wire with a Potential Difference

The direction of electron flow, shown in Figure 10, is from the negative (-) side of the battery, through the wire, and back to the positive (+) side of the battery. The direction of electron flow is from a point of negative potential to a point of positive potential. The solid arrow shown in Figure 10 indicates the direction of electron flow. As electrons vacate their atoms during electron current flow, positively charged atoms (holes) result. The flow of electrons in one direction causes a flow of positive charges. The direction of the positive charges is in the opposite direction of the electron flow. This flow of positive charges is known as *conventional current* and is shown in Figure 10 as a dashed arrow. All of the electrical effects of electron flow from negative to positive, or from a higher potential to a lower potential, are the same as those that would be created by a flow of positive charges in the opposite direction. Therefore, it is important to realize that both conventions are in use and that they are essentially equivalent; that is, all effects predicted are the same. In this text, we will be using electron flow in our discussions.

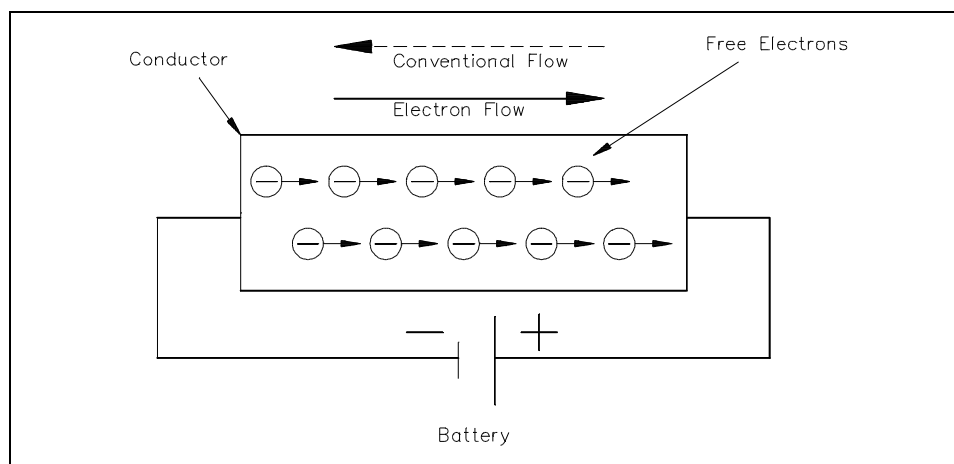


Figure 10 Potential Difference Across a Conductor Causes a Current to Flow

Generally, electric current flow can be classified as one of two general types: *Direct Current* (DC) or *Alternating Current* (AC). A direct current flows continuously in the same direction. An alternating current periodically reverses direction. We will be studying DC and AC current in more detail later in this text. An example of DC current is that current obtained from a battery. An example of AC current is common household current.

Real and Ideal Sources

An *ideal source* is a theoretical concept of an electric current or voltage supply (such as a battery) that has no losses and is a perfect voltage or current supply. Ideal sources are used for analytical purposes only since they cannot occur in nature.

A *real source* is a real life current or voltage supply that has some losses associated with it.



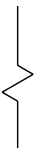

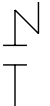

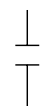









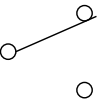
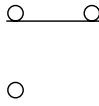
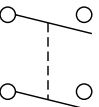
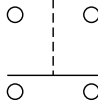
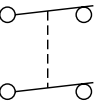
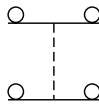
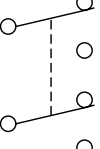
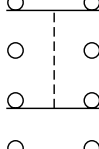

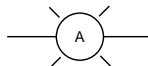
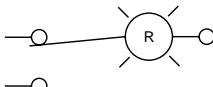

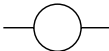

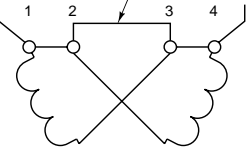
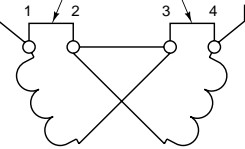


Summary


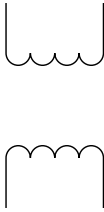

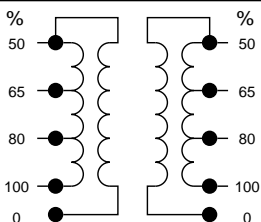
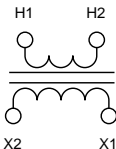
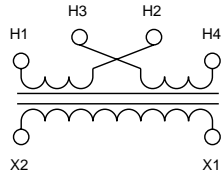
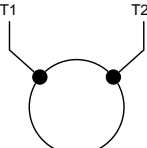
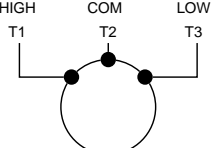
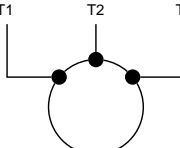
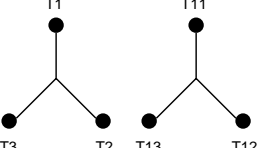
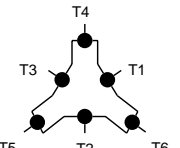
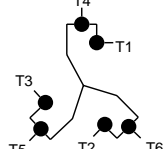
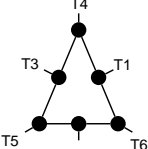
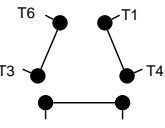
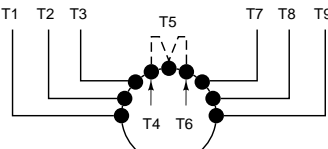







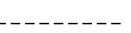



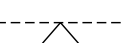
The important information contained in this chapter is summarized below.

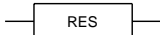

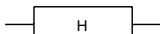

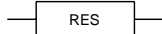


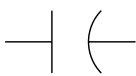

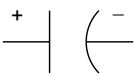
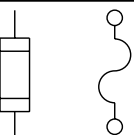
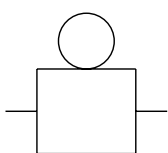
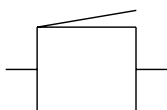
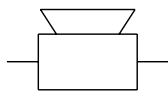

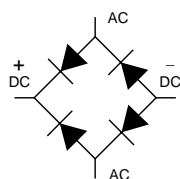

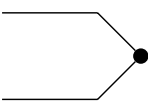
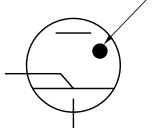
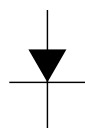
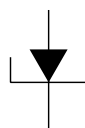
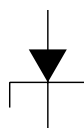
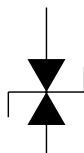
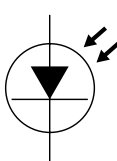
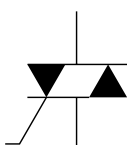
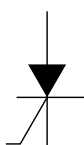
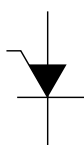
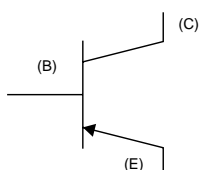
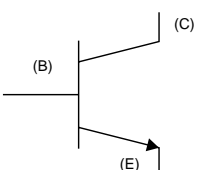
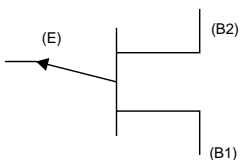
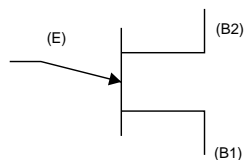
Terminology Summary

- Conductor - material with electrons loosely bound to its atoms or that permits free motion of large number of electrons
- Insulator - material with electrons tightly bound to its atoms; requires large amounts of energy to free electrons from its nuclei
- Resistor - material that conducts electricity, but opposes current flow
- Electron Current Flow - current flow from negative to positive potentials
- Conventional Current Flow - current flow from positive to negative potentials
- Direct Current - current flow continuously in the same direction
- Alternating Current - current flow periodically reverses direction
- Ideal Source - theoretical current or voltage supply with no losses
- Real Source - actual current or voltage supply with losses

INDUSTRIAL ELECTRICAL SYMBOLS . . .																																		
DISCONNECT	CIRCUIT INTERRUPTER	CIRCUIT BREAKER WITH THERMAL OL	CIRCUIT BREAKER WITH MAGNETIC OL	CIRCUIT BREAKER W/ THERMAL AND MAGNETIC OL																														
LIMIT SWITCHES		FOOT SWITCHES	PRESSURE AND VACUUM SWITCHES	LIQUID LEVEL SWITCH	TEMPERATURE-ACTUATED SWITCH	FLOW SWITCH (AIR, WATER, ETC.)																												
NORMALLY OPEN	NORMALLY CLOSED																																	
SPEED (PLUGGING)		ANTI-PLUG	SYMBOLS FOR STATIC SWITCHING CONTROL DEVICES																															
			STATIC SWITCHING CONTROL IS A METHOD OF SWITCHING ELECTRICAL CIRCUITS WITHOUT USE OF CONTACTS, PRIMARILY BY SOLID-STATE DEVICES. USE SYMBOLS SHOWN IN TABLE AND ENCLOSE THEM IN A DIAMOND.																															
			INPUT COIL	OUTPUT NO	LIMIT SWITCH NO	LIMIT SWITCH NC																												
SELECTOR																																		
TWO-POSITION		THREE-POSITION		TWO-POSITION SELECTOR PUSHBUTTON																														
 X-CONTACT CLOSED		 X-CONTACT CLOSED		<table><tr><th rowspan="3">CONTACTS</th><th colspan="4">SELECTOR POSITION</th></tr><tr><th colspan="2">A</th><th colspan="2">B</th></tr><tr><th colspan="2">BUTTON</th><th colspan="2">BUTTON</th></tr><tr><th></th><th>FREE</th><th>DEPRESSED</th><th>FREE</th><th>DEPRESSED</th></tr><tr><td>1-2</td><td>X</td><td></td><td></td><td></td></tr><tr><td>3-4</td><td></td><td>X</td><td>X</td><td>X</td></tr></table> X - CONTACT CLOSED			CONTACTS	SELECTOR POSITION				A		B		BUTTON		BUTTON			FREE	DEPRESSED	FREE	DEPRESSED	1-2	X				3-4		X	X	X
CONTACTS	SELECTOR POSITION																																	
	A		B																															
	BUTTON		BUTTON																															
	FREE	DEPRESSED	FREE	DEPRESSED																														
1-2	X																																	
3-4		X	X	X																														
PUSHBUTTONS																																		
MOMENTARY CONTACT				MAINTAINED CONTACT		ILLUMINATED																												
SINGLE CIRCUIT	DOUBLE CIRCUIT	MUSHROOM HEAD	WOBBLE STICK	TWO SINGLE CIRCUIT	ONE DOUBLE CIRCUIT																													
 NO	 NO AND NC																																	
 NC																																		

... INDUSTRIAL ELECTRICAL SYMBOLS ...									
CONTACTS								OVERLOAD RELAYS	
INSTANT OPERATING				TIMED CONTACTS - CONTACT ACTION RETARDED AFTER COIL IS:				THERMAL	MAGNETIC
WITH BLOWOUT		WITHOUT BLOWOUT		ENERGIZED		DE-ENERGIZED		 	 
NO	NC	NO	NC	NOTC	NCTO	NOTO	NCTC		
									
SUPPLEMENTARY CONTACT SYMBOLS									
SPST NO		SPST NC		SPDT		TERMS			
SINGLE BREAK	DOUBLE BREAK	SINGLE BREAK	DOUBLE BREAK	SINGLE BREAK	DOUBLE BREAK	<div>SPST SINGLE-POLE, SINGLE-THROW</div> <div>SPDT SINGLE-POLE, DOUBLE-THROW</div> <div>DPST DOUBLE-POLE, SINGLE-THROW</div> <div>DPDT DOUBLE-POLE, DOUBLE-THROW</div> <div>NO NORMALLY OPEN</div> <div>NC NORMALLY CLOSED</div>			
									
DPST, 2NO		DPST, 2NC		DPDT					
SINGLE BREAK	DOUBLE BREAK	SINGLE BREAK	DOUBLE BREAK	SINGLE BREAK	DOUBLE BREAK				
									
METER (INSTRUMENT)					PILOT LIGHTS				
INDICATE TYPE BY LETTER	TO INDICATE FUNCTION OF METER OR INSTRUMENT, PLACE SPECIFIED LETTER OR LETTERS WITHIN SYMBOL.				INDICATE COLOR BY LETTER				
	NON PUSH-TO-TEST		PUSH-TO-TEST						
	AM or A	AMMETER	VA	VOLTMETER					
	AH	AMPERE HOUR	VAR	VARMETER					
	μA	MICROAMMETER	VARH	VARHOUR METER					
	mA	MILLAMMETER	W	WATTMETER					
	PF	POWER FACTOR	WH	WATTHOUR METER					
	V	VOLTMETER							
INDUCTORS		COILS							
IRON CORE				DUAL-VOLTAGE MAGNET COILS				BLOWOUT COIL	
				HIGH-VOLTAGE		LOW-VOLTAGE			
				LINK		LINKS			
									
AIR CORE									
									

... INDUSTRIAL ELECTRICAL SYMBOLS ...							
TRANSFORMERS							
AUTO	AIR CORE	CURRENT	CONTROL TRANSFORMER		AUTOTRANSFORMER FOR REDUCED-VOLTAGE STARTING		
			SINGLE-VOLTAGE	DUAL-VOLTAGE			
							
AC MOTORS							
SINGLE-PHASE	SEPARATE PHASE, TWO-SPEED	THREE-PHASE	SEPARATE WINDING, TWO-SPEED	CONSTANT-TORQUE, TWO-SPEED			
							
VARIABLE-TORQUE, TWO-SPEED	CONSTANT-HORSEPOWER, TWO-SPEED	WYE/DELTA, REDUCED-VOLTAGE	WYE-CONNECTED, PART WINDING, REDUCED-VOLTAGE				
							
DC MOTORS				WIRING			CONNECTIONS
ARMATURE	SHUNT FIELD	SERIES FIELD	COMM OR COMPENS FIELD	NOT CONNECTED	POWER	WIRING TERMINAL	MECHANICAL
							
							
				CONNECTED	CONTROL	GROUND	MECHANICAL INTERLOCK
CONTROL AND POWER CONNECTIONS-600 V OR LESS ACROSS-THE-LINE STARTERS							
				1 ϕ	2 ϕ , 4-WIRE	3 ϕ	
LINE MARKINGS				L1, L2	L1, L3 PHASE 1 L2, L4 PHASE 2	L1, L2, L3	
GROUND WHEN USED				L1 IS ALWAYS UNGROUND	—	L2	
MOTOR RUNNING OVERCURRENT UNITS IN				1 ELEMENT — 2 ELEMENT — 3 ELEMENT —	— L1, L4 —	— — L1, L2, L3	
CONTROL CIRCUIT CONNECTED TO				L1, L2	L1, L3	L1, L2	
FOR REVERSING INTERCHANGE LINES				—	L1, L3	L1, L3	

... INDUSTRIAL ELECTRICAL SYMBOLS					
RESISTORS			CAPACITORS		
FIXED	ADJUSTABLE BY FIXED TAPS	RHEOSTAT, POT, OR ADJUSTABLE TAP	FIXED	ADJUSTABLE	POLARIZED
<div></div> <div></div> <div><div></div><div>HEATING ELEMENT</div></div>	<div></div> <div><div></div></div>	<div></div> <div><div></div></div>	<div></div>	<div></div>	<div></div>
FUSE	BELL	BUZZER	HORN, SIREN, ETC.	HALF-WAVE RECTIFIER	FULL-WAVE RECTIFIER
<div>POWER OR CONTROL</div> <div></div>	<div></div>	<div></div>	<div></div>	<div></div>	<div></div>
BATTERY	THERMOCOUPLE	IGNITRON TUBE	SEMICONDUCTORS ...		
<div></div>	<div></div>	<div></div>	<div>DIODE</div> <div></div>	<div>TUNNEL DIODE</div> <div></div>	<div>UNIDIRECTIONAL BREAKDOWN (ZENER) DIODE</div> <div></div>
... SEMICONDUCTORS ...					
BIDIRECTIONAL BREAKDOWN DIODE	PHOTOSENSITIVE CELL	TRIAC (BIDIRECTIONAL TRIODE THYRISTOR)	SILICON CONTROLLED RECTIFIER	PROGRAMMABLE UNIT - JUNCTION TRANSISTOR (PUT)	
<div></div>	<div></div>	<div></div>	<div></div>	<div></div>	
... SEMICONDUCTORS					
TRANSISTOR			UNIJUNCTION TRANSISTOR		
PNP BASE	NPN BASE		P BASE	N BASE	
<div></div>	<div></div>		<div></div>	<div></div>	