

# Frumeinda- og ljósfræði

## Dæmablað 1

Skilafrestur 21. Janúar 2021 kl. 15:00

### 1. Vetnisafhleðsla – Hydrogen discharge (10)

Í vetnisafhleðslu sjást litrófslínur sem svara til bæði færslna  $2^2P_{1/2} \rightarrow 1^2S_{1/2}$  og  $2^2P_{3/2} \rightarrow 1^2S_{1/2}$ . Metið styrkhlutfall þessara lína.

In a hydrogen gas discharge both the spectral lines corresponding to the transitions  $2^2P_{1/2} \rightarrow 1^2S_{1/2}$  and  $2^2P_{3/2} \rightarrow 1^2S_{1/2}$  are observed. Estimate the ratio of their intensities.

(Próf apríl 2020)

### 2. Electron in a Thomson atom (10)

Show, for a Thomson atom, that an electron moving in a stable circular orbit rotates with the same frequency at which it would oscillate in an oscillation through the center along a diameter.

### 3. Speed of a proton in a hydrogen atom (10)

Calculate the speed of the proton in a ground state hydrogen atom.

### 4. Isotope shift (10)

The deuteron has approximately twice the mass of the proton. Calculate the difference in the wavelength of the Balmer- $\alpha$  line in hydrogen and deuterium.

5. **Hydrogen series** (10)

(a) Using Balmer's generalized formula, show that a hydrogen series identified by the integer  $m$  of the lowest level occupies a frequency interval range given by

$$\Delta\nu = cR_{\text{H}}/(m + 1)^2$$

(b) What is the ratio of the range of the Lyman series to that of the Pfund series ?