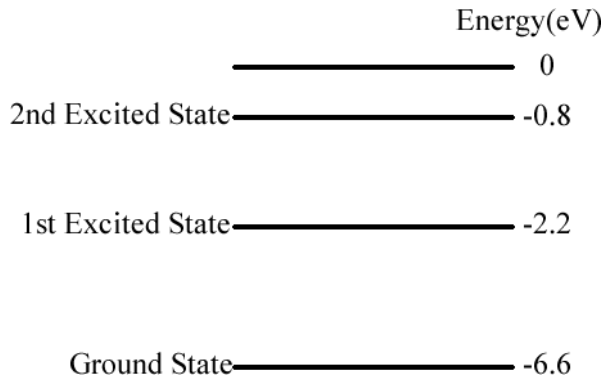
AP Physics
Modern

Name:_____
Period: 2-3A 3B-4 5-6A 6B-7

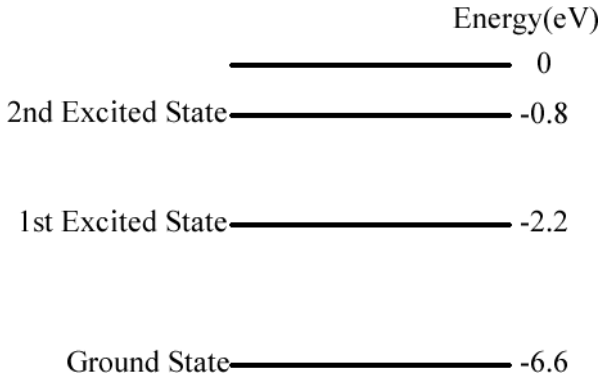
An energy-level diagram for a hypothetical atom is shown below.

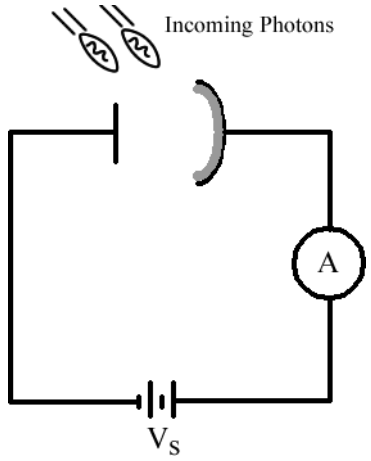


a. Determine the frequency of the lowest energy photon that could ionize the atom, initially in its ground state.

b. Assume the atom has been excited to the state at -0.8 electron volt. Determine the wavelength of the photon for each possible spontaneous transition.

c. Assume the atom is initially in the ground state. Show on the following diagram the possible transitions from the ground state when the atom is irradiated with electromagnetic radiation of wavelengths ranging continuously from 2.1×10^{-7} meter to 10.0×10^{-7} meter.





Electromagnetic radiation is incident on the surface of a material as shown to the left. Photoelectrons are emitted from the surface only for radiation of wavelength 450 nm or less. It is found that for a certain ultraviolet wavelength, which is unknown, a potential V_s of 4 volts is necessary to stop the photoelectrons from reaching the receptor, thus eliminating the photoelectric current.

a. Determine the frequency of the 550 nm radiation.

b. Determine the work function for the material.

c. Determine the energy of the photons associated with the unknown wavelength.

d. Determine the unknown wavelength.

e. If the metal is bombarded by a large range of photons, sketch a graph of the current generated by the photoelectrons as a function of the frequency of the incoming photons.