no clickers & yes calculators.

Have out the 22 vocabulary and write the number completed over 11.

Get the ch. 22 study guide from the brown table and do the first 11.

May 30-11:29 AM

Section 22.1: Current and Circuits

In this section you will:

- **Describe** conditions that create current in an electric circuit.
- **Explain** Ohm's law.
- **Design** closed circuits.
- **Differentiate** between power and energy in an electric circuit.

Section 22.1-1

May 30-9:07 AM

Producing Electric Current

Flowing water at the top of a waterfall has both potential and kinetic energy.

However, the large amount of natural potential and kinetic energy available from resources such as Niagara Falls are of little use to people or manufacturers who are 100 km away, unless that energy can be transported efficiently.

Electric energy provides the means to transfer large quantities of energy over great distances with little loss.

This transfer is usually done at high potential differences through power lines.
Once this energy reaches the consumer, it can easily be converted into another form or combination of forms, including sound, light, thermal energy, and motion.
Because electric energy can so easily be changed into other forms, it has become indispensable in our daily lives.

May 30-9:11 AM

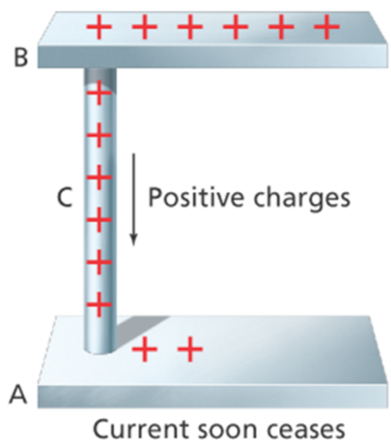
Producing Electric Current

When two conducting spheres touch, charges flow from the sphere at a higher potential to the one at a lower potential.
The flow continues until there is no potential difference between the two spheres.
A flow of charged particles is an **electric current**.

In the figure, two conductors, A and B, are connected by a wire conductor, C. Charges flow from the higher potential difference of B to A through C.

This flow of positive charge is called **conventional current**.

The flow stops when the potential difference between A, B, and C is zero.



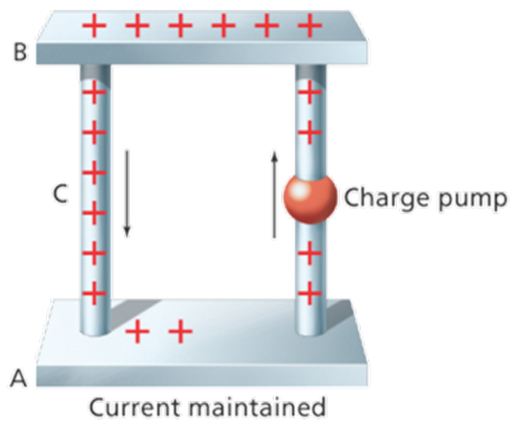
May 30-9:17 AM

Producing Electric Current

You could maintain the electric potential difference between B and A by pumping charged particles from A back to B, as illustrated in the figure.

Since the pump increases the electric potential energy of the charges, it requires an external energy source to run.

This energy could come from a variety of sources.



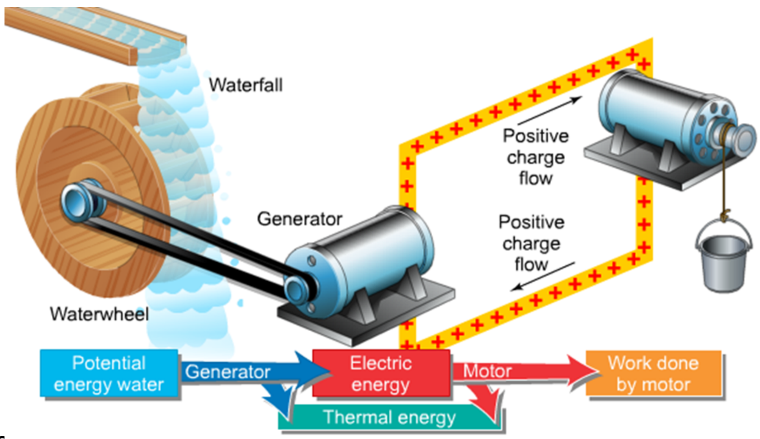
One familiar source, a voltaic or galvanic cell (a common dry cell), converts chemical energy to electric energy.
A **battery** is made up of several galvanic cells connected together.
A second source of electric energy— a photovoltaic cell, or solar cell—changes light energy into electric energy.

May 30-9:23 AM

Electric Circuits

The charges in the figure move around a closed loop, cycling from pump B,through C to A, and back to the pump.
Any closed loop or conducting path allowing electric charges to flow is called an **electric circuit**.

A circuit includes a charge pump, which increases the potential energy of the charges flowing from A to B, and a device that reduces the potential energy of the charges flowing from B to A.



The potential energy lost by the charges, qV, moving through the device is usually converted into some other form of energy. For example, electric energy is converted to kinetic energy by a motor, to light energy by a lamp, and to thermal energy by a heater. A charge pump creates the flow of charged particles that make up a current.

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Conservation of Charge

Charges cannot be created or destroyed, but they can be separated.
Thus, the total amount of charge—the number of negative electrons and positive ions—in the circuit does not change.
If one coulomb flows through the generator in 1 s, then one coulomb also will flow through the motor in 1 s. Thus, charge is a conserved quantity.

Energy is also conserved. The change in electric energy, ΔE, equals qV. Because q is conserved, the net change in potential energy of the charges going completely around the circuit must be zero.

The increase in potential difference produced by the generator equals the decrease in potential difference across the motor.

Rates of Charge Flow and Energy Transfer

Power, which is defined in watts, W, measures the rate at which energy is transferred.
If a generator transfers 1 J of kinetic energy to electric energy each second, it is transferring energy at the rate of 1 J/s, or 1 W.
The energy carried by an electric current depends on the charge transferred, q, and the potential difference across which it moves, V. Thus, $E = qV$.

The unit for the quantity of electric charge is the coulomb.
The rate of flow of electric charge, q/t, called electric current, is measured in coulombs per second. Electric current is represented by I, so $I = q/t$. A flow of 1 C/s is called an **ampere**, A.

May 30-9:31 AM

Rates of Charge Flow and Energy Transfer

The energy carried by an electric current is related to the voltage, $E = qV$.
Since current, $I = q/t$, is the rate of charge flow, the power, $P = E/t$, of an electric device can be determined by multiplying voltage and current.

$\mathcal{E} = P \cdot t$ (seconds)

To derive the familiar form of the equation for the power delivered to an electric device, you can use $P = E/t$ and substitute $E = qV$ and $q = It$

Power $P = IV$ (current, voltage)

Power is equal to the current times the potential difference.

Ex: 1

A 120 - V motor operates at 13 A. Determine the power and the energy used in one hour of operation.

$P = I \cdot V$

$13A \cdot 120V = 1{,}560\ W$

$1.56 \times 10^3\ W$

$\mathcal{E} = P \cdot t$

$1{,}560 \cdot 3600 = 5.62 \times 10^6\ J$

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Ex: 2

A 6.0 - V battery delivers a 0.50-A current to an electric motor connected across its terminals. What power us delivered to the motor? If the motor runs for 5.0 min, how much electric energy is delivered?

$P = IV$

$.5 \cdot 6 = 3\,W$

$E = 3 \cdot 5 \cdot 60 = 900\,J$

$9 \times 10^2\,J$

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① ch 22 S.G. 1-11

② Pg. 594

1-5 all

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