**Physical Science**  Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block: \_\_

**Energy Unit Review Sheet**

***Possibly useful facts:***

*1 kWh = 3412 BTUs = 860,000 calories (cal) = 3,600,000 Joules (J)*

*1 quad = 1 quadrillion BTUs = 1x1015 BTUs = 1,000,000,000,000,000 BTUs*

*Households: 113,600,000 in the US, 2.6 million in MA*

*Total energy used in a day by an average MA household: 727 kWh*

*US household electricity is 120V.*

1. Convert:
   1. 2550 kWh to kcal

2550 kWh x 860,000 cal/kWh x 1 kcal/1000 cal = 2,193,000 kcal

* 1. 6,900,000 GWh to quads

6,900,000 GWh x 106 kWh/GWh x 3412 BTU/kWh x 1 quad/1015 BTU = 23.542 quads

* 1. 45 kW to BTUs / hour

45 kW x 3412 BTU/hr/kW = 153,540 BTU/hr

* 1. Total energy used by all of the MA households in a year in GBTU’s

727 kWh/day/MA HHx2.6 x106 MA HHx365 d/yr x3412 BTU/kWhx1 GBTU/109 BTU= 2.35 x106 GBTU

1. John wants to run the 1200-W microwave, and Jane wants to use her 1200-W hair dryer. Will they blow a 15 Amp fuse? Explain!

P = I V

2400 W = I (120 V)

I = 20 A Yes, they will blow a 15-A fuse.

1. A 38,000 V power plant line carries 1500 Amps of current. If the voltage is stepped up to 115,000 V for long distance transmission that carries the same power, how many Amps will be carried on the long distance line?

P = IV = 1500 A x 38,000V = 5.7 x 107 W

P = IV

5.7 x 107 W = I (115,000 V)

I = 496 A

1. Mark which of the following units represent Energy (E), Power (P) or Neither (N):

\_P\_ W \_E\_ GWh \_E\_ BTU \_E\_ quad

\_E\_ kW-year \_P\_ BTU / hour \_E\_ Joules \_P\_ cal / hour

5. a. How much energy is needed to run a 1500-W space heater for a day?

E = Pt = 1500 W x 1 kW/1000 W x 1 d x 24 h/d = 36 kWh

b. If the power company charges 17 cents per kWh, how much would it cost you to run the space heater in part a) above for a year?

36 kWh/d x $0.17/kWh x 365 d/yr = $2,233.80

1. Jason leaves his 500-mW iPhone charger on all day, every day. How much energy in kWh does that consume in a 30-day month?

E = Pt =500 mW x 1 W/1000mW x 1 kW/1000W x 24 h/d x 30 d/month = 0.36 kWh

1. Sarah read off of her electric bill that her family used an average of 18.5 kWh of electricity per day. How much electricity would you expect her family to use in a year?

18.5kWh/day x 365 days/year = 6752.5 kWh/year

1. The US uses 797 kWh/day per household of energy in all forms. Aside from electricity in the home, what are the other four or five major things that make up that 797 kWh/day?

Transportation, industrial, manufacturing, commercial, shipping

1. If your car gets 26 miles per gallon and gasoline’s heat content is 124,000 BTU/gallon, how many kWh of energy does it take to drive a mile?

124,000 BTU/Gallon x 1 kWh/3412 BTU x 1 gallon/26 miles = 1.4 kWh/mile

1. If a power plant is about 35% efficient. How many BTUs of natural gas does it use to produce a MWh of electricity?

Energy out:

1MWh x 1000kWh/1MWh x 3412 BTU/1 kWh = 3,412,000 BTU

Energy out/Energy in = 35/100

3,412,000BTU/Energy in = 0.35

Energy in = 3,412000/0.35 = 9,748,571 BTU

1. Austin, TX used about 0.016 quads of electricity at home in 2011. There are 340,000 households in Austin. In kWh, how much did each household use each day?

0.016 quads/city\* year x 1015 BTU/1 quad x 1 kWh/3412 BTU x 1 city/340,000 HH x 1year/365 day

37.8 kWh

1. During which season would you expect the highest electricity usage in the U.S? Why?

Summer AC

1. What is the efficiency of a generator that can provide 2500W of power for 6 hours on one gallon of gasoline? (Gasoline’s heat content is 124,000 BTU/gallon.)

Energy out = Power x time = 2500 W x 1kW/1000 W X 6 hours = 15 kWh

Energy in = 124,000 BTU x 1kWh/3412 BTU = 36.34 kWh

Efficiency = energy out/energy in x 100%

Efficiency = 15kWh/36.34 kWh x 100% = 41.3 %

1. How long would you need to leave a 12-W appliance on to consume 100 calories of energy?

P = E/t t = E/P

t = [100 cal x 1 kWh/860,000 cal x 1000 W/ kW]/12 W = 0.0097 h = 35 seconds