In-class activity 13

Assemble Your Group
1.   Find your assigned group members, and sign in below.

Team member: _____   Team member: _____

Team member: _____   Team member: _____

Quantum Leaps
2.   (Cf. Seeds and Backman, *ASTRO3*, Brooks/Cole Cengage Learning (2018), pp. 86-88.)
        Review the "quantum leap" rules for electrons and photons:

An electron can move from a lower to a higher energy level by absorbing a photon.
An electron can move from a higher to a lower energy level by emitting a photon.

On these diagrams, only consider the five lowest permitted orbits/energy levels in a
hydrogen atom, and that the spacing between levels is correlated to the energy of the
photon that is absorbed or emitted.

An electron is currently in energy level 3, as shown at right.
Clearly circle your answers below.

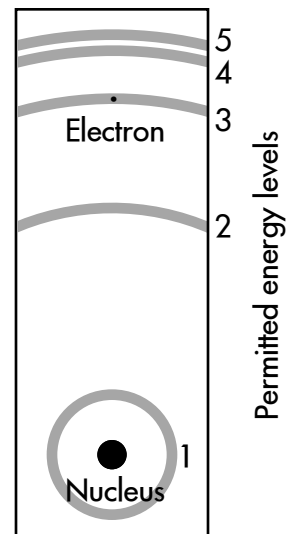(a)   Which electron jump starting from energy level 3 would *emit*

        the *highest*-energy photon? $\begin{vmatrix} 3 \rightarrow 5 \\ 3 \rightarrow 4 \\ 3 \rightarrow 2 \\ 3 \rightarrow 1 \end{vmatrix}$.

(b)   Which electron jump starting from energy level 3 would *emit*

        the *lowest*-energy photon? $\begin{vmatrix} 3 \rightarrow 5 \\ 3 \rightarrow 4 \\ 3 \rightarrow 2 \\ 3 \rightarrow 1 \end{vmatrix}$.

Electron / Nucleus — Permitted energy levels (1–5)

(c)   Which electron jump starting from energy level 3 would *absorb* the *highest*-energy

photon? $\begin{vmatrix} 3 \to 5 \\ 3 \to 4 \\ 3 \to 2 \\ 3 \to 1 \end{vmatrix}$.

(d)   Which electron jump starting from energy level 3 would *absorb* the *lowest*-energy

photon? $\begin{vmatrix} 3 \to 5 \\ 3 \to 4 \\ 3 \to 2 \\ 3 \to 1 \end{vmatrix}$.

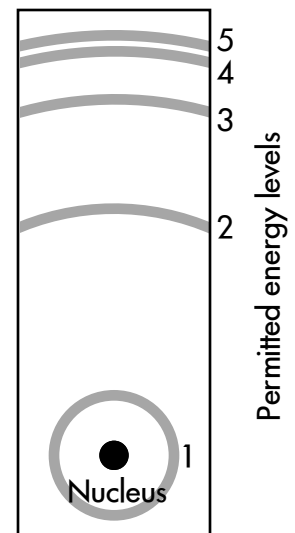Now consider an electron currently in the ground state (energy level 1), as shown at right. Clearly circle your answers below.

(e)   Which electron jump starting from energy level 1 would

absorb the *highest*-energy photon? $\begin{vmatrix} 1 \to 5 \\ 1 \to 4 \\ 1 \to 3 \\ 1 \to 2 \end{vmatrix}$.

(f)   Which electron jump starting from energy level 1 would

absorb the *lowest*-energy photon? $\begin{vmatrix} 1 \to 5 \\ 1 \to 4 \\ 1 \to 3 \\ 1 \to 2 \end{vmatrix}$.

(g)   Explain why it is not possible for a ground state electron to emit a photon, *and* then explain what could happen to this electron in order to be able to emit a photon.

Explanation: