No clickers & yes calculators.

Get the 22.2 Superconductor notes (LAST NOTES!!) from the brown table.

Have out pg. 600 17 - 21 all

Jun 7-10:01 AM

22.2 Superconductors

A **superconductor** is a material with zero resistance.

There is no restriction of current in superconductors, so there is no potential difference, *V*, across them.

Because the power that is dissipated in a conductor is given by the product *IV*, a superconductor can conduct electricity without loss of energy.

Kelvin

At present, almost all superconductors must be kept at temperatures below 100 K. The practical uses of superconductors include MRI magnets and in synchrotrons, which use huge amounts of current and can be kept at temperatures close to 0 K.

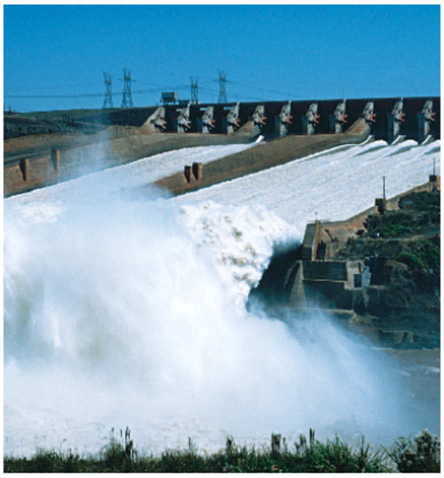
Jun 7-8:12 AM

Transmission of Electric Energy

Hydroelectric facilities are capable of producing a great deal of energy.
This hydroelectric energy often must be transmitted over long distances to reach homes and industries.
How can the transmission occur with as little loss to thermal energy as possible?

Thermal energy is produced at a rate represented by $P = I^2R$. Electrical engineers call this unwanted thermal energy the joule heating loss, or I^2R loss. To reduce this loss, either the current (Reduce), I, or the resistance, R, must be reduced.

All wires have some resistance, even though their resistance is small. The large wire used to carry electric current into a home has a resistance of 0.20 Ω for 1 km.



Jun 7-8:41 AM

Transmission of Electric Energy

Suppose that a farmhouse was connected directly to a power plant 3.5 km away. The resistance in the wires needed to carry a current in a circuit to the home and back to the plant is represented by the following equation:

$$R = 2(3.5\text{ km})(0.20\ \Omega/\text{km}) = 1.4\ \Omega.$$

An electric stove might cause a 41-A current through the wires. Divide 1000
The power dissipated in the wires is represented by the following relationships:
Decimal 3 places ←

2.4×10^3 W
2.4×10^0 KW

$$P = I^2R = (41\text{ A})^2\,(1.4\ \Omega) = 2400\text{ W.}$$

2.4 kW

All of this power is converted to thermal energy and, therefore, is wasted.
This loss could be minimized by reducing the resistance.
Cables of high conductivity and large diameter (and therefore low resistance) are available, but such cables are expensive and heavy.
Because the loss of energy is also proportional to the square of the current in the conductors, it is even more important to keep the current in the transmission lines low.

Jun 7-8:45 AM

Transmission of Electric Energy

How can the current in the transmission lines be kept low?
The electric energy per second (power) transferred over a long-distance transmission line is determined by the relationship $P = IV$.
The current is reduced without the power being reduced by an increase in the voltage.
Some long-distance lines use voltages of more than 500,000 V.

The resulting lower current reduces the I^2R loss in the lines by keeping the I^2 factor low.
Long-distance transmission lines always operate at voltages much higher than household voltages in order to reduce I^2R loss.
The output voltage from the generating plant is reduced upon arrival at electric substations to 2400 V, and again to 240 V or 120 V before being used in homes.

Jun 7-8:48 AM

Transmission of Electric Energy

While electric companies often are called power companies, they actually provide energy rather than power.
Power is the rate at which energy is delivered.
When consumers pay their home electric bills, they pay for electric energy, not power.
The amount of electric energy used by a device is its rate of energy consumption, in joules per second (W) times the number of seconds that the device is operated.

Joules per second times seconds, (J/s)s, equals the total amount of joules of energy.
The joule, also defined as a watt-second, is a relatively small amount of energy, too small for commercial sales use.
For this reason, electric companies measure energy sales in a unit of a large number of joules called a kilowatt-hour, kWh.

A kilowatt-hour is equal to 1000 watts delivered continuously for 3600 s (1 h), or 3.6×10^6 J.

Jun 7-8:50 AM

Ex 1:

An electric space heater draws 12.0 A from a 130-V source. It is operated, on the average, for 5.0 h each day. How much power does the heater use? How much energy in kWh does it consume in 31 days? At $0.24 per kWh, how much does it cost to operate the heater for 31 days?

$P = IV = 1{,}560\ W$

$1.56\ kW$

$\mathcal{E} = P \cdot t = 1.56^{kW} \cdot 5h/\cancel{day} \cdot 31\cancel{days}$

$242\ kWh$

Cost = $58.08

Jun 7-8:52 AM

Ex 2: $\frac{V}{I \cdot R}$

A digital clock has a resistance of 14,000 Ω and is plugged into a 110 V outlet. How much current and power does is use? At $0.24 per kWh, how much does it cost to operate the clock for 31 days?

$I = \frac{V}{R} = \frac{110V}{14{,}000\Omega} = 7.9 \times 10^{-3}\ A$

$.0079$

$P = IV$

$.0079 \cdot 110 = .87\ W$

$(.00087) \cdot (.24)(24)(00087\,kW)(31) = \$0.16$

Jun 7-9:26 AM

Ex 3:

An automotive battery can deliver 54 A at 12 V for 1.0 h and requires 1.5 times as much energy for recharge due to its less-than-perfect efficiency. How long will it take to charge the battery using a current of 7.0 A? Assume that the charging voltage is the same as the discharging voltage.

$$E_{charge} = 1.5IV\boxed{t}$$

$$1.5(54)(12)(1) = 972\,Wh$$

$$t = \frac{E}{IV} \quad \frac{972\,Wh}{7 \cdot 12} = 11.57\,h$$

Jun 7-9:30 AM

① Pg. 600
correct
17-21

② 603 23-27

Pg. 600 12-16 ap
22.1 Study Guide

Wed: Pg. 605 28-31
22.2 Study Guide

Thur: Correct & Hidden figures"

Jun 7-12:39 PM