Please complete the following problems on separate paper. Make sure your name, T.A.’s name, and tutorial day (Mon or Wed) is written at the top of your problem set. Show all your reasoning and work legibly, and draw a box around the final numerical or single-word answer where applicable. You may turn your problem set either directly to Professor Harlow or your T.A., or you may drop it in your T.A.’s designated drop box at the base of the stairs outside the lecture hall, in the basement of MP. Any work received after 7:00 PM on the due date will be considered late, and a late penalty will be applied.

1. (2 points) Briefly describe the difference between AM and FM radio.

2.1 (1 point) Porous, unglazed ceramics can absorb water and moisture. Why are they unsuitable for use in a microwave oven?

2.2 (1 point) Why are microwavable dinners packaged in plastic or cardboard rather than aluminum trays?

2.3 (1 point) Why is it so important that a microwave oven turn off when you open the door?

3.1 (1 point) The yellow light from a sodium vapour lamp has a frequency of $5.08 \times 10^{14}$ Hz. How much energy does each photon carry?

3.2 (1 point) A particular X-ray has a frequency of $1.2 \times 10^{19}$ Hz. How much energy does its photon carry?

3.3 (1 point) Which photon could cause more damage to the nucleus of one of your cells?

4. (2 points) When you stand at the edge of a lake and try to look into the water, you mostly see a reflection of the sky. You’re considering designing sunglasses specially designed for fishermen. If you are interested in seeing fish down in the water, is it better to block horizontally polarized light, vertically polarized light, or both? Why?
Some suggested problems (not to be turned in):

Practice 1. You buy a cordless phone that operates at 2.45 GHz, and place it’s cradle next to your microwave oven in the kitchen. If you want to make popcorn while talking on the phone, can you expect problems? If so, why?

Practice 2. In air, green light has a frequency of about $5.5 \times 10^{14}$ Hz and a wavelength of about 520 nanometres. If this light enters a bowl of water, will the frequency change? Will the wavelength change? In both cases, if the answer is yes, will the number increase or decrease?

Practice 3. When astronauts walked on the surface of the moon, they could see the stars even though the Sun was overhead. Why can’t we see the stars while the Sun is overhead?

Practice 4. Why is a pile of granulated sugar white while a single large piece of rock candy (solid sugar) is clear?