

SHRINKY DINK PALETTES

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Lesson Summary for Grades 10–12

This activity is designed to provide practice for students using equations for finding wavelength, given values for energy and frequency ($\lambda\nu = c$, $E = h\nu$, and $\lambda = ch/E$). They then apply the results in a creative project to make key rings or earrings.

Science Activity: Shrinky Dink Project

Students practice using the equations for wavelength and energy.

Objectives

1. Provided with data in one form, the students transform the data into another form that is useful in understanding the phenomenon.
2. The students demonstrate understanding of a concept by translating between physical and mathematical representations.

Materials

Per class

- toaster ovens
- jewelry fittings
- key rings
- 4-inch x 5-inch pieces of Shrinky Dinks[®] plastic (one per student)
- single-hole punches
- colored pencils (students may also use permanent markers)

Procedure Notes

1. Fill in two energies and three frequencies in the circles on the palette worksheet using the table below. Make multiple palettes to reduce cheating.

Color	Energy (10^{-19} J)	Frequency (10^{14} Hz)
Red	2.83–3.15	4.29–4.75
Orange	3.16–3.36	4.77–5.07
Yellow	3.38–3.48	5.09–5.25
Green	3.50–3.97	5.28–5.98
Blue	3.99–4.31	6.01–6.51
Indigo	4.34–4.51	6.54–6.80
Violet	4.53–4.96	6.83–7.50

2. Make one of the frequencies outside of the range of visible light (ultraviolet or infrared).
3. Provide background information on seeing color and thermoset plastics on the back of the lab sheet as an FYI section.
4. Buy:
 - Shrinky Dink plastic (available online at *www.shrinkydinks.com* in packages of 10, 8-inch x 10-inch pieces);
 - key rings (available from JoAnn Fabrics); and
 - earring fittings (available from JoAnn Fabrics).
5. Cut each Shrinky Dink plastic sheet into 4, 4-inch x 4-inch pieces (40 pieces per package).

Procedure

See steps on Shrinky Dink worksheet.

Evaluation

Check for:

- appropriate colors on artist palette and calculations from which they were derived;
- proper identification of the value outside of the visible range;
- correct value and calculation for the frequency of their chosen color; and
- quality of the final project.

Handout Masters

Masters for the following handouts are provided:

- Calculations—Worksheet
- Palette—Worksheet

Copy as needed for classroom use.

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Calculations—Worksheet

Name _____

Fill in the blanks using the information from the worksheet and completing the calculation.

1. From Energy (E) to Wavelength (λ):

$$E = h\nu \quad \nu = E/h \quad \lambda\nu = c \quad \lambda = c/\nu \quad \lambda = \frac{c}{E/h}$$

$$\lambda = \frac{ch}{E} = \frac{(3.00 \times 10^8 \text{ m/s})(6.62 \times 10^{-34} \text{ Js})}{\text{_____} \times 10^{-19} \text{ J}} = \text{_____} \times 10^{-7} \text{ m}$$

2. From Frequency (ν) to Wavelength (λ):

$$\lambda\nu = c \quad \lambda = \frac{c}{\nu} = \frac{3.00 \times 10^8 \text{ m/s}}{\text{_____} \times 10^{14} \text{ 1/s}} = \text{_____} \times 10^{-6} \text{ m} = \text{_____} \times 10^{-7} \text{ m}$$

3. From Wavelength (λ) to Frequency (ν):

$$\lambda\nu = c \quad \nu = \frac{c}{\lambda} = \frac{3.00 \times 10^8 \text{ m/s}}{\text{_____} \times 10^{-7} \text{ m}} = \text{_____} \times 10^{15} \text{ 1/s} = \text{_____} \times 10^{14} \text{ 1/s}$$

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Palette—Worksheet

Name _____

1. Calculate the wavelengths for the energies and frequencies written in the circles on the palette.
2. Staple your paper showing all of your calculations to this page.
3. Using the chart below, determine the color of light reflected.
4. Identify the wavelength that is outside the range of visible light. Label that circle as either ultraviolet or infrared.
5. Color in the artist's palette below with the appropriate color for the four that are visible.
6. Draw a design on the Shrinky Dink plastic using these four colors plus one color of your choice. If you plan on using a key ring or jewelry fitting, use a hole punch to make a hole in the plastic before it is shrunken.
7. Calculate the frequency of the light for the color that you choose to add; write that on the line inside the circle and color that circle too.
8. Bake your Shrinky Dink project at 325°F until it has reflattened and stopped shrinking.
9. After "show and tell," tape your finished project to the right of your palette below.

Visible Light Spectrum (wavelength $\times 10^{-7}$ m)

Red	Orange	Yellow	Green	Blue	Indigo	Violet
6.3–7.0	5.8–6.3	5.7–5.9	5.0–5.7	4.6–5.0	4.4–4.6	4.0–4.4

