DEVIL PHYSICS

THE BADDEST CLASS ON CAMPUS

IB 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:

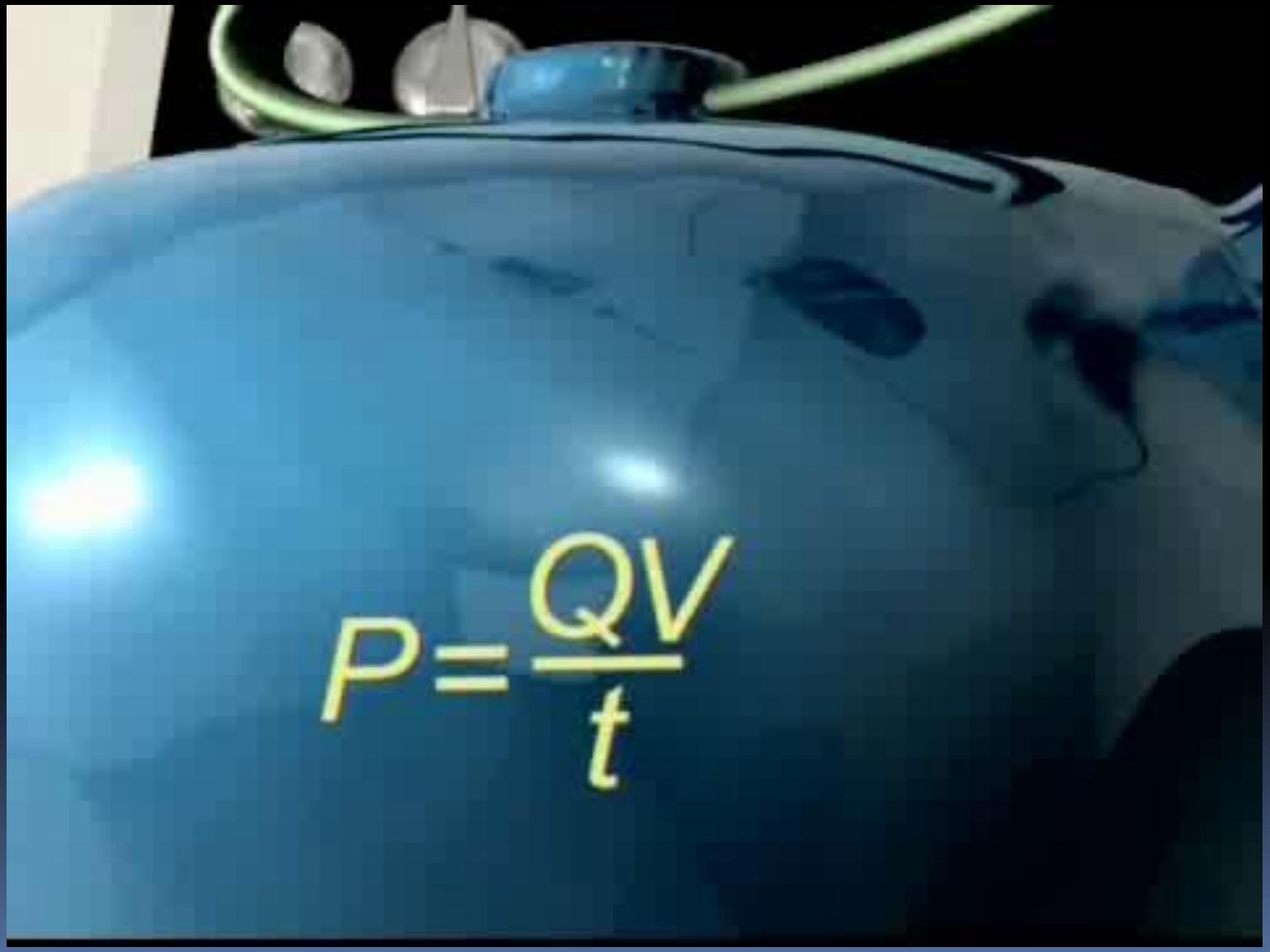
- Energy can be transferred by an external force exerted on an object or system that moves the object or system through a distance; this energy transfer is called work.
- Energy transfer in mechanical or electrical systems may occur at different rates.
- Power is defined as the rate of energy transfer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

Data Guide Equations

- In Data Guide
  - $\left|\overrightarrow{F_E}\right| = k\frac{|q_1 q_2|}{r^2}$
  - $I = \frac{\Delta q}{\Delta t}$
  - $R = \frac{\rho l}{A}$
  - $I = \frac{\Delta V}{R}$
  - $P = I\Delta V$
  - $R_s = \sum_i R_i$
  - $\frac{1}{R_p} = \sum_i \frac{1}{R_i}$

- 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



Electric 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

$$P = \frac{Work}{Time}$$

$$W = QV$$

$$P = \frac{QV}{\Delta t}$$

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

$$P = VI$$

Electric Power

- 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 behavior)***

$$V = IR$$

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

$$P = VI$$

$$P = I^2 R$$

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

Electric Power

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- We can re-write the formula for power for devices that obey Ohm's law (ohmic behavior)

$$P = VI$$

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

$$V = IR$$

$$P = RI^2$$

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

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

Electric Power

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

Electric Power

- A light bulb rated as 60W at 110V (normal household voltage) means it will dissipate 60 watts of energy when a potential of 110 V is applied across it
- *So, what is the current and resistance?*

Electric Power

- A light bulb rated as 60W at 220V (normal household voltage) means it will dissipate 60 watts of energy when a potential of 220 V is applied across it
- *So, what is the current and resistance?*

$$P = VI$$

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

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

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

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

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

What Is This?

PIN: 967160711

METER READINGS

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

PAYMENTS RECEIVED AS OF DEC 27 2011 195.99 THANK YOU

RSL-1/2 091 RESIDENTIAL LOAD MANAGEMENT
BILLING PERIOD..12-08-11 TO 01-09-12 32 DAYS

CUSTOMER CHARGE			8.76	
ENERGY CHARGE				
FIRST 1000 KWH	1000 KWH @	6.27500¢	62.75	
ABOVE 1000 KWH	642 KWH @	7.36600¢	47.29	
FUEL CHARGE				
FIRST 1000 KWH	1000 KWH @	4.86000¢	48.60	
ABOVE 1000 KWH	642 KWH @	5.86000¢	37.62	
*TOTAL ELECTRIC COST				205.02
EnergyWise Home (Load Management) Credit				11.50CR
GROSS RECEIPTS TAX				4.96
TOTAL CURRENT BILL				198.48

TOTAL DUE THIS STATEMENT $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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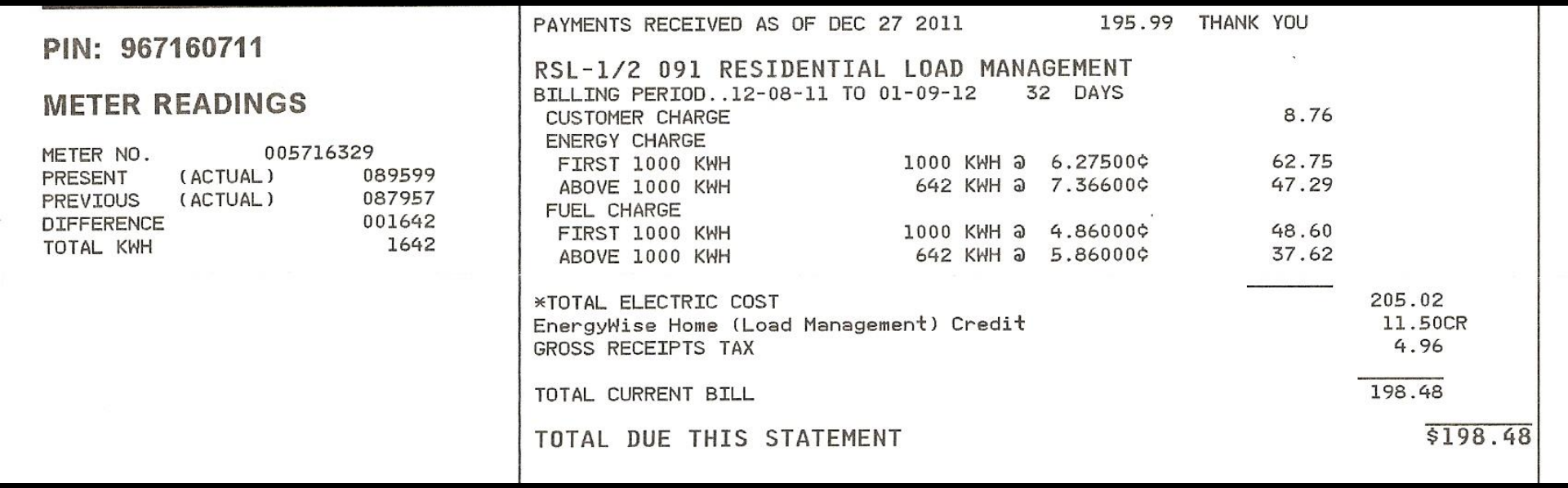

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  - ***Kilowatt-hour***

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- What is a kilowatt-hour?

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- What is a kilowatt-hour?
  - $\frac{10^3 J}{s} x 3600 s = 3,600,000 J$

Power Protection

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

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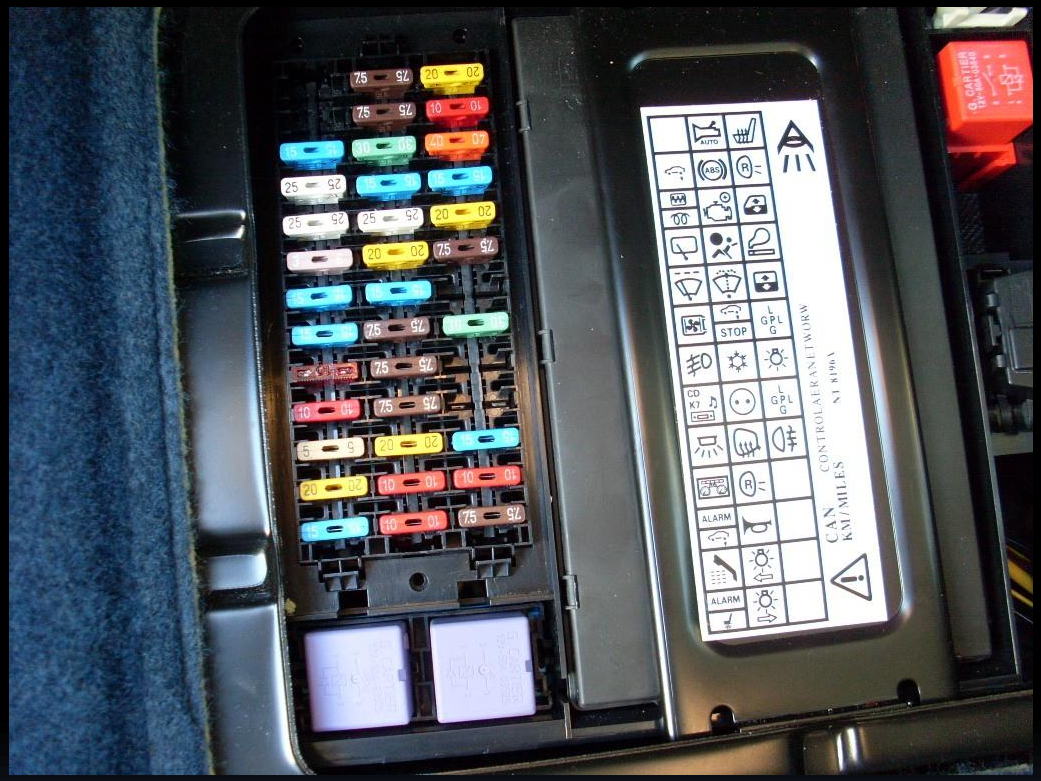

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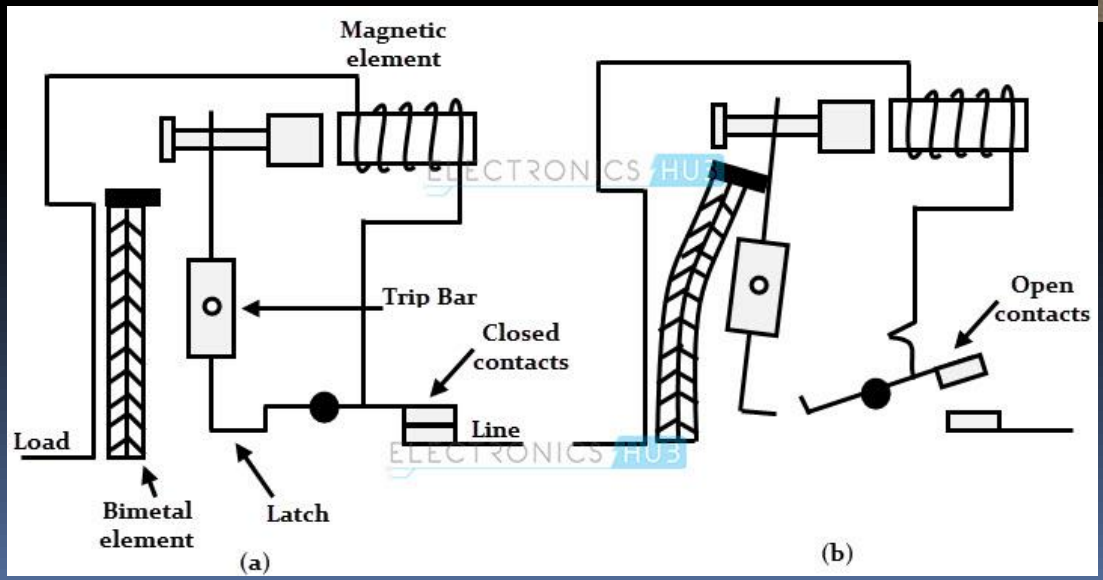

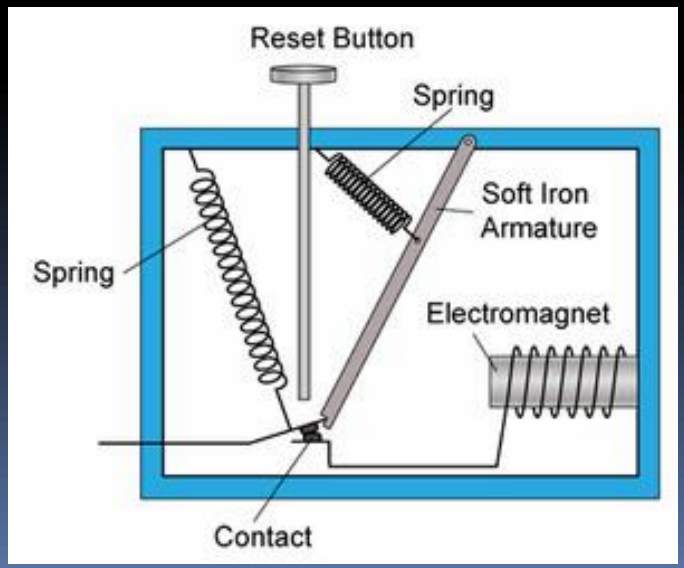

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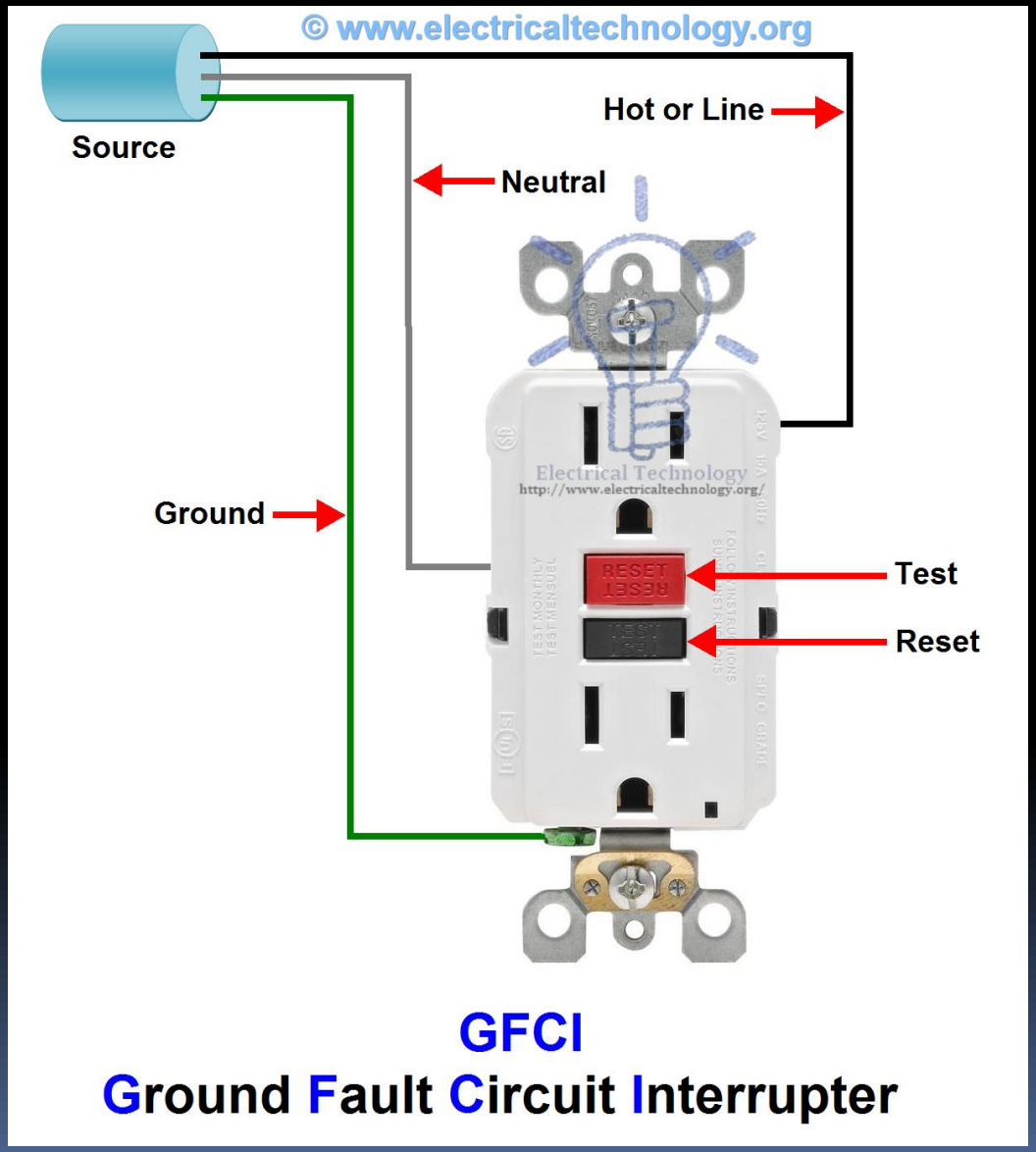

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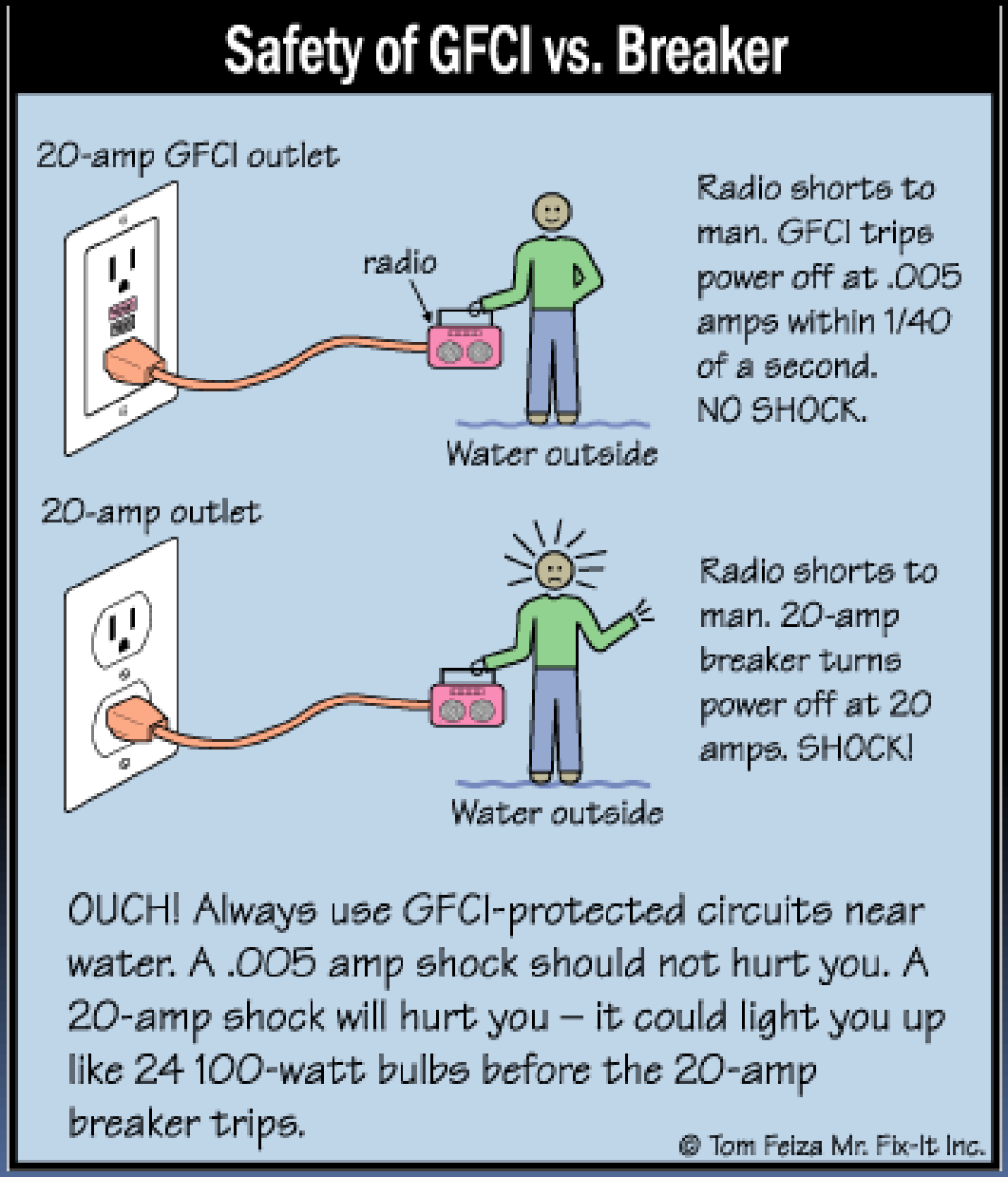

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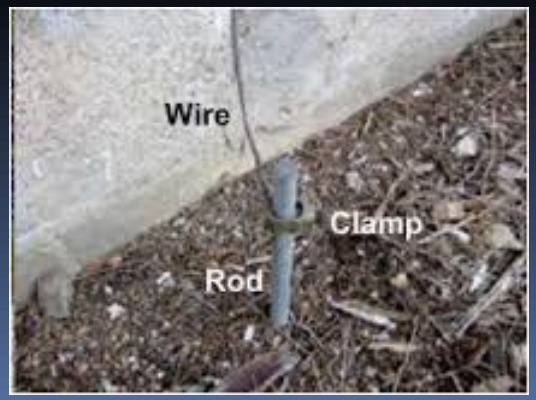

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Enduring Understanding:

- The energy of a system is conserved.

Big Idea:

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

QUESTIONS?

Homework

#26-39

STOPPED HERE 4/21/15