Name: ______________________________ Period:________ Date: ____________

1. Most activities involve one form of energy being transformed to another form.

2. When energy transformations occur thermal energy is always produced.

3. The Law of Conservation of Energy states that energy cannot be created or destroyed.

4. Complete the chart for energy transformations that occur in different devices.

Device	Starting Energy	Changes to...
Battery	a. Chemical	Electrical energy
Clothes dryer	Electrical energy	b. Thermal
Car engine	Chemical energy	c. Kinetic
Fireplace	d. Chemical	Heat Energy
Fan	Electrical energy	e. Kinetic
Drum	f. Potential	Sound energy

5. What is the energy transformation that occurs in a ceiling fan?
a) electrical to chemical
b) mechanical to electrical
c) electrical to mechanical
d) mechanical to thermal

6. What energy transformation is occurring in a campfire
a) chemical to thermal
b) Chemical to mechanical and thermal
c) chemical to light and thermal
d) thermal to light

7. What energy transformation occurs in a green plant on a sunny day
a) light energy to mechanical energy
b) light energy to chemical energy
c) chemical energy to light energy
d) chemical energy to mechanical energy

8. What energy transformation occurs when you rub your hands together?
a) mechanical energy to heat energy
b) chemical energy to heat energy
c) mechanical energy to chemical energy
d) heat energy to mechanical energy

9) Stored energy is
a) friction
b) kinetic energy
c) potential energy
d) gravitational energy

10) Which type of energy is contained in a tank of gasoline?
a) chemical
b) mechanical
c) electrical
d) thermal

Power

1. A Scottish inventor James Watt who invented the steam engine did a tremendous amount of work with energy studies. Since his time we have defined the word *power* to be the rate at which a device converts energy into useful energy. The unit of *power* is the __Watt__ (_W_).

2. What is the relationship between power, current and voltage in an electric circuit?

$$P = IV$$

(W) (A) × (V)

Power = Current × Voltage

Power Practice Problems

Answer each of the following questions, showing the formula, substitution and correct answer (including units). Don't forget to include a sentence with your answer.

3. If you wanted to cook your pizza pop in a microwave oven that had a power rating of 750 W and it is plugged into the wall socket beside your bed, how much current is flowing through the microwave? (Hint: How can you figure out voltage . . . how many volts come out of the wall socket?)

120V out of a wall socket

$$P = IV$$

$$\frac{750\,W}{120\,V} = \frac{I \times 120\,V}{120\,V}$$

$$\boxed{6.25\,A = I}$$

4. What is the power (in watts and kilowatts) of a hair dryer that requires 10 A of current to operate on a 120 V circuit?

$$P = IV$$

$$= 10A \times 120V$$

$$\boxed{= 1200W \text{ or } 1.2kW}$$

$$1200\,W \times \frac{1\,kW}{1000\,W} = 1.2\,kW$$

5. The maximum current that a 68.5 cm television can withstand is 2 A. If the television is connected to a 120 V circuit, how much power is the television using?

$P = IV$

$= 2A \times 120V$

$= \boxed{240W}$

6. A 900 W microwave oven requires 7.5 A of current to run. What is the voltage of the circuit to which the microwave is connected?

$P = IV$

$\frac{900W}{7.5A} = \frac{7.5A \times V}{7.5A}$

$\boxed{V = 120}$

7. A flashlight using two 1.5 V D-cells contains a bulb that can withstand up to 0.5 A of current. What would be the maximum power of the bulb?

$P = IV$

$= 0.5A \times (2 \times 1.5V)$

$\boxed{P = 1.5W}$

8. A colour TV draws 1.5 A when connected to a 120 V outlet. What is the power rating of the TV set?

$P = VI$

$= 120V \times 1.5A$

$\boxed{= 180W}$

Energy

9. The energy consumption of an electrical device is its *input power multiplied by the amount of time the device is in use.* Rewrite this as a mathematical relationship.

Energy (J) = Power (W) × time (s)

10. Using the scenario in question #3 calculate the *energy consumed* if you used the microwave for 2 minutes instead of 30 minutes. Show your work below.

750W

$2 \text{min} \times \frac{60s}{1\text{min}} = 120s$

$E = Pt$

$= 750W \cdot 120s$

$= \boxed{90\,000J}$

11. Why are *joules* not a practical way of expressing energy consumption with electrical devices? How then is electrical consumption measured?

kWh usually. Joules are too big.

12. How many *kilowatt hours* (kWh) of energy did the microwave in the scenario from question #3 use? Show your calculation below.

$750W \times \frac{1kW}{1000W} = 0.75kW$

$120s \times \frac{1\text{min}}{60s} \times \frac{1h}{60\text{min}} = 0.033h$

$E = Pt$

$= 0.75kW \times 0.33h$

$= \boxed{0.2475kWh}$

Answer each of the following questions, showing the formula, substitution and correct answer (including units). Don't forget to include a sentence with your answer.

13. a. If a refrigerator requires 700 W of power to function, how much kilowatt-hours of power will it require in a 30-day period?

$E = Pt$

$700\,W \times \frac{1\,kW}{1000\,W} = 0.7\,kW$

$30\,day \times \frac{24\,h}{1\,day} = 720\,h$

$0.7\,kW \times 720\,h = 504\,kWh$

b. If electricity costs 11 cents per kilowatt-hour, how much would the refrigerator cost to operate in that period?

$\frac{11¢}{kWh} \times 504\,kWh = 5544¢ \div 100 = \$55.44$

14. A homeowner finds that she has a total of 42 light bulbs (100 W) in use in her home.

a. If all the bulbs are on for an average of 5 hours per day, how many kilowatt-hours of electricity will be consumed in a 30-day period?

$42 \times 100\,W = 4200\,W$

$4200\,W \times \frac{1\,kW}{1000\,W} = 4.2\,kW$

$5\,h \times 30 = 150\,h$

$E = Pt$
$= 4.2\,kW \times 150\,h = 630\,kWh$

b. At 11 cents per kilowatt-hour, how much will operating these lights cost the homeowner during that period?

$\frac{11¢}{kWh} \times 630\,kWh = 6930¢ \div 100 = \$69.30$

c. How much money would the homeowner save if she switched all of the bulbs to energy-saving 52 W light bulbs?

$42 \times 52\,W = 2184\,W$

$2184\,W \times \frac{1\,kW}{1000\,W} = 2.184\,kW$

$2.184\,kW \times 150\,h = 327.6\,kWh$

$327.6\,kWh \times \frac{11¢}{kWh} = 3603.6¢$

$\$36.04$

$69.30 - 36.04 = 33.26$

They would save \$33.26

15. Bob has a stereo that operates a 120 V, using 2.5 A of current.

a. How much power does Bob's stereo need to operate?

$P = IV$

$= 120V \times 2.5A$

$= \boxed{300W}$

b. If Bob plays his stereo for an average of 5 hours each day, how much electricity will he use in a 30-day period?

$5h \times 30 = 150h$

$300W \times 150h = 45000Wh$

$45000Wh \times \frac{1kW}{1000W} = \boxed{45kWh}$

16. You bake a potato in a 1200 W toaster oven for 25 minutes. How many joules of electricity did the toaster oven use? How many kilowatt-hours did it use?

$E = Pt$

$= 1200W \times 1500s$

$= \boxed{1800000J}$

$25min \times \frac{60s}{1min} = 1500s$

$1200W \times \frac{1kW}{1000W} = 1.2kW$

$25min \times \frac{1h}{60min} = 0.4167h$

$1.2kW \times 0.4167h = \boxed{0.50kWh}$

17. What is the difference between energy and power?

Energy is joules. Power is joules per second. Power quantifies how much energy is used in a specific time frame.

Energy can be stored. Power cannot.