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Spectrophotometers: Optical Instruments

Spectronic 20

Why?

As you continue your studies in chemistry, it will become obvious that spectrophotometers are tremendously valuable in both analytical applications through applications of Beer's Law and sample identification as tools to probe and illustrate properties of molecules. A basic understanding of how these instruments actually work is essential to the development of new instrumental techniques and also simply gives a chemist a better understanding of what happens "inside the box". Throughout the semester we will be examining different analytical instruments and comparing their function.

Learning Objectives

- * Identify the key components a single beam visible spectrophotometer or "Spec 20"
- * Explain the function of the various components of the spectrophotometer.
- * Summarize the key functions of all spectrophotometer components and describe the role each plays in generating a usable spectrum.

Success Criteria

- ❖ Easily locate key components of any spectrophotometer.
- ❖ Discuss the function of each component in terms of the analytical signal generated.

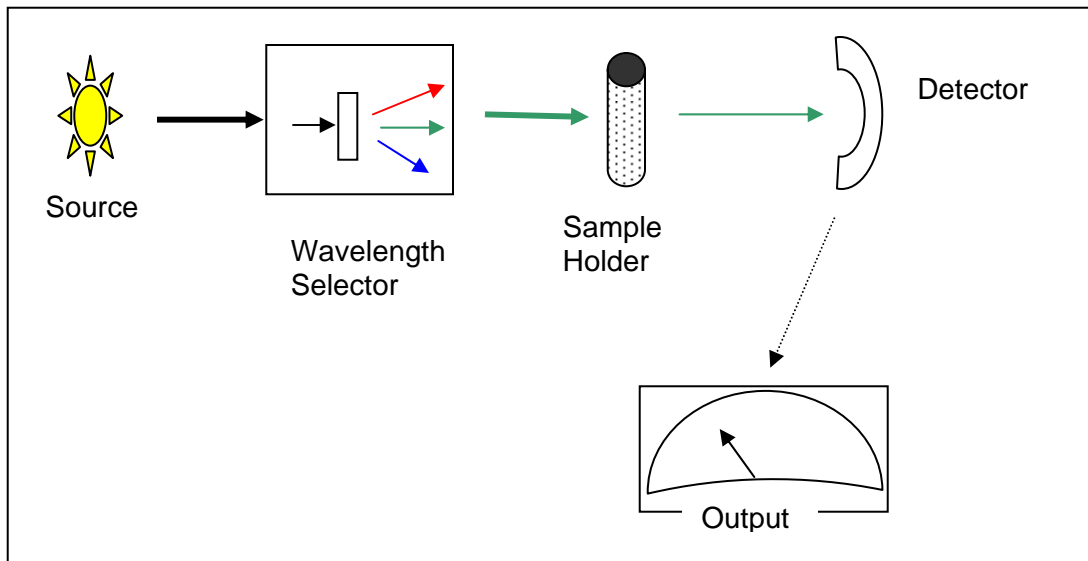
Resources

Robinson, Frame, and Frame (Undergraduate Instrumental Analysis), Chapter 2.
Skoog, Holler, and Nieman (Principles of Instrumental Analysis) Chapters 7 and 13
Bausch and Lohm Instrument manual

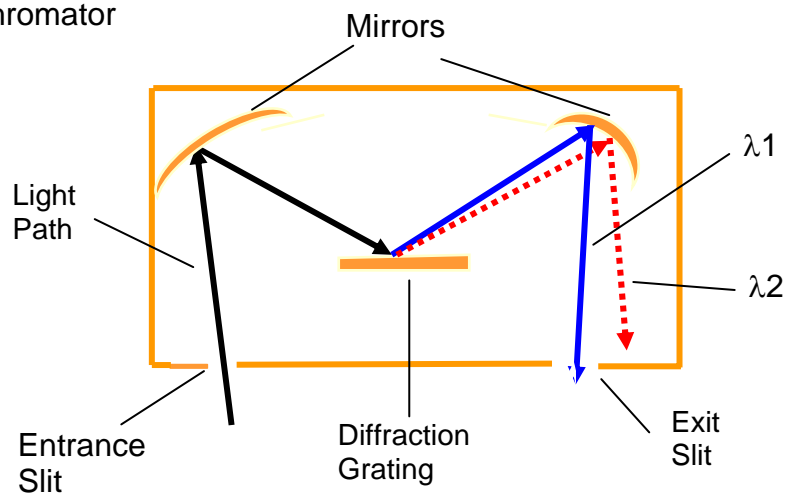
Prerequisites

Electromagnetic radiation

Model 1: Single beam Diagram



Monochromator



Key Questions

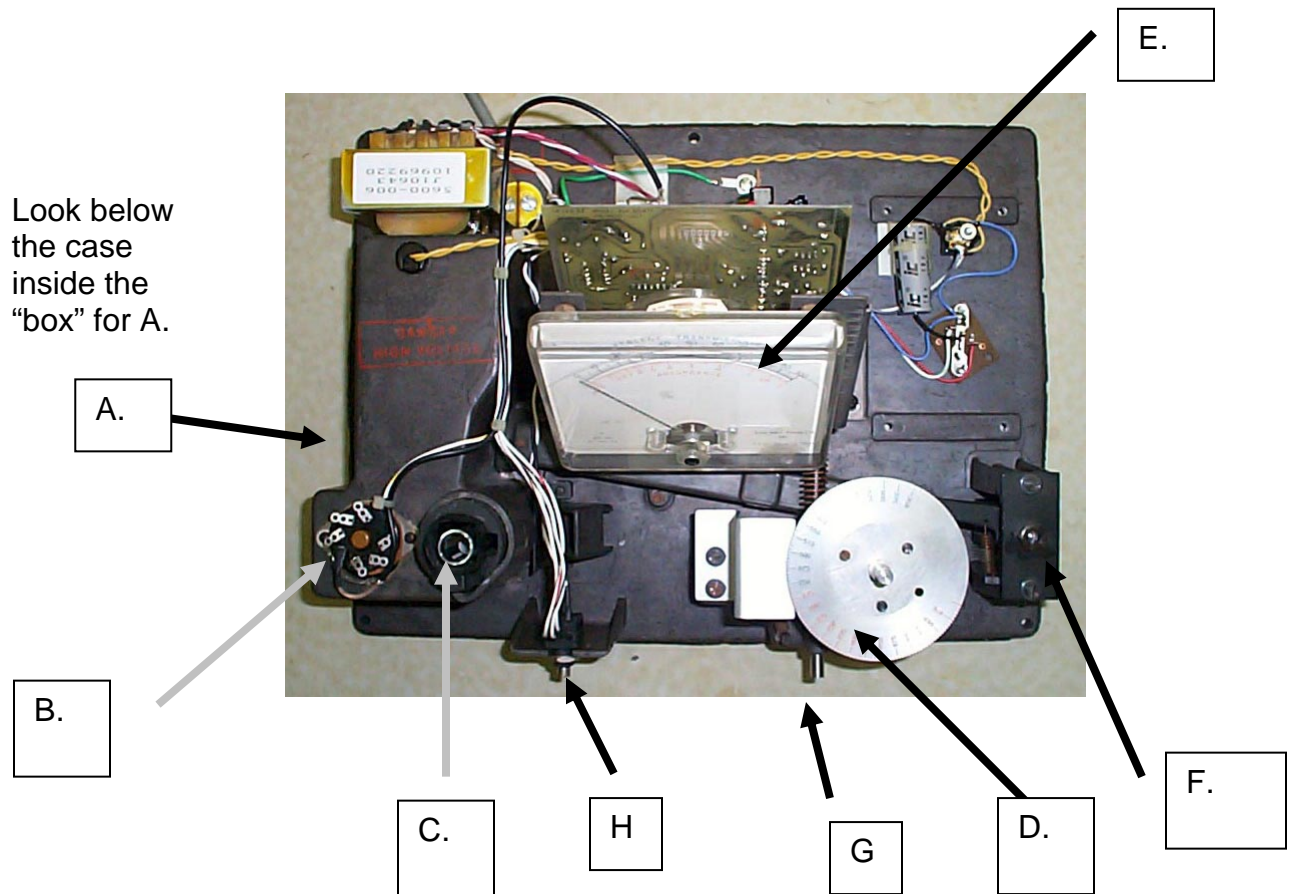
1. What happens to the light as it goes through the sample?
2. In the single beam diagram, what is the difference between the solid arrows and the dotted arrow?

3. What does the diffraction grating do in the monochromator?

4. Why is the exit slit of the monochromator crucial to its function?

Spec 20 UV-vis Spectrophotometer

Examine the inside of the Spec 20 spectrophotometer. Using Model 1 answer the following questions.



Exercises:

1. Identify the following in the picture of the spec-20.

1) Source

2) Monochromator components

3) Detector

4) Output Device

5) Sample Holder

2. Trace the light path in this instrument. Describe what happens to the source light as it “moves” through the instrument.

3. Instructions to zero the instrument: With nothing in the sample holder, turn knob H until the reading is 0% transmittance. Then place a blank in the sample holder and turn knob G until the reading is 100% transmittance.

Describe what happens when you take each step of zeroing the instrument. How does each step effect the light that reaches the detector?

4. What happens when you turn “D”? How is the light path affected by turning “D”?

5. Explain the specific function of each labeled component of this instrument.