

## Infrared Spectra of Plastics

### PA State Standards:

- 1.2.11.A Read and understand the central content of informational texts and documents in all academic areas.
- 3.1.10.C Apply patterns as repeated processes or recurring elements in science and technology.
- 3.4.10.A Explain concepts about the structure and properties of matter.
- 3.7.10.B Apply appropriate instruments and apparatus to examine a variety of objects and processes.
- Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties.

### Introduction:

Infrared (IR) light is electromagnetic radiation with lower energy than visible light. Infrared light can make bonds vibrate, bend, or stretch. Different energies of IR radiation are required to move bonds based on the bond strength and the mass of the atoms involved. A specific grouping of atoms in a molecule, or a functional group, will always absorb the same level of IR energy. Wavenumbers (inverse wavelengths) are used to measure these different energies of IR radiation. In this experiment, you will compare infrared spectra of plastic samples to determine their identities.

This IR uses an ATR accessory. ATR stands for attenuated total reflectance. IR energy from a laser is reflected off a mirror, through the sample, then back down into the instrument. This procedure makes the IR much easier to use, but it does reduce peak size considerably. It will not, however, change the location of the peaks.

### Guiding Question:

Please answer the following question before beginning the lab.

Will infrared spectroscopy be sufficient to positively identify a plastic sample? Why or why not?

### Equipment / Materials:

FTIR	Paper
ATR accessory	Mouse
Plastic samples	Mousepad
Forceps	Keyboard (opt.)
Printer	

### Safety:

- Always wear safety glasses in the lab.

**Procedure:****Getting Started:**

1. Turn on the FTIR with the switch at the back left of the instrument. *The instrument should warm up for a minimum of 15 minutes.*
2. Enter any username. (Ex. Student) Click the configuration Plastics or Plastics Transmittance, then click OK. *(Plastics will have peaks that go up, while Plastics Transmittance will have peaks that go down.)*
3. Click View, and then click Show Report.

**Running a Background:**

1. Twist the pressure device clockwise until it makes a clicking sound. Click Collect, and then click Background.
2. Enter the Spectrum title with the keyboard. (Ex. Background) Press Enter or click OK. Wait for the scan to be completed.

**Running a Sample:**

1. Twist the pressure device counterclockwise to lift it from the surface of the crystal. Using forceps, place a plastic sample on the crystal, then twist the pressure device clockwise until it makes a clicking sound. *If the plastic sample is painted on one side, place the unpainted side on the crystal. Paint will absorb IR energy.*
2. Click collect, and then click Sample. Enter a Spectrum title. Press enter or click OK to begin the scan.

**Analyzing a Sample:**

1. When the scan has been completed, click Analyze, and then click Search Library. Record the library's best match for your sample in the data section. Click OK.
2. Visually determine the best match for your sample. *The visually determined match may or may not be the same as the computer determined match.* To clear any single spectrum that clearly does not match your sample, click on it to turn it red. Click View, and then click Clear Spectrum. Clear any unnecessary spectra from the screen. Do not save.
3. Click File, then click Print. Choose Printer: PCL Inkjet. Choose Orientation: Landscape. Click OK. Label the printout with your names or initials and the date.
4. When finished, clear all spectra for the next sample. Click view, and then click Clear All Spectra. Do not save.
5. Click View again, and then click Clear Report.

