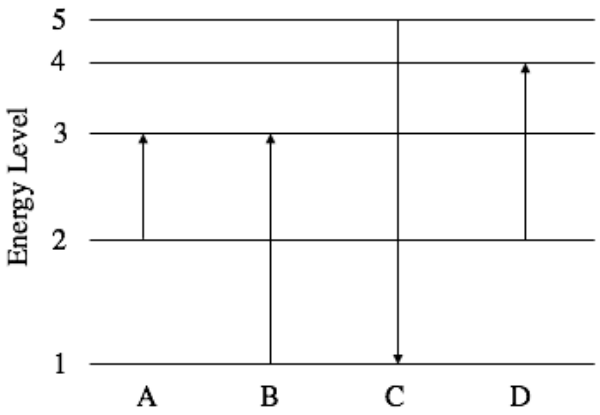
3.091 Introduction to Solid State Chemistry
Fall Term 2018
Quiz 2 (A)
9/20/2018

1) Below is the energy level diagram showing the transitions made by an electron in a hydrogen atom according to the Bohr model.



a) Identify the highest energy absorption indicated among the four electron transitions indicated above and calculate the energy of the photon required to cause the transition in eV. (2 pts)

b) Will a transition starting from n=3 to n=2 emit a photon in the visible light range (390nm-700nm)? Can this photon ionize an electron in the n=3 level? (2pts)

c) Use your spectroscope to look at the lights above you. What is the minimum number of energy levels in a Bohr atom needed to produce these lines? (1 pt)

2) When humans are exposed to sunlight, Ultraviolet-B (UVB) light of wavelength **~295nm** reacts in our skin to make vitamin D (**$C_{28}H_{44}O$**). The recommended daily dose of vitamin D for adults is **0.1mg** which amounts to $1.52 * 10^{17}$ molecules.

   a) It takes **one photon to create one vitamin D molecule**. How many Joules of UVB energy does our body absorb per day to create the necessary amount of vitamin D? (3 pts)

   b) About 2.5 mW ($2.5x10^{-3}$ J/s) of vitamin D - producing UVB light strike our exposed skin when we're outside (with a t-shirt and shorts on).
   If 5% of incident UVB light is utilized by our skin, how long should people spend outside to ensure they get the required dose of vitamin D? (2 pts)

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