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Problems set # 1 **Physics 131** September 4, 2018

1. If a household consumes 300 kWh of electrical energy in a 30 day month, what is the average actual power usage, assuming utilization for 16 hour/day?

2. During a normal day of activities, the average person consumes about $2,200$ Cal (2.5 kKh). *(i)* If 300 Cal are released by burning 1 oz fat, how much weight (not including initial water loss) will a person lose by going on a starvation diet for 2 weeks? *(ii)* How long would it take to lose 15 lb by reducing intake to $1,600$ Cal?

3. A typical Detroit automobile averages about 15 miles/gallon in the city. If the energy content of gasoline is about 32,000 Cal/gal (126,944 Btu/gal), compare the energy used in driving a mile to that used in walking a mile (about 20 Cal), and to that used as electrical energy (per day) for an average household (about 10 kWh).

4. For an astronaut sealed inside a space suit, getting rid of body heat can be difficult. Suppose an astronaut is performing vigorous physical activity, expending 200 watts of power. An energy of 47.8 Cal is enough to raise the body temperature by 1°C. If none of the heat can escape from the space suit, how long will it take before the body temperature rises by 6°C (11°F), an amount sufficient to kill. Express your answer in units of minutes.

5. The cost of home-heating fuel oil is about 40¢/gallon. If the cost of heating a certain home during the winer is about \$60/month, calculate the cost of suppling electric heat to the same home. Assume the thermal energy content of fuel oil to be 140,000 Btu/gal, and the cost of electricity to be 12¢/kWh.