

Frumeinda- og ljósfræði

Dæmablað 2

Skilafrestur 23. Janúar 2020 kl. 15:00

1. **Gravitational force** (10)

Compare the gravitational attraction of an electron and proton in the ground state of a hydrogen atom to the Coulomb attraction. Are we justified in ignoring the gravitational force?

2. **Photon absorption by hydrogen atom** (10)

Can a hydrogen atom absorb a photon whose energy exceeds its binding energy, 13.6 eV ?

3. **Zeeman effect** (10)

What is the magnitude of the Zeeman shift for an atom in

- (a) the Earth's magnetic field ?
- (b) a magnetic flux density of 1 T ?

Express your answers in both MHz, and as a fraction of the transition frequency $\Delta f/f$ for a spectral line in the visible.

4. **Relativistic effects** (10)

Evaluate the magnitude of relativistic effects in the $n = 2$ level of hydrogen. What is the resolving power $\lambda/(\Delta\lambda)_{\min}$ of an instrument that could observe these effects in the Balmer- α line ?