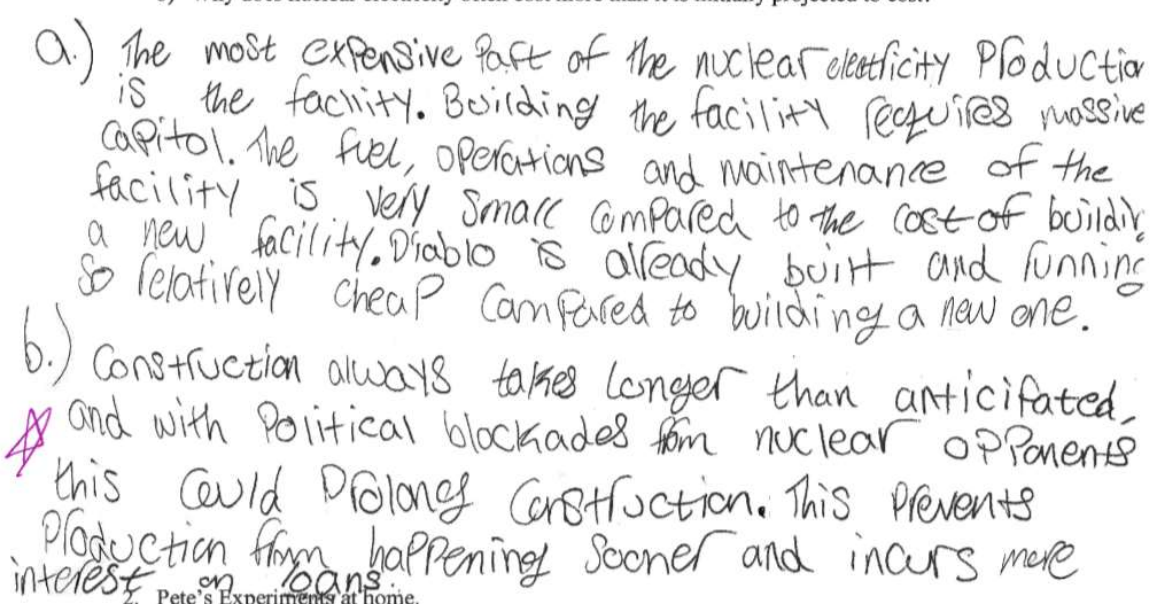
Assessment #8

1. Nuclear is expensive?
   a) I heard someone say that we should keep Diablo Canyon nuclear facility open because the electricity from it is so cheap! Then the same person said that we shouldn't build a new nuclear facility in Fresno because nuclear electricity is so expensive. How can this be?
   b) Why does nuclear electricity often cost more than it is initially projected to cost?



2. Pete's Experiments at home.
   a) Which one of Pete's innovations at home do you find the most environmentally beneficial? Explain why.
   b) In what way(s) is what Pete has done at home really an example of failure environmentally?

Whatever you put here is fine. I was just seeing that you put something in that was factually correct.
For (b) I particularly was referring to two things:

- *i) That I was able to lead a "sustainable lifestyle" because I am rich, white privileged… able to own a house in SLO, which is very expensive.*
- *ii) I do not make optimal use of this expensive land… it should have many people living on it. Whether through my own social incompetence, bad luck, or the environmental choices I've made, I've managed to separate myself from family so that I actually largely live on it by myself.*

3. You replaced a kW of incandescent light bulbs (16 blubs, 60 W each) with 100 W of LED lights (16 blubs, 6 W each) that provide the same amount of light! You paid $80 for the LEDs. You use these lights for 6 hours every day – or about ¼ the time.
   a) In a year, how much electricity did you use with the incandescent lights?
   b) How much CO_2 was produced in California in a year to power your incandescent lights?
   c) How much money do you save each year on electricity bill using the LED lights?
   d) What is the payback time?

You're a renter and actually have to move after only 6 months. You don't take the LED lights with you.

   e) What was your cost of conserved energy? Please put answer in $/kWh
   f) What was your cost of abated carbon? Please put answer in $/Ton_$CO_2$.
   g) What are some of the other benefits of LED lights?

a) 1kW × 6 hrs/day = 6 kWhrs/day × 365 days/year ≈ 2200 kWhrs of electricity in a year

b) Energy intensity of NG (Calif.) = 1/3 kg CO_2/kWhr

$\frac{1}{3} \times 2200 \approx 733$ kg CO_2 produced to power incandescent lights

c) incandescent: 2200 kWhrs × $0.12/kWhr ⇒ ≈ $440/year on lighting

LED: 100W × 6hrs = .600 kWhrs × 365 = 220 kWhrs × $0.12/kWhr ⇒ ≈ $44/year on lighting

$440 − $44 = $396 saved/year on lighting

d) The payback time is about 3 months

$396 = savings ≈ $1/day savings ≈ $80 saved in 80 days ≈ 3 months
$80 = cost of transition

This student did an excellent job, but forgot to allow for the fact that this was only for ½ year… so the cost savings, energy NOT consumed, and carbon NOT emitted should all be cut in half.

e) Cost of conserved: $80/200 kWh = 8/200 = 4/100 = 2/50 ≈ $.04/kWhr

f) Cost of abated: ($80 − $396)/660 kg CO_2 = −$316/.66 Tons CO_2 = 158/−316 · 3/2 ≈ −$474/Ton CO_2

g) LED lights have a very long lifetime so they won't need to be replaced. If you drop them, they won't break like they are really tough. They also don't use toxic substances like mercury. They are powered by DC so you can connect them directly to a solar panel.

Hence the correct answers are:
e) about 8 cents / kWh
f) about - $300 / Ton CO2