

OEVIL PHYSICS
THE BADDEST CLASS ON CAMPUS
18 PHYSICS

LSN 18-5 ELECTRIC POWER

LSN 18-6 POWER IN HOUSEHOLD

CIRCUITS

Reading Activity Questions?

Big Idea:

 Changes that occur as a result of interactions are constrained by conservation laws.

Enduring Understanding:

The energy of a system is conserved.

Essential Knowledge:

- Energy can be transferred by an external force exerted on an object or system that moves the object or system through a distance; this energy transfer is called work.
- Energy transfer in mechanical or electrical systems may occur at different rates.
- Power is defined as the rate of energy transfer into, out of, or within a system.

Data Guide Equations

In Data Guide

$$|\overrightarrow{F_E}| = k \frac{|q_1 q_2|}{r^2}$$

$$\Box I = \frac{\Delta q}{\Delta t}$$

$$R = \frac{\rho l}{A}$$

$$I = \frac{\Delta V}{R}$$

$$P = I\Delta V$$

$$R_s = \sum_i R_i$$

$$\frac{1}{R_p} = \sum_{i} \frac{1}{R_i}$$

NOT in Data Guide

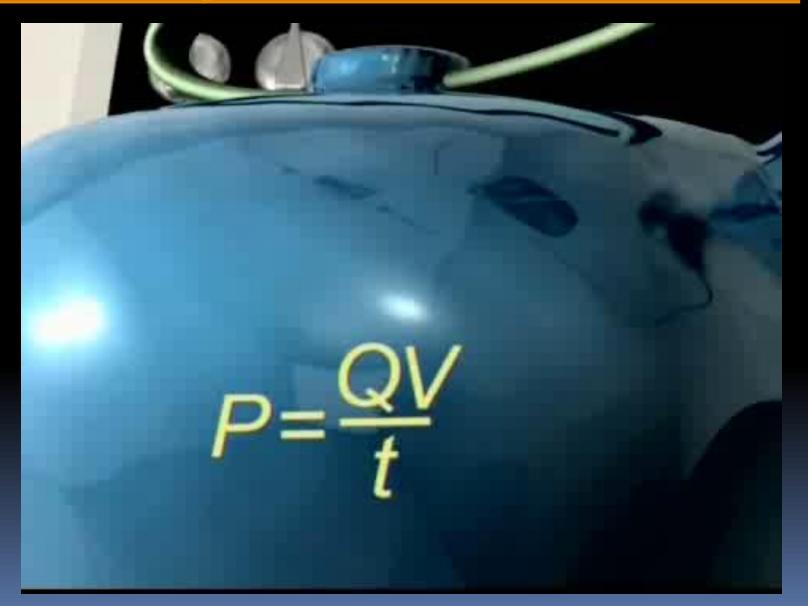
$$V = IR$$

$$\rho_T = \rho_0 [1 + \alpha (T - T_0)]$$
not in curriculum

$$P = I^2 R$$

$$P = \frac{V^2}{R}$$

Electricity - Measurement of Power



- We have seen that it requires work to move a charge across a potential
- A current is a movement of charge so work is being done, and it is movement per unit time
- Where there is work per unit time, there is POWER

$$P = rac{Work}{Time}$$
 $W = QV$
 $P = rac{QV}{\Delta t}$
 $I = rac{\Delta Q}{\Delta t}$
 $P = VI$

- This power is translated into mechanical work or thermal energy
- We can re-write the formula for power for devices that obey Ohm's law (ohmic behαvior)

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$$P = VI$$

$$R = \frac{V}{I}$$

$$V = IR$$

$$P = RI^{2}$$

$$I = \frac{V}{R}$$

$$P = \frac{V^{2}}{R}$$

- Power is measured in watts (J/s)
- Electrical devices are normally rated in watts (power) and volts (potential)

- A light bulb rated as 6oW at 11oV (normal household voltage) means it will dissipate 6o watts of energy when a potential of 11o V is applied across it
- So, what is the current and resistance?

- A light bulb rated as 6oW at 22oV (normal household voltage) means it will dissipate 6o watts of energy when a potential of 22o V is applied across it
- So, what is the current and resistance?

$$P = VI$$

$$\frac{P}{V} = I$$

$$\frac{60}{110} = I = 0.55A$$

$$P = \frac{V^2}{R}$$

$$R = \frac{V^2}{P}$$

$$R = \frac{110^2}{60} = 202\Omega$$

PIN: 967160711

METER READINGS

METER NO. 005716329
PRESENT (ACTUAL) 089599
PREVIOUS (ACTUAL) 087957
DIFFERENCE 001642
TOTAL KWH 1642

-	PAYMENTS RECEIVED AS OF D	DEC 27 2011	195.99	THANK YOU	
-	RSL-1/2 091 RESIDENT			•	
Contract Contract	BILLING PERIOD12-08-11 CUSTOMER CHARGE	TO 01-09-12 3	2 DAYS	8.76	
-	ENERGY CHARGE FIRST 1000 KWH	1000 KWH 9	6.27500¢	62.75	
-	ABOVE 1000 KWH FUEL CHARGE	642 KWH @	7.36600¢	47.29	
-	FIRST 1000 KWH	1000 KWH @		48.60	
ACCRECATE VANCOUS AND ADDRESS OF	ABOVE 1000 KWH	642 KWH a	5.86000¢	37.62	E
	*TOTAL ELECTRIC COST EnergyWise Home (Load Mar	pagement) Credit			205.02 11.50CR
-	GROSS RECEIPTS TAX	lagement, or ear			4.96
-	TOTAL CURRENT BILL				198.48
-	TOTAL DUE THIS STATE	MENT			\$198.48
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- What's wrong with calling this a 'power bill'?
- Do we pay for power?

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It is charging me for 1642 KWH. What does KWH stand for?

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-	BILLING PERIOD CUSTOMER CHARGE		1-09-1	2	32 DAYS			8.76	
	ENERGY CHARGE							0.70	
1	FIRST 1000 KWH		1000	KMH 9	6.2750	0¢		62.75	
1	ABOVE 1000 KWH		642	KWH 9	7.3660	0¢		47.29	
	FUEL CHARGE					-			
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- It is charging me for 1642 KWH. What does KWH stand for?
 - Kilowatt-hour

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What is a kilowatt-hour?

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What is a kilowatt-hour?

$$\frac{10^3 J}{s} \times 3600 s = 3,600,000 J$$

- Most houses have four methods of protection from electricity:
 - Fuses
 - Circuit Breakers
 - GFCI
 - Grounding posts

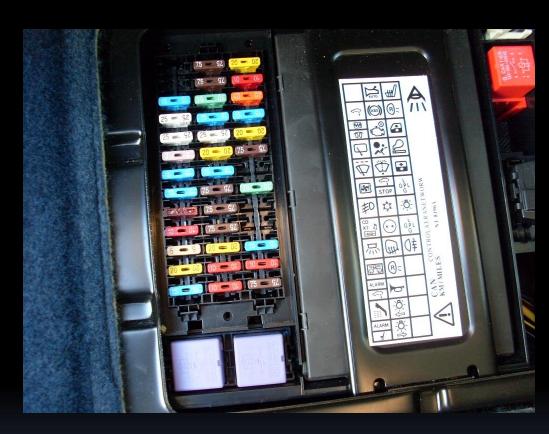
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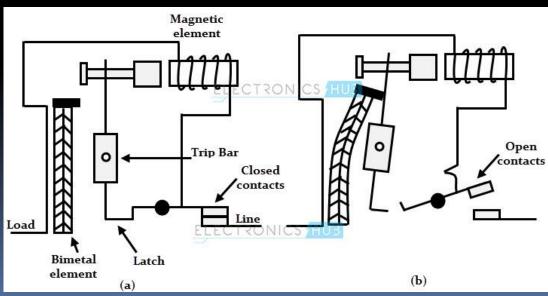


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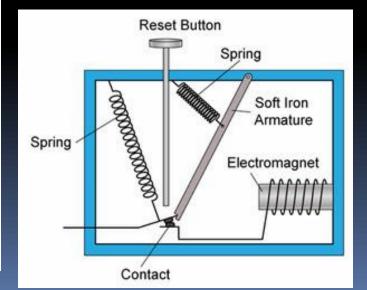




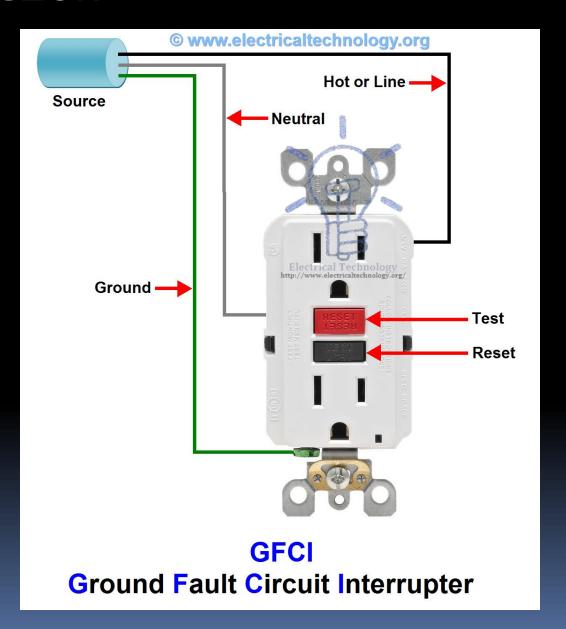
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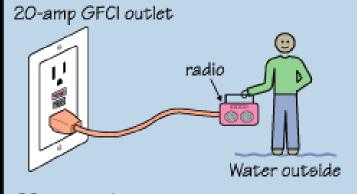


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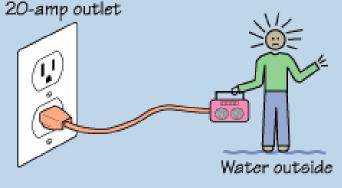


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 - □ *GFCI*
 - Grounding posts

Safety of GFCI vs. Breaker



Radio shorts to man. GFCl trips power off at .005 amps within 1/40 of a second. NO SHOCK.

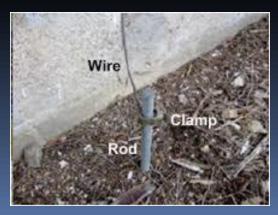


Radio shorts to man. 20-amp breaker turns power off at 20 amps. SHOCK!

OUCH! Always use GFCI-protected circuits near water. A .005 amp shock should not hurt you. A 20-amp shock will hurt you – it could light you up like 24 100-watt bulbs before the 20-amp breaker trips.



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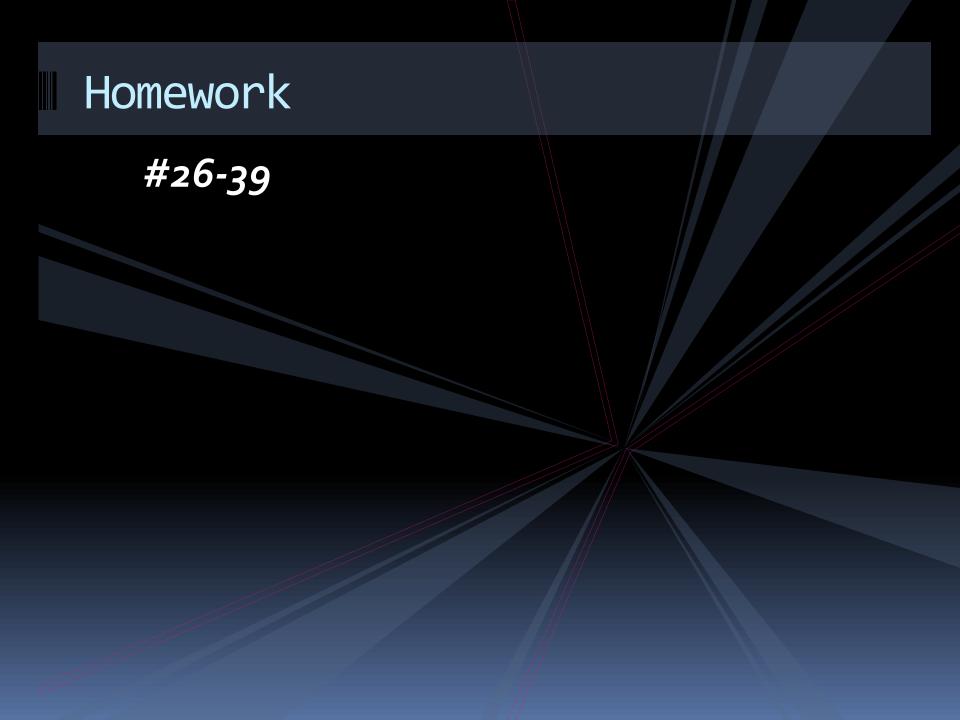
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Big Idea:

 Changes that occur as a result of interactions are constrained by conservation laws.



QUESTIONS?



STOPPED HERE 4/21/15