

## PHYSICS-2

### Elementary Physics of Energy

#### Homework 2

Due Date: APRIL 14, 2010 in class

A few more problems on Chapter 1 material:

1. You are going to visit a friend and pack a 25 lb suitcase. How many kilograms is that? What is the force, in Newtons, required to pick it up? Your friend lives on the 3rd floor of an apartment building. When you arrive you must carry your suitcase up 2 flights of stairs, each with a vertical distance of 10 ft. How much work is done against gravity, in joules, during this process? If it takes you 2.5 minutes, how much horsepower was that?

2. A typical clothes dryer uses 4 kW of power when it is running. If it takes about 1 hr to dry a load of clothes, and your house does about 10 loads each month, about how much does this cost on your pg&e bill if:

a. it's an electric dryer?

b. it runs on gas?

Hint: current Santa Cruz energy charge rates can be found in the lecture notes, or on your pg&e bill.

3. Mass vs. Force vs. Weight: Because the moon is much less massive than Earth, if you were on the moon the force of gravity you experience would be only 17% of what you experience on Earth. If a person that weighs 130 lbs on Earth goes to the moon, what will their weight be? What is their mass in kilograms on the moon and on Earth?

4. A person consumes 2000 Calories and this energy is equivalent to raising the temperature of an amount of water equal to their mass by 35 degrees C, what is the mass of this person in kg?

Questions from Chapter 2 on page 59 of Ristinen and Kraushaar:

1. In Example 2.2 it is shown that gasoline costs more per Btu than does natural gas. Why then do we power our cars and trucks predominantly with gasoline rather than natural gas?

3. Why is two-thirds of the petroleum left in the ground after the primary extraction process comes to an end? Can this problem be overcome?
5. On a worldwide basis, how much remaining oil is there per person? How does this compare to the remaining oil per person in the United States?
6. What is oil shale and how can it be converted into useful fuels for transportation and heating?

Multiple Choice Questions from Chapter 2:

1. A bacterial colony starts growing in a jar at about 11:00 AM. The size of the colony doubles each minute, and the jar is just full at 12:00 noon. At what time was the jar 1/8 full? Appendix A discusses growth rates, but this problem can be simply solved by thinking backwards (i.e. when was the jar 1/2 full?).
 

a. 11:07	e. 11:45
b. 11:15	f. 11:56
c. 11:30	g. 11:57
d. 11:36	h. 11:58
5. A reasonable estimate for  $Q_\infty$  (petroleum) for the United States, including Alaska and offshore oil, is about
 

a. $324 \times 10^9$ bbl	c. $113 \times 10^9$ bbl
b. $250 \times 10^6$ bbl	d. $458 \times 10^9$ bbl
7. One of the problems of producing shale oil is the amount of water needed for aboveground retorting. The engineers designing this process estimate that about \_\_\_\_ barrels of water are needed for each barrel of oil produced.
 

a. 300	c. 3
b. 30	d. 0.3
8. In tar sands, the organic material that contains the oil and that surrounds the grains of sand is
  - a. kerogen
  - b. kerosene
  - c. marlstone
  - d. bitumen
  - e. paraffin