Performance Task

15.2 The Behavior of Electromagnetic Radiation 16.

Design an experiment to observe the phenomenon of thin-film interference. Observe colors of visible light, and relate each color to its corresponding wavelength. Comparison with the magnitudes of visible light wavelength will give an appreciation of just how very thin a thin film is. Thin-film interference has a number of practical applications, such as anti-reflection coatings and optical filters. Thin films used in filters can be designed to reflect or transmit specific wavelengths of light. This is done by depositing a film one molecular layer at a time from a vapor, thus allowing the thickness of the film to be exactly controlled.

- EYE SAFETY—Chemicals in this lab are poisonous if ingested. If chemicals are ingested, inform your teacher immediately.
- FUMES—Certain chemicals or chemical reactions in this lab create a vapor that is harmful if inhaled. Follow your teacher's instructions for the use of fume hoods and other safety apparatus designed to prevent fume inhalation. Never smell or otherwise breath in any chemicals or vapors in the lab.
- FLAMMABLE—Chemicals in this lab are highly flammable and can ignite, especially if exposed to a spark or open flame. Follow your teacher's instructions carefully on how to handle flammable chemicals. Do not expose any chemical to a flame or other heat source unless specifically instructed by your teacher.
- HAND WASHING—Some materials may be hazardous if in extended contact with the skin. Be sure to wash your hands with soap after handling and disposing of these materials during the lab.
- WASTE—Some things in this lab are hazardous and need to be disposed of properly. Follow your teacher's instructions for disposal of all items.

- A large flat tray with raised sides, such as a baking tray
- Small volumes of motor oil, lighter fluid or a penetrating oil of the type used to loosen rusty bolts, and cooking oil
- Water
- A camera

a. Thin-film interference causes colors to appear on the surface of a thin transparent layer. Do you expect to see a pattern to the colors?
b. How could you make a permanent record of your observations?
c. What data would you need to look up to help explain any patterns that you see?
d. What could explain colors failing to appear under some conditions?

Teacher Support

Teacher Support This performance task supports NGSS HS-PS4-3. Analyze observations to support the assertion that thin films must be of the order of

magnitude of the wavelengths of visible light for thin-film interference to be observed. Explain how variations in film thickness affect the colors produced.

Performance Task Rubric

a. Add just enough water to the tray to completely cover the bottom. Add one or two drops of only one of the other liquids: motor oil, kerosene, or cooking oil.
b. Observe and photograph the results.
c. Thoroughly wash out and rinse the tray and repeat steps (a) and (b) with each of the other liquids.
d. Create a table with one column that lists the colors in order from the center of the film to its edge. In another column, write the approximate wavelength of the color in nanometers.
e. Explain the tabulated results in terms of film thickness.