Háskóli Íslands
Raunvísindadeild
Eðlisfræði

Vor 2020

Frumeinda- og ljósfræði

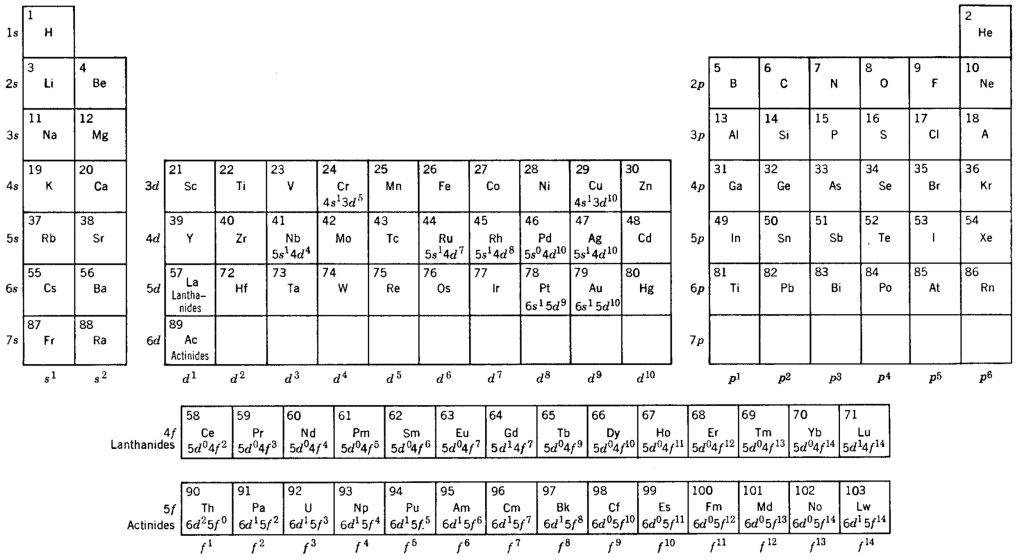
Dæmablað 6

Skilafrestur 25. Febrúar 2020 kl. 15:00

1. **Ground state configurations** (10)

   (a) Use the periodic table below to determine the ground state configurations for the atoms ^{12}Mg, ^{13}Al, and ^{14}Si.

   (b) Then predict the LS coupling quantum numbers for the ground state of each atom. Express your result in spectroscopic notation.



2. **Assign quantum numbers** (10)

   In an atom which obeys LS coupling, the separations between adjacent energy levels of increasing energy in the five levels of a particular multiplet are in the ratios 1:2:3:4. Assign the quantum numbers S, L, and J to these levels.

3. **The Zeeman Effect** (10)

   A collection of hydrogen atoms is placed in a magnetic field of 3.50 T. Ignoring the effects of electron spin, find the wavelengths of the three normal Zeeman components

   (a) of the 3d to 2p transition

   (b) of the 3s to 2p transition

4. **Fine Structure** (10)

   Calculate the wavelengths of the components of the first line of the Lyman series, taking the fine structure of the 2p level into account.

5. **Addition of Angular Momenta** (10)

   Chromium has the electron configuration $4s^1 3d^5$ beyond the inert argon core. What are the ground-state L and S values ?

6. **Hund's rule** (10)

   Using Hund's rules, find the ground-state L and S of

   (a) fluorine ($Z = 9$)

   (b) magnesium ($Z = 12$)

   (c) titanium ($Z = 22$)

   (d) iron ($Z = 26$)