1. Moseley

2. It tells you the ratio of the velocity of n=1 electron to the speed of light

3. He assumed light was absorbed and emitted in quanta.

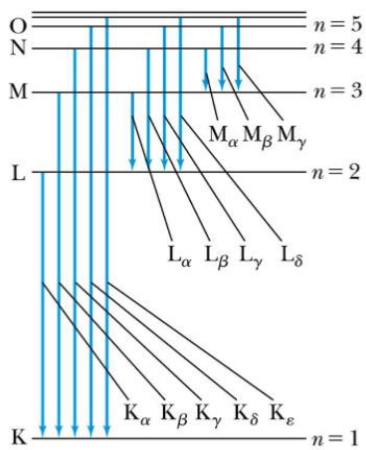
4. a decrease in the necessary stopping voltage.

5. Electrons transitioning down from an outer shell replace electrons ejected from an inner shell

6. P = 180 W, P_γ = 4MeV

$$\frac{180\ J}{1\ S} * \frac{1\ MeV}{1.6E-13\ J} * \frac{1\ Photon}{4\ MeV} = \underline{2.81E14\ photon/s}$$

7. From the O-shell to a vacancy in the M-shell.



8. T = 7562°C = 7835K, const = 2.9E-3 (m*K)

$$\lambda = \frac{const}{T} = \frac{2.9E-3\ m*K}{7835K} = 3.7E\text{-}7\ m = \underline{370\ nm}$$

9. Be+++

10. excitation of a Hg atom to the first excited state.

11. B = 0.032 , λ = 607 nm , $\lambda = \frac{c}{f}$

Note: The signs are flipped because we converted from frequency to wavelength.

$$\lambda' = \lambda\sqrt{\frac{1-\beta}{1+\beta}} = 607\sqrt{\frac{1-0.032}{1+0.032}} \approx \underline{588\ nm}$$

12. a_0 = 0.5E-10(m), r_p = 0.875E-15 (m)

$$r_2 = n^2 a_0 = 4*0.5E\text{-}10(m) = 2E\text{-}10\ (m)$$

$$\frac{r_2}{r_p} = \frac{2E - 10\ (m)}{0.875E - 15\ (m)} = 2.3E5$$

0.01(m)*2.3E5 = <u>2300 (m)</u>

13. All wavelength's scatter the same

14. The nucleus and electron(s) revolve around their mutual center of mass which virtually decreases the apparent mass of the electron.

15. v_0 = 0.5c

$$P_0 = \gamma_0 m v_0 = \frac{1}{\sqrt{1-0.5^2}} * m * (0.5c) = m * 0.577c$$

$$P_1 = 1.5 * P_0 = 0.866c$$

$$v_1 = \frac{P_1 * c}{\sqrt{1+{P_1}^2}} = \underline{0.655c}$$

16. The emission of a photon from an electron being accelerated by a nucleus.

17. $r_n = n^2 a_0$, a_0 = 0.5E-10(m)

$$r_6 = 6^2 * 0.5E\text{-}10(m) = 18E\text{-}10(m)$$

$$D = 2*r = 2*18E\text{-}10(m) = \underline{36E\text{-}10(m)}$$

18. $T = \frac{const}{\lambda}$, const = 2.9E-3 (m*K)

for <u>λ = 9348(nm), T ≈ 310K ≈ 38°C</u>

19. m_p = 938 (MeV/c^2) , m_τ = 1777 (MeV/c^2) , $k = \frac{1}{4\pi\varepsilon}$, $k*e^2$ = 1.44E-15(MeV*m) , ħc = 197 (MeV*fm)

$$\mu = \frac{m_p m_\tau}{m_p + m_\tau} = 613.9(MeV/c^2)$$

$$a_0 = \frac{\hbar^2}{k*\mu*e^2} = \underline{1711.3\ (fm)}$$

Note: for this problem, keeping track of units is *very* important. Using the already precompiled constants and unit conversions located on the tables at the front of the textbook is helpful.

20. λ=500 (nm) , R_{earth} = 1400(W/m^2) , A = 1(m^2) , ϵ = 20% , Φ_{bc} = 1.49(eV)

$$P_{delivered} = R_{earth} * A = 1400(W)$$

$$P_{electrical} = \epsilon * P_{delivered} = 0.2*1400(W) = 280(w)\ \&\ P_{electrical} = V*I$$

$$V = hf - \Phi_{bc} = hc/\lambda - \Phi_{bc} = \frac{1240(eV*nm)}{500(nm)} - 1.49(eV) = \underline{0.99(V)}$$

$$I = \frac{P_{electrical}}{V} = \frac{280(W)}{0.99(V)} = \underline{282.8(A)}$$