PHYS 1020: Physics of Energy

Exam 3 Examples

The Atom

Equations

$$E = hf = \frac{hc}{\lambda} \qquad h = 6.626 * 10^{-34} J \cdot s = 4.136 * 10^{-15}\ eV \cdot s$$

$$E = mc^2 \qquad c^2 = 931.494\ MeV/u$$

$$N = N_0 e^{-rt} \qquad Half\ Life = t_{1/2} = \frac{\ln(2)}{r}$$

$$m_{proton} = 1.0073\ u \qquad m_{neutron} = 1.0087\ u$$

Questions

1. The northern lights are the result of high-energy particles exciting the electrons of gases in the atmosphere, particularly nitrogen. An electron in a Nitrogen atom is excited to a higher state, then drops, releasing a photon with a wavelength of 445 nm (blue). How much energy did this electron release in the photon?

2. How many neutrons are in Krypton-85?

3. If a Krypton-85 atom undergoes alpha decay, what is the resulting element?

4. If a Krypton-85 atom undergoes beta(-) decay, what is the resulting element?

5. If a Krypton-85 atom undergoes beta(+) decay, what is the resulting element?

6. If a Krypton-85 atom undergoes gamma decay, what is the resulting element?

7. Radon-222 has a decay rate of 18.1% per day. What is the half-life of Radon-222?

8. If you have 400 g of Radon-222, how much will you have after 19.25 days?

9. If you have 400 g of Radon-222, how much will you have after one week?

10. If Radon-222 undergoes alpha decay in the following reaction. How much energy is released in this reaction?

$$^{222}_{86}Rn \rightarrow {}^{218}_{84}Po + {}^{4}_{2}He$$

- Mass of Radon-222 = 222.01758 u
- Mass of Polonium-218 = 218.008973 u
- Mass of an alpha particle = 4.0015 u