

- 1) I'm horrified when I walk in building 53 in the morning to sometimes find that the lights in a room have been left on all night (!!!!). Each lighting tile has (I think) 2 tubes at 40 W per tube, and there are three rows of 6 lighted tiles, meaning 18 lighted tiles, except they're not all working. So, we're talking about 1500 W. Estimate:
 - a) How many Joules of electricity were consumed during the night.
 - b) The financial cost to Cal Poly for this mistake
 - c) The CO₂ emitted into the atmosphere because of the mistake, if the generated electricity is from NGCC. *It's actually worse than this. It turns out that there are four tubes in each rectangular tile at 32 W per tube, or 124 W per lighted tile, or that we are consuming electricity at a rate of about 2200 W when the lights are on.*

- 2) Heat Engines
 - a) How do all heat engines work? Explain: what are the steps that the air goes through to drive a heat engine?

 - b) Please pick *either* the engine in a car, *or* a Rankine cycle (steam turbine). Carefully explain with a good drawing how this works through the steps you describe above – not just a flow chart – please include images so we know how the machine actually works.

 - c) Please draw an energy flow diagram explaining the energy transitions for the device you chose above. Please extend the energy flow back to primary energy, and forward to the final energy form.

- 3) In international negotiations, countries argue about how much CO₂ they're *allowed* to emit.
 - a) I thought that we *wanted* to *reduce* CO₂ emissions. Why would a country want to *increase* CO₂ emissions?

 - b) We learned that China's CO₂ emissions are increasing, but the CO₂ intensity of their economy is decreasing. Please explain how this can happen, what you expect to happen with these trends in the future.

- 4) Natural Gas Combined Cycle
 - a) What is the chief benefit of NGCC

 - b) how do we achieve this great benefit? You don't need to draw the diagram of the entire machine. Just support your answer.

- 5) Why does coal have a bad rap? Why is Coal Dirty? compare Coal vs Natural Gas,
 - a) What do we do we use coal for? That is what is the chief purpose for burning coal?
I didn't word this very well. The answer I was looking for was that we burn it to heat water in a Rankine Cycle to generate electricity.
 - b) Why does Coal put so much more CO₂ into the environment than NG? (two reasons would be best)

 - c) What other pollutants does Coal release that natural gas doesn't?

 - d) Why does coal release these other pollutants?

6) How does an electric motor work? Explain with a drawing.

I was surprised at how many people wrote about an electric generator, or spoke about how you could turn the crank on one motor/generator and it would turn the other motor/generator.

Usually for motors you provide electrical energy either with a battery or a plug-in, and the electric motor turns this into work or kinetic energy. I expected a good drawing with labeled magnets and wires... and even a good commutator.

7) You are turning an electric generator connected to a bunch of lightbulbs, but they are turned off.

As you are generating the electricity, someone turns the lights on.

a) What do you experience?

b) Why do you experience this?