$^9/_{12}$

D9   Atomic Spectra

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

<div style="text-align:center">

Ionization 0 eV
....
——————————————-1.6
——————————————-4.8

————————————-8.0

————————————-15.0

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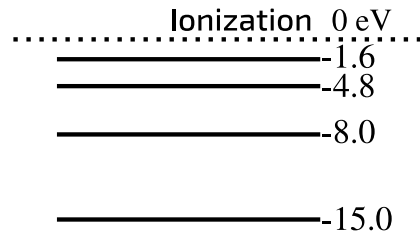
D9.1   What energy (in eV) is needed to ionize it when in its ground state?

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:

    a) If a 10 eV photon passes through it in its ground state.

    b) If instead the atom starts in the -8.0 eV state. You should give a different answer to part (a) if at all possible.

    c) 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) $E = -13.6$ eV/n^2, where n = 1 is the ground state, n = 2 is the first excited state etc.

D9.6   a) Give the energy (in eV) of the photon absorbed when the atom is excited from n = 1 to n = 2.

    b) 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:

    a) An 11.0 eV photon passing through it?

    b) An 11.0 eV *electron* passing through it?

D9.8   Would the atom be able to absorb a 22 eV photon?