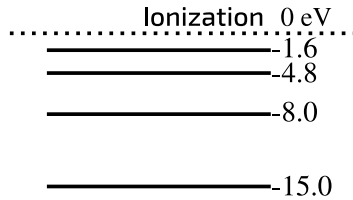


D9 Atomic Spectra

Questions D9.1 to D9.5 concern an atom with energy level diagram below



- D9.1 What energy (in eV) is needed to ionize it when in its ground state?
- D9.2 What wavelength of light would be emitted if an electron descended from the -4.8 eV state to the ground state?
- D9.3 If the atom is in the -1.6 eV state, and the electron descends to the ground state in three separate stages, what is the wavelength of the least energetic photon emitted?
- D9.4 When white light is shone onto a gaseous sample of these atoms, which wavelength will be absorbed as atoms excite from the ground state to the first excited state?
- D9.5 How much energy (in eV) is the atom likely to absorb:
- If a 10 eV photon passes through it in its ground state.
 - If instead the atom starts in the -8.0 eV state. You should give a different answer to part (a) if at all possible.
 - If a 10 eV *electron* passes through the atom in its ground state.

D9.6 to D9.8 concern atomic hydrogen, with energy levels (in electron volts, with respect to the ionization level) $E = -13.6 \text{ eV}/n^2$, where $n = 1$ is the ground state, $n = 2$ is the first excited state etc.

- D9.6
- Give the energy (in eV) of the photon absorbed when the atom is excited from $n = 1$ to $n = 2$.
 - Give the wavelength (in nm) of the photon emitted when the atom de-excites from $n = 3$ to $n = 2$.
- D9.7 How much energy is the atom likely to take from:
- An 11.0 eV photon passing through it?
 - An 11.0 eV *electron* passing through it?
- D9.8 Would the atom be able to absorb a 22 eV photon?