Physics 1110 Problem Set 2

Note: Include units in all problems.

1. A woman weighing 100 pounds walks up 3 flights of stairs, each flight having 10 steps. Each step is 6.0 inches high. What is her increase in gravitational potential energy? Where does this energy come from?

2. A man having a mass of 80 kg is running at 5.0 m/s. What is his kinetic energy? Where does this energy come from?

3. How much heat will it take to raise the temperature of 10.0 kg of water 1.0 Centigrade degree? Express in terms of kilocalories, calories, and joules. NOTE: 1 kilocalorie = 4.186 joules.

4. How much heat will it take to raise the temperature of 20 pounds of water 1.0 Fahrenheit degree? Express in terms of BTU's and ft lbs. NOTE: 1 BTU = 778 ft lb

5. How much does it cost to operate a 125 W sleeping blanket for an 8.0-hour night's sleep? (Assume it's on all the time.) The cost is 9.0 cents per kilowatt- hour.

6. How much will a loaf of bread, costing $1.00 per loaf in 1982, cost in the year 2002 if the rate of inflation continued at 14% per year? Note: This is just 20 years from that date!

Physics 1110 Problem Set 2 Solution Sheet

1. Weight = 100lbs

Height = (3flights)(10 steps/flight)(0.50 ft/step) = 15.0 ft.

Increase in GPE = weight x height = (100lbs)(15.0 ft) = 1500ft lb

The increase in gravitational potential energy comes from work done by the woman (which in turn comes from the food she eats which in turn comes from the sun which grows the food).

2. KE = ½ mv^2 = ½ (80 kg)(5.0 m/s)^2 = ½ (80)(25) kg m^2/s^2 Or KE =1000 joules

The energy again comes from energy (from food) stored in the muscles of the man.

3. Heat required = (10 kg)(1.000 kilocalorie/kg C°)(1.0 C°) = 10 kilocalories

10 kilocalories =10,000 calories = 10 Calories ←——(Food Calories)

Also 10 kilocal= (10 kilocal/1) (4,186j/kilocal) = 41, 860 joules = 42,000 joules (using Significant Figures)

4. Heat required = (20lbs)(1.000 BTU/lb F°) (1.0 F°)= 20 BTU (just *barely* 2 sig. figs.)

Also 20 BTU = (20 BTU/1) (778ft lb/BTU) = 15,560 ft lb = 16,000 BTU (keeping 2 sig. figs.)

5. P= 125 W = 0.125 KW T= 8.0 H

W= Pt = (0.125 KW)(8.0 H) = 1.00 KWH

Cost = (1.00 KWH)(9.0 cents/KWH) = 9.0 cents

6. Doubling Time =70/P = 70/14 = 5.0 yrs

1982 $1.0 1987 $2.0 1992 $4.0 1997 $8.0 2002 $16.0