Week 1 Recitation

BIOCHEM 5722

Course Overview and Ch. 11 Practice Problems

Course Overview

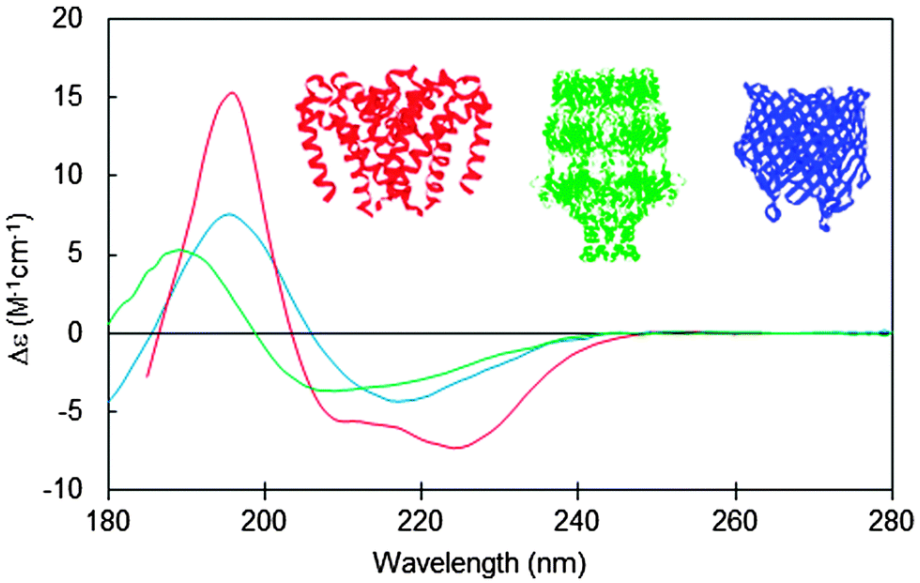
Chapter 11: Molecular Structures and Interactions: Theory

Chapter 12: Molecular Structures and Interactions: Biomolecules

Chapter 13: Optical Spectroscopy

Chapter 14: Magnetic Resonance

Chapter 15: Macromolecular Structure and X-ray Diffraction



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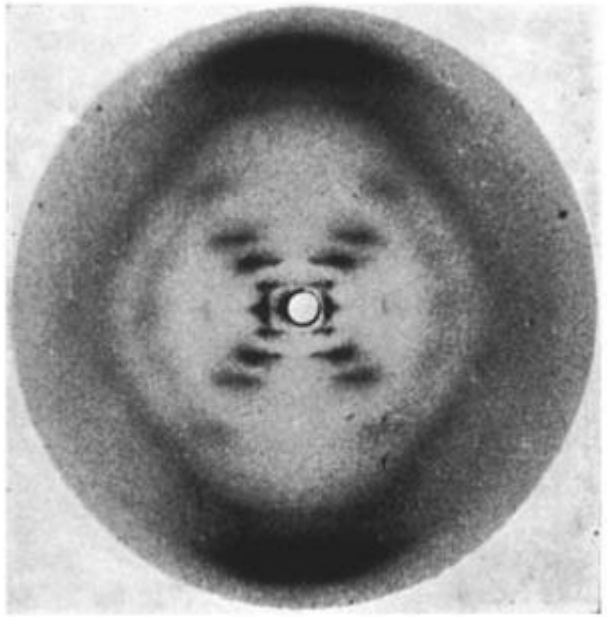

Gosling and Franklin, *Photo 51*.

Questions?

Objectives

1. Work through the recitation questions posted on Carmen.
2. Introduce concepts relevant to the practice problems.
3. Survey class about format of recitation and suggestions for improvement (your preferences are worth stating).

Q1

Electrons have been used to determine molecular structure by diffraction. Calculate the speed of an electron for which the wavelength is equal to a typical bond length, namely, 0.150 nm.

Key Concepts:

- Wave-particle duality
- *de Broglie Relation*: $\lambda = \frac{h}{mv}$

Steps to solve:

1. Write out constants and known variables. Convert to base SI units if using constants (i.e. h or Planck's constant).
2. Rearrange to solve for the unknown variable (i.e. the velocity).
3. Answer: 4.85e6 m/s

Q2

The power per unit area radiated by blackbody per unit area of surface expressed in units of W m^{-2} is given by $P = \sigma T^4$ with σ = 5.67e-8 W m^{-2} K^{-4}. The radius of the sun is 7.00e5 km and the surface temperature is 6000 K. Calculate the total energy radiated per sec by the sun. Assume ideal blackbody behavior.

Key Concepts:

- Blackbody radiation (412-413)
- Identify missing information

Steps to solve:

1. Use the known temperature of the sun to find P.
2. P is in units of power/area; therefore, find the total surface area of the sun (What crucial conversion needs to be made?) Find the product of P and SA.
3. Answer: 4.52e26 W

Q3

The work function of platinum is 5.65 eV. What is the minimum frequency of light required to observe the photoelectric effect on Pt? If light with a 150-nm wavelength is absorbed by the surface, what is the velocity of the emitted electrons?

Key Concepts:

- Photoelectric effect (414)
- Conservation of energy and the work function: $\frac{1}{2}m\boldsymbol{v}^2 = h\boldsymbol{\nu} - \phi$

Steps to solve:

1. The work function is related to minimum frequency by $\phi = h\nu_0$. Solve.
2. Use $\lambda = \frac{c}{\nu}$ and above equation to solve for velocity using λ = 150 nm.
3. Answers: 1.37e15 Hz and 9.59e5 m/s

Questions?

Have a good weekend!