Name 2016 Key Hour _____

Current and Resistance Notes

Variable	What it stands for	Unit its measured in	Abbreviation for unit
I	Current	Amps	A
R	Resistance	Ohms	Ω
ΔV	Voltage (Potential Difference)	Volts	V
P	Power	Watts	W
W	Work	Kilowatt-hours (or Joules)	kWh

I, R and ΔV, and Ohm's Law

I = current – Movement of electrons through wires

R = Resistance - the opposition to the movement of current (slows it down)

ΔV = voltage or potential difference - Rate at which energy is drawn from a source of electricity. (What pushes the current through the wires)

The voltage (potential difference) across the outlets in your home is typically 120 V

Rest of the world = 240 Volts

* need converter

OHM'S LAW relates these three variables!

$$\Delta V = IR$$

Example 1: The resistance of a steam iron is 19 Ω. What is the current in the iron?

$R = 19\,\Omega$
$\Delta V = 120\ V$

$120 = I(19)$

$I = 6.32\ A$

Power and How to Find Electricity Cost

P = Power (watts) - Rate at which work is done

from earlier in the year

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

New : **ELECTRICAL POWER**

$$P = I\Delta V$$

Example 2: An electric space heater is connected across a 120 V outlet. The heater uses 1,500 W of power. Calculate the **resistance** of the space heater.

$\Delta V = 120\ V$
$P = 1500\ W$
$R = ?$

(1) need I
$P = I\Delta V$
$1500 = I(120)$
$I = 12.5\ A$

(2) need R
$\Delta V = IR$
$120 = 12.5 \cdot R$
$R = 9.6\,\Omega$

Name _____ Hour _____

Electricity Cost:

Power companies charge for electrical WORK **, not power!**

They measure work in kilowatt-hours (kWh).

For Dakota Electric customers, one kWh costs $.101 *(on electric bill)*

10.1¢

We can use Joules (J) or kilowatt-hours (kWh) to measure Work so we have to be able to convert between the two.

If you rearrange the variables: W = $P \times \Delta t$

Units of work = Joules = watts · sec

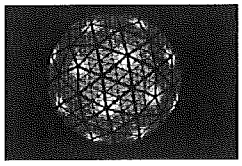
1 Joule = 1 Watt-second

Example 3: Convert 50,000 Joules = 0.014 kWh

$50{,}000 \text{ watt·sec} \times \frac{1\text{kW}}{1000\text{W}} \times \frac{1\text{hr}}{3600\text{sec}} = 0.014 \text{ kWh}$

FINDING THE COST OF ELECTRICITY:

1. Convert Power into kW, time into hours
2. Solve for work (in kWh)
3. Multiply work by price per kWh



Example 4: The New Year's Eve ball in New York's Times Square has 32,256 lights with an average wattage of 40 Watts each (total Watts = 1290240 W!) How much does it cost to have that ball on for **24 hours**? The **whole year**?

Givens:

P= $1290240 \text{ watts} \times \frac{1\text{ KW}}{1000\text{ W}} = 1290.24 \text{ kW}$

Δt= 24 hr

Unknown: W

Equation: $P = \frac{W}{\Delta t}$

$1290.24 = \frac{W}{24} = 30965.76 \text{ kWh} \times \frac{\$.101}{\text{kWh}} = \frac{\$3128}{\text{day}}$

year = $1,141,552 over 1 million $

QUIZ YOURSELF: There will be a section of these on the Quiz Friday.

1. What is the variable for current? I
2. What is the variable for voltage? ΔV
3. What is the variable for power? P
4. What is the unit for resistance? Ω
5. What does "A" stand for? amps
6. What unit does "W" stand for? watts
7. What does "Ω" stand for? ohms
8. What is measured in volts? voltage
9. What is measured in Watts? power
10. Potential Difference is another way of saying what? voltage
11. What other unit is the same as a J? watt·sec
12. How many Watts are in a kilowatt? 1000
13. What is made up of moving electrons? current
14. The rate at which energy is drawn from a source of electricity is known as voltage
15. What is the variable for resistance? R
16. What is the variable for work? W
17. What is the unit for current? A
18. What is the unit for voltage? ΔV
20. What does "J" stand for? Joule
21. What does "kWh" stand for? kilowatt hr
22. What does ΔV stand for? voltage | potential difference
23. What is measured in Ohms? resistance
24. What is measured in kWh? work