

## Energy Worksheet

### 1) Energy units

a) What units do we use to measure energy?

(Note: *lb* is the symbol for pound)

BTU = British Thermal Unit

1 BTU = energy it takes to heat 1 lb of water by 1°F

Another way to say it: 1 BTU per lb per °F

“per” is like saying “divided by”.

Write an equation that “says” 1 BTU per lb per °F

b) Energy Example – how many BTU’s does it take to heat 10 lbs of water by 5°F? (check your units to make sure the equation is written correctly)

$$\underline{\hspace{2cm}} \times \underline{\hspace{2cm}} \times \underline{\hspace{2cm}} = \underline{\hspace{2cm}} \text{ BTU}$$

## 2) A Longhorn's shower

a) Our Longhorn is using a shower that sprays 5 gallons/minute, and she spends 5 minutes in the shower. How much water does she use?

Volume of water = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ gal

b) How many pounds of water is this? We need to convert volume to mass, using density.

density of water = 8lb/gallon

mass of water = \_\_\_\_\_ x \_\_\_\_\_ = \_\_\_\_\_ lbs

c) How much does the temperature of the water increase?

tap water = 60°F

hot shower = 110°F

temperature change =  $\Delta T$  = \_\_\_\_\_ - \_\_\_\_\_ = \_\_\_\_\_ °F

d) Energy for the Longhorn's shower?

\_\_\_\_\_ lbs water heated by \_\_\_\_\_ °F

How many BTU's?

\_\_\_\_\_ lbs x \_\_\_\_\_ °F x (1BTU/lb/°F) = \_\_\_\_\_ BTU



e) How fast can you generate your energy?

POWER = Energy / Time

What is your generator's power in ft·lb/min?

$$\frac{\text{_____ cycles}}{\text{min}} \times \frac{BTU}{\text{_____ cycles}} = \text{_____ } BTU / \text{min}$$

f) What is your generator's rating in units of horsepower?

$$\frac{\text{_____ } BTU}{\text{min}} \times \left( \frac{1hp}{41BTU / \text{min}} \right) = \text{_____ } hp$$

g) So how long would your human-power generator have to run for each 5 minute shower that Suzie Longhorn takes?

$$\frac{\text{_____ } BTU}{\text{_____ } BTU / \text{min}} = \text{_____ } \text{min}$$

h) Convert your answer to days

$$\text{_____ } \text{min} \times \left( \frac{\text{_____}}{\text{_____}} \right) \times \left( \frac{\text{_____}}{\text{_____}} \right) = \text{_____ } \text{days}$$