Infrared Light *vs*. Visible Light

OverView

This is a qualitative activity; the only data collection will be the descriptions of the objects the students view. You may have the students record the observations they make in their lab notebooks.

This experiment can be a great opportunity for students to explore their environment with the infrared camera. They will be surprised to find that some objects (like the plastic grocery bag) is transparent in infrared while other objects, such as a window, are opaque to infrared.

While this activity requires the FLIR ONE™ thermal camera, the data collection capability of the Vernier Thermal Analysis for FLIR ONE™ app is not required. Simply using the free FLIR ONE app from FLIR is sufficient. The FLIR ONE app is available on the App Store.

RELATED SKILL

* Observing objects in infrared using FLIR ONE.

Estimated Time

It is estimated that exploration and analysis can be completed in one 45-minute class period.

Next Generation Science Standards (NGSS)

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| Disciplinary Core Ideas | Crosscutting Concepts | Science and Engineering Practices |
| PS4.B Electromagnetic Radiation | Structure and function | Engaging in argument from evidenceObtaining, evaluating, and communicating information |

EQUIPMENT TIPS

1. Charge the FLIR ONE camera before use.

2. The outline of visible objects provided by the visible light camera on the FLIR ONE may be a distraction. Students can cover this camera (it is the one that looks like a camera lens, not the opaque circle) with a piece of masking tape for the duration of this activity. Remove the tape when finished.

3. Plastic grocery bags or black trash bags are a dramatic example of a material opaque to visible light but transparent to infrared.

4. A piece of clear acrylic such as that included in the KidWind Solar Thermal Exploration Kit (order code: KW-STXK. For more information, visit www.vernier.com/kw-stxk) is a good example of a material opaque to infrared but transparent to visible light. Acrylic sheets can also be found at home-improvement stores.

5. If you don't have pieces of window glass, empty beakers can also work well. Look at the beaker from the side as a student slowly places a hand inside it. You should be able to see the hand above the beaker, but not inside it.

Instructor Notes

If you have students working in groups, encourage them to take pictures of the objects they find using the FLIR ONE app.  Students can then share their findings with the rest of the class.

SAMPLE DATA

Examples of objects/materials that students could observe:

Glass/window: transparent to visible light, opaque to infrared. A window can reflect both visible light and infrared and create an image for both (for visible light image reflection, it helps to have one side dark).

Clear plastic: transparent to visible light. Most plastic is opaque for infrared. You can form an infrared mirror image with plastic if it is flat.

Plastic grocery bag or trash bag: opaque to visible light but transparent to infrared.

White board/dry-erase board: this should be able to form a reflected image with infrared (but not visible light).

Answers to ANALYSIS Questions

1. A material can be transparent to visible light, but that does not necessarily mean that it is also transparent to infrared (e.g., glass).

2. There are materials that are transparent to both infrared and visible light.  One example is air as both visible and infrared cameras see through air to create an image.

3. A plastic grocery bag is opaque to visible light but transparent to infrared.

4. You could not use a glass lens to focus infrared light.  The infrared light would not go through the lens so you would not get an image.

5. Objects that create a reflected infrared image are all smooth.  The smoother the surface, the better the infrared reflection.

6. Since the FLIR ONE determines temperature by looking at the infrared spectrum, a glass window is difficult to measure.  You will likely be measuring the temperature of infrared light reflected from the glass and not the temperature of the window.