PSC 320 Problem Set #1

1) Your friend leaves a 100W light bulb on 24/7 because he likes to have the light on.

a) How much electrical energy does this use in a year?
Answer in kWh, Joules, and BTU

10 hrs 1 kwh

kWh: $100W \times \frac{8765 \text{ hrs}}{\text{year}} \quad \frac{876{,}500 \text{ Wh}}{\text{year}} \left(\frac{1 \text{ kWh}}{1000 \text{ Wh}}\right)$

$= \boxed{876.5 \text{ kWh/year}}$

Joules: ~~J~~ = watts · seconds

$J = 100W \cdot 31{,}556{,}926 \text{ seconds}$

$\boxed{J = 3{,}155{,}692{,}600}$

Scientific notation please

BTU: $J = 3{,}155{,}692{,}600 \text{ J} \left(\frac{1 \text{ BTU}}{1055.1 \text{ J}}\right) = \boxed{3.0 \times 10^6 \text{ BTU}}$

b) How much does this cost in a year?

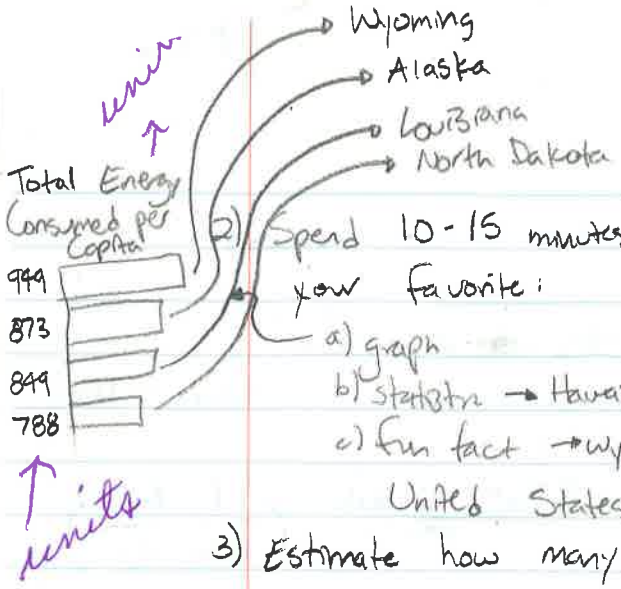
1 kwh = 15¢

$15¢/\text{kwh} \left(876.5 \text{kwh}\right) = \boxed{\$131.48}$

c) Having light on for 3 hours a day is 1/8 the hours. So,

$\$131.48 / 8 = \boxed{\$16.43}$

This could significantly change the amount of power used and the cost of your friend.



where's California?

2) Spend 10-15 minutes on EIA website. Printout & write down your favorite:
   a) graph
   b) statistic → Hawaii pays the most for natural gas in $/thousand cu ft at $38.71
   c) fun fact → Wyoming has the #1 total energy per capita of all the United States

3) Estimate how many years our oil will last?

$P = E/t$ $\quad t = E/P$

110×10^{23} J

1.10×10^{23} J of oil, and using at a rate of 5.0 TW

E ↑

J = watts · seconds $\quad 1.10 \times 10^{23}\ J = 5.0 \times 10^{12}\ \text{watts} \cdot \text{seconds} = \text{Time}$

TW watts/sec $\quad 5.0 \times 10^{12}$ W Power ↑

seconds = 2×10^{10} seconds $\left(\frac{1\ \text{year}}{31{,}556{,}926\ \text{seconds}}\right)$

Please use Scientific notation

3.2×10^{7} s

years = 633 of oil left at the rate we use it now, every last drop

4) Rate of petroleum use + verify that it is about 5TW

barrels/day if we used 5TW :

$$5\text{TW} = \frac{5\text{TJ}}{\text{s}}\left(\frac{1\times10^{12}\ \text{J}}{1\ \text{TJ}}\right)\left(\frac{60\ \text{sec}}{1\ \text{min}}\right)\left(\frac{60\ \text{min}}{1\ \text{hr}}\right)\left(\frac{24\ \text{hr}}{1\ \text{day}}\right)\left(\frac{1\ \text{barrel petroleum}}{6120000000\ \text{J}}\right) =$$

70,588,235 barrels of petroleum/day ≈ 70 million

National Average for barrels of petroleum used/day: 93 million 83 million

5) Sun → Plants → Decomposed Matter for thousands of years under high pressure far beneath the Earth's surface → Gasoline ← good

Gasoline → My gas tank → heat, I.R. radiation