**QUESTIONS & PROBLEMS FOR MODULE 8**

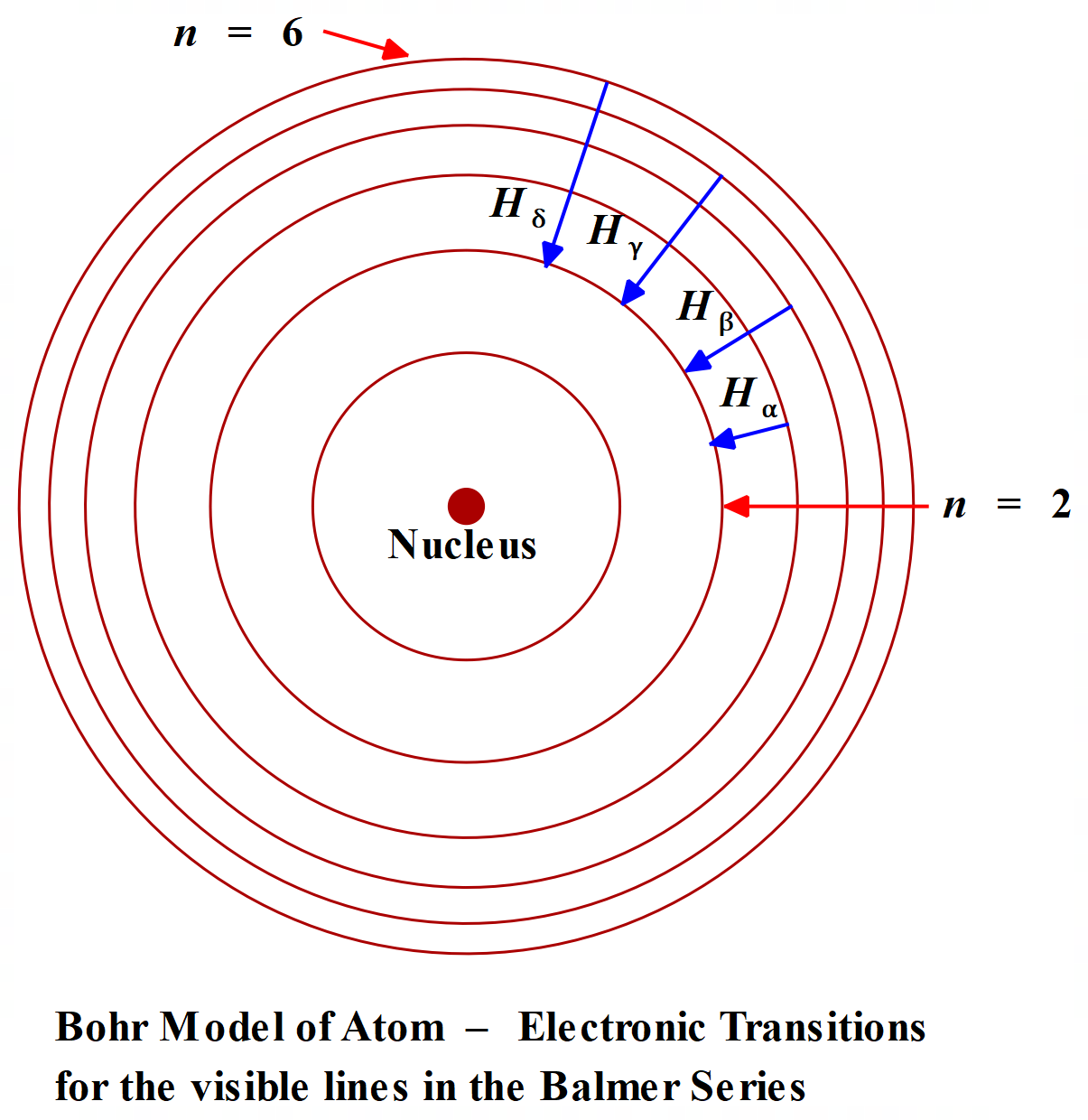
**FROM THE UNIVERSE TO THE ATOM**

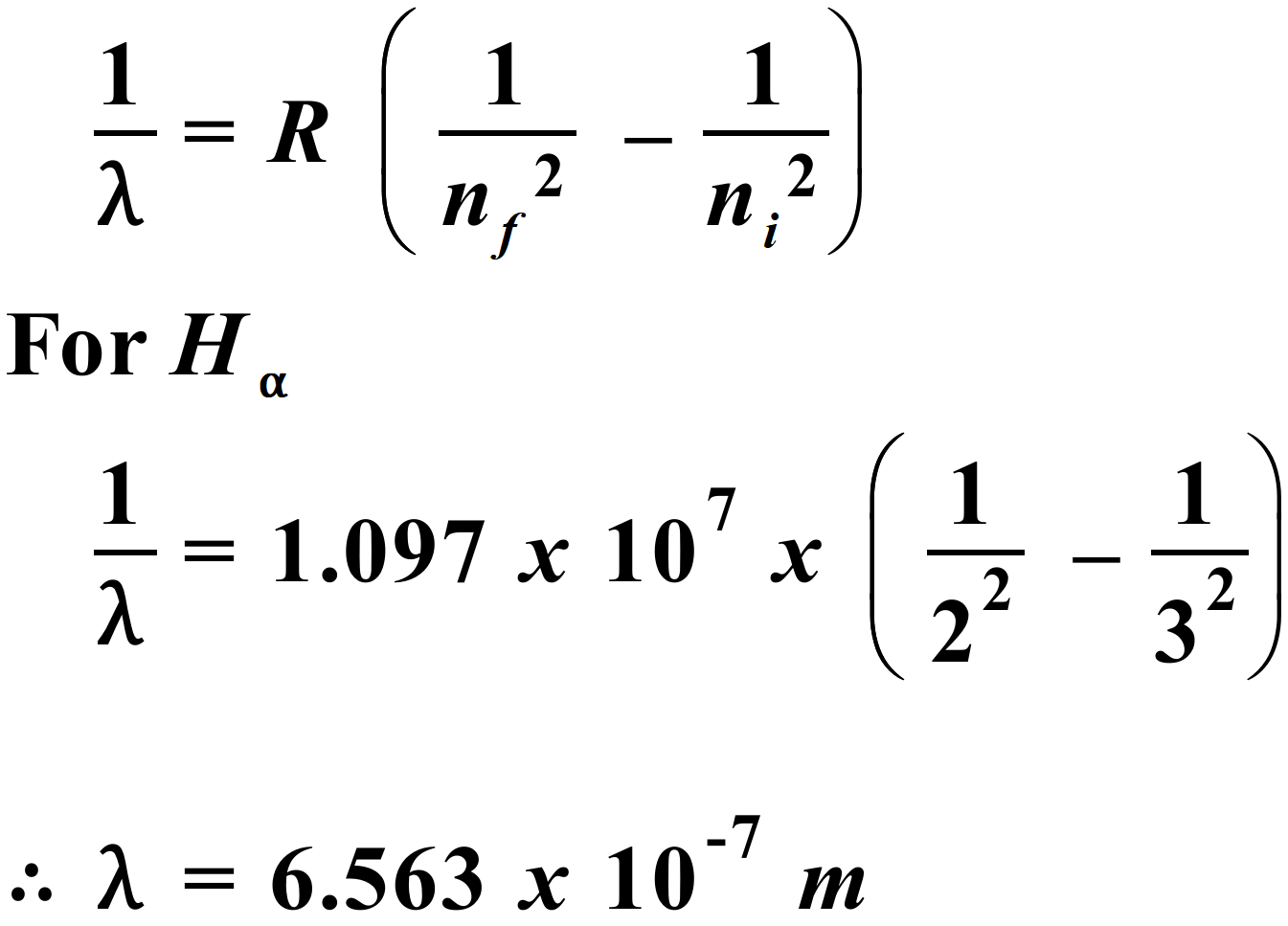
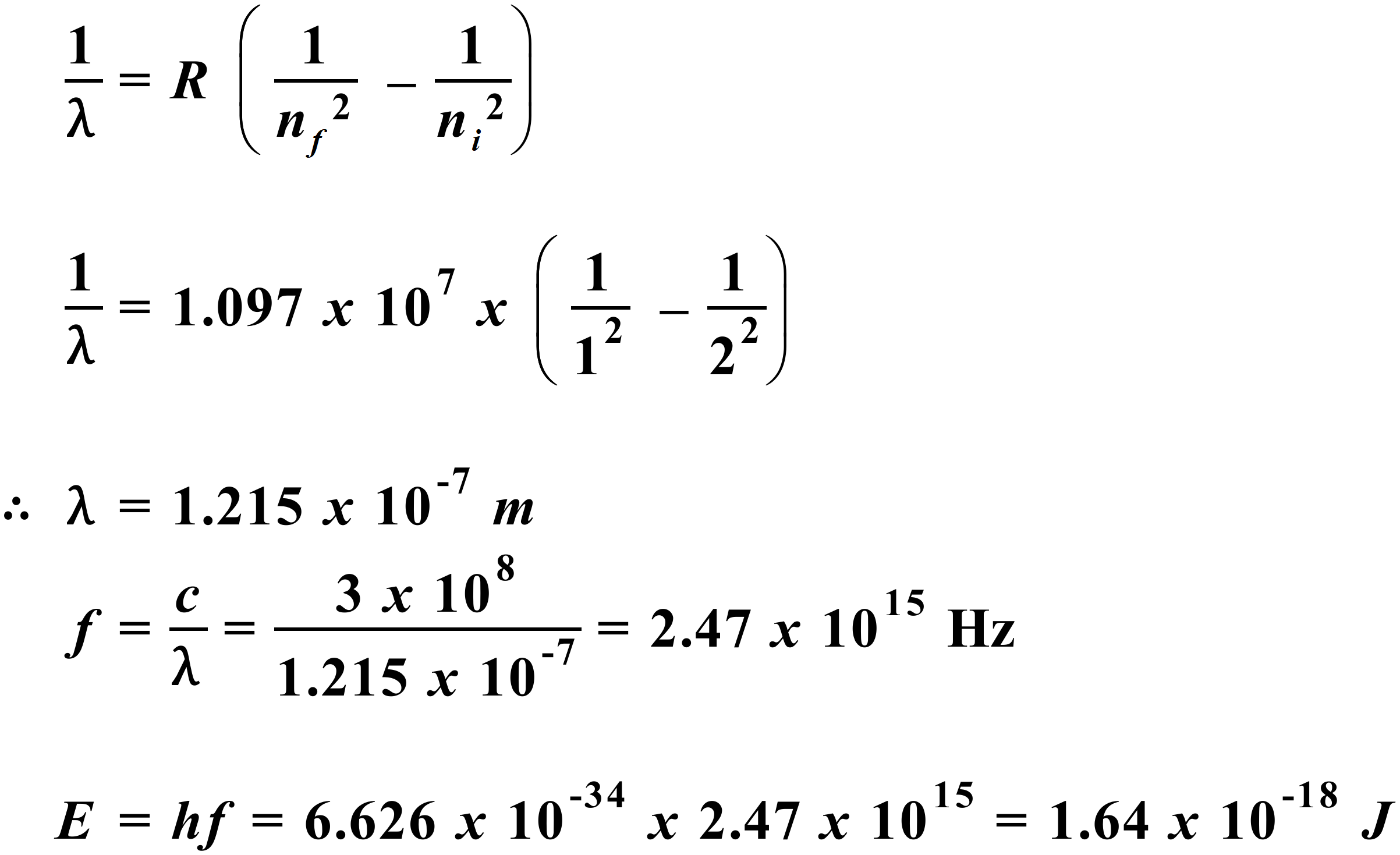
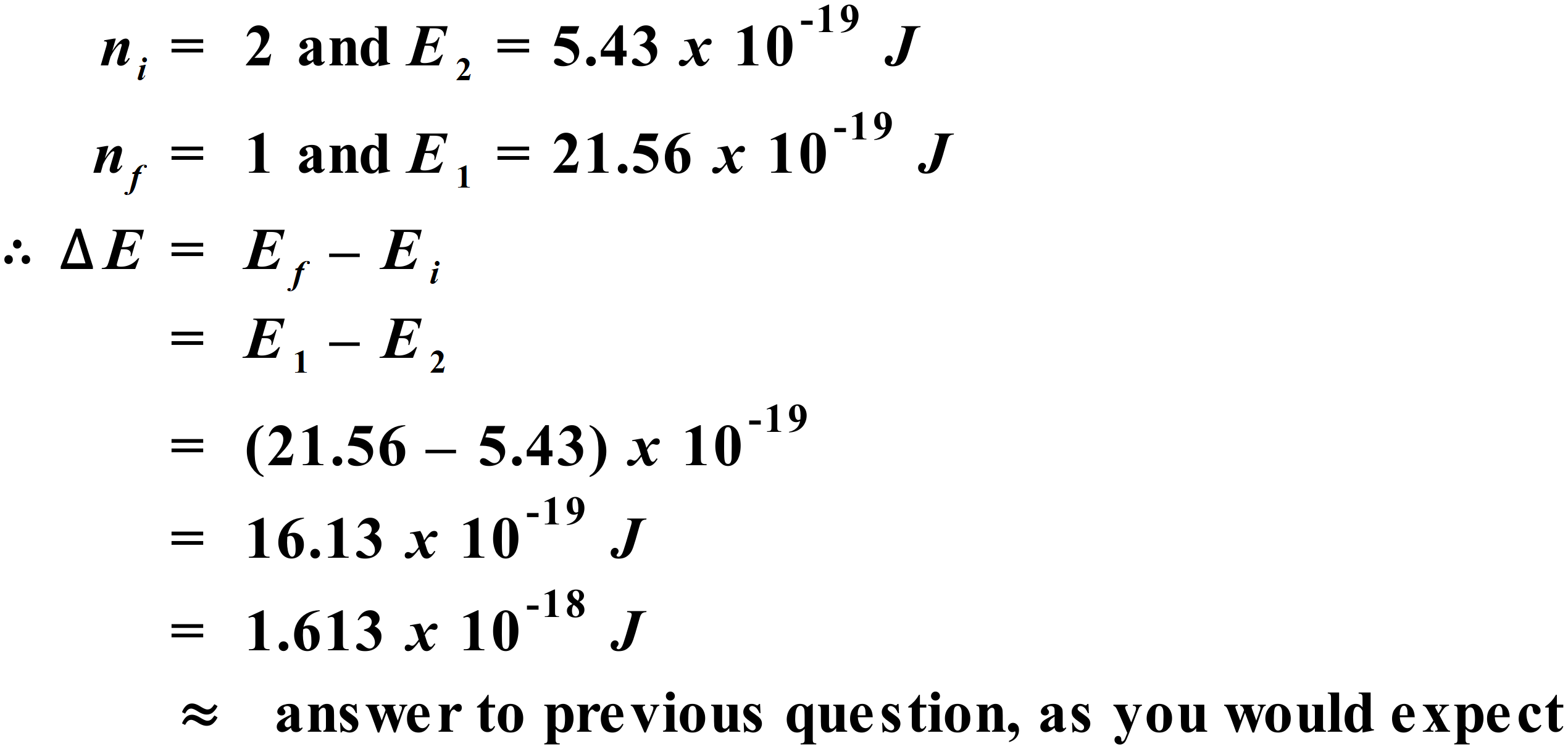
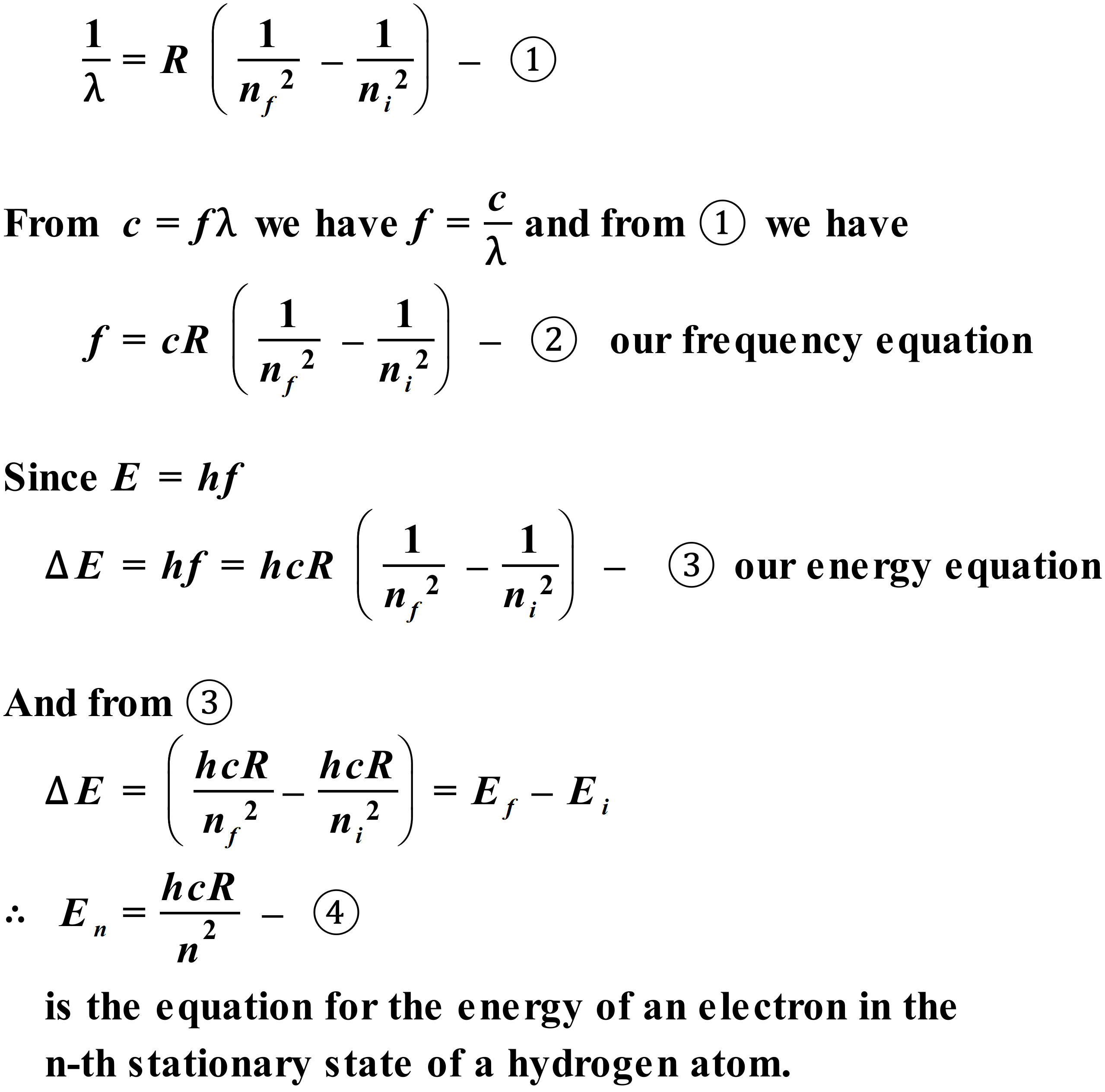
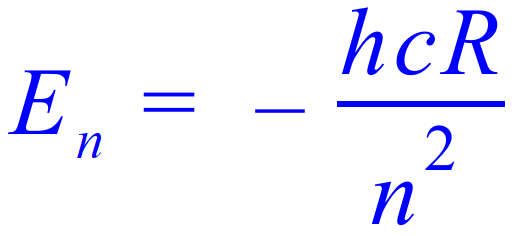
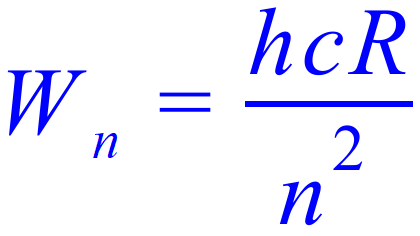
**Worksheet on Bohr’s Model**

1. State the four postulates used by Bohr to explain the nature of the atom.
2. Draw a sketch of the Bohr model of the atom, clearly labelling the electronic transitions responsible for the four visible lines in the hydrogen emission spectrum (H, H, H, & H ).
3. The red line within the Balmer series has a wavelength of 6560Å. 1 Å = 1 x 10-10 m. Identify the initial and final stationary states corresponding to this transition within the hydrogen atom?
4. Calculate the wavelengths of each of the visible lines in the Balmer series for hydrogen.
5. Determine the frequency of the radiation emitted when an electron in a hydrogen atom undergoes a transition from the ni = 2 energy level to the nf = 1 level. Calculate the energy emitted by the electron in making this transition.
6. An electron in a hydrogen atom drops from stationary state n = 2 of binding energy 5.43 x 10-19J to stationary state n = 1 of binding energy 21.56 x 10-19J. Determine the energy emitted by the electron in making this transition.
7. **Extension Question:** Starting with the Rydberg equation, derive equations for the frequency and energy of the radiation emitted when an electron in a hydrogen atom undergoes a transition from stationary state ni to stationary state nf. Hence write an equation for the energy of an electron in the n-th stationary state of the hydrogen atom.

**ANSWERS & SOLUTIONS**

1. See your Module 8 notes page 15.



1. **Red line, Hα**,is produced by the transition **ni** = 3 to **nf** = 2.
2.    
     
   Using same method and **nf** = 2 each time, with progressively **ni** = 4, 5 and 6, we obtain the following values for the other three visible lines in the Balmer series:  
   **Hb: l = 4.862 x 10-7 m; Hg: l = 4.341 x 10-7 m; Hd: l = 4.102 x 10-7 m**.
3. 
4.    
     
     
   Answer to Q7 on next page.
5.   
     
   Note: Strictly speaking,  is the ionization energy for the hydrogen atom and  is the binding energy for hydrogen.