

June 21, 2021

1. Exposure to high doses of microwaves can cause tissue damage. Estimate how many photons, with $\lambda=12\text{cm}$, must be absorbed to raise the temperature of your eye by 3.5°C . Assume the mass of an eye is 11 g and its specific heat capacity is $4.0\text{ J/g}^\circ\text{C}$.
2. Molybdenum metal must absorb radiation with a minimum frequency of $1.09\times 10^{15}\text{ s}^{-1}$ before it can eject an electron from its surface via the photoelectric effect.
 - a. What is the minimum energy needed to eject an electron?
 - b. What wavelength of radiation will provide a photon of this energy?

4. Suppose a microwave emits electromagnetic radiation with a wavelength of 11.2 cm. How many photons of radiation are required to heat 200. mL of coffee from 23 °C to 60°C? If the power of the microwave is 900. W (J/s), how long would it take to heat the coffee? (assume the specific heat and density of coffee are the same as water's).

5. What is the maximum number of orbitals (m_l) with:

- a. $n=4$ and $l=1$:**
- b. $n=2$ and $l=2$:**
- c. $n=3$ and $l=2$:**
- d. $n=5$, $l=2$, and $m_l=-1$:**

5. What are the quantum numbers (n , l , and m_l) that can describe a 3p orbital?

6. What are the quantum numbers that can describe a 5d orbital?

7. What is the maximum number of electrons that can occupy each of the following subshells? (Hint: each electron must have a unique set of quantum numbers)

a. 3p:

b. 2s:

c. 5d:

d. 4f: