Physikalische Chemie III für Lehramt

Übungsblatt 1

(21.04.2023)

Besprechung 27.04.2023

The Google Colab notebook that we created in our first meeting is here:
https://colab.research.google.com/drive/1RUr8sIqNg4_FjZJ8u04yPN5RJ7lZrOzz?usp=sharing

The following questions for our next meeting are from the textbook *Modern Physics* by Kenneth S. Krane.

1 Photons

(a) What are the energy and momentum of a photon of red light of wavelength 650 nm?

(b) What is the wavelength of a photon of energy 2.40 eV?

(c) What photon energies corresponds to radio-wave frequencies of 1 MHz and 100 MHz? Our bodies are continuously bombarded by photons in this frequency range. Why are they not dangerous to us?

2 Photoelectric effect

The *work function* (Austrittsarbeit) for tungsten metal is $\phi = 4.52$ eV.

(a) A photon that supplies an energy equal to ϕ, exactly the minimum amount needed to remove an electron, corresponds to light of frequency equal to the *cutoff frequency* λ_c. What is λ_c for tungsten?

(b) If the photon energy exceeds the work function, the excess energy appears as the kinetic energy of the electron. What is the maximum kinetic energy of the electrons when radiation of wavelength 198 nm is used?

(c) The voltage corresponding to the maximum kinetic energy is the *stopping potential*. What is the stopping potential in (b)?

3 Double slit experiment

A double-slit experiment is performed with sodium light ($\lambda = 589.0$ nm). The slits are separated by 1.25 mm, and the screen is 2.604 m from the slits. Find the separation between adjacent maxima on the screen.