

“Minerals that do things...”

Hands-on demonstrations of mineral properties

Provided for the Mineral Information Institute by Andrew A. Sicree, Ph.D.

Glow in the Dark Rocks

Object: Formerly, demonstration of the **fluorescence** and **phosphorescence** of minerals under ultraviolet lamps was possible only in a darkened room. New, high-output ultraviolet lamps are much brighter than earlier lamps and the resulting fluorescence and phosphorescence are bright enough, for some minerals, to be seen even in a lighted room. An easily made “dark-box” still helps students observe fluorescence and phosphorescence in minerals with maximum effect, however.



Procedure description: Students place minerals in the dark-box under an ultraviolet lamp and observe the resulting fluorescent colors. If the fluorescence persists after the ultraviolet light is turned off, the phenomenon is known as phosphorescence.

Specimens to test: Willemite and calcite from the Franklin/Sterling Hill Mines in Sussex County, New Jersey, are strongly fluorescent (willemite – green; calcite – red) and are excellent performers for demonstrations. These mines also produce many other fluorescent minerals. Contact the Sterling Hill Mining Museum at (973) 209-7212 for more details.

Other minerals from other localities that are strongly fluorescent include fluorite; opal; halite; chalcedony; scheelite; wernerite; strontianite; calcite; and many more. For more information, contact the Fluorescent Mineral Society (www.uvminerals.org).

Equipment needed: High-output ultraviolet lamp (short-wave is best, or get one with both long- and short-wave bulbs); dark-box. (A dark box can be easily and cheaply made – simply get a large sturdy cardboard box, and spray-paint the interior black. Then cut an access port on top in which to place your UV lamp and a viewing port on the side through which you can look at specimens placed under the UV lamp.)

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Scientific discussion: Fluorescence is the emission of light caused by the excitation of an atom's electrons. Unlike under simple reflection of light, when a material fluoresces, it gives off more light of a given wavelength than it receives in that wavelength. This is possible because the material absorbs light of a higher energy and radiates it at a lower energy. In the case of fluorescence under ultraviolet light, the higher energy input light is the ultraviolet light, and the lower energy output light is in the visible part of the spectrum. Thus you shine an invisible light (UV) on a mineral and it glows with a visible light.

Phosphorescence is delayed emission of light so it continues even after the UV light is turned off.

Fluorescence may occur even under visible light alone. For instance, the "international orange" color that hunters wear for safety is really a fluorescent orange. In this case the orange material absorbs visible light and reemits it as orange. Thus the orange looks brighter than a merely reflective orange. All of the "Day-Glo" colors used in paints and poster papers are fluorescent.

Additional possibilities: It is possible to demonstrate fluorescence in materials that are not minerals. Examples include fluorescent orange safety vests, fluorescent plastic cups, and ultra-bright photocopy papers. Many white fabrics, like those used in cotton T-shirts, have been treated with whiteners and will fluoresce strongly. Driver's licenses and credit cards have hidden marks on them that show up only under UV. Some high-value postage stamps fluoresce green or red (esp. airmail stamps). New \$5, \$10, and \$20 bills (US) have thin fluorescent anti-counterfeit strips in them. The location and fluorescent color of the strip varies from one denomination bill to the next.

Notes for demo tables: If you are doing demonstrations for large numbers of visitors (such as at a booth at a trade show), make up a larger "dark-box" with two or three view ports. I've also found that it is best to use one of the strong high-output UV lamps manufactured by companies such as Way Too Cool, Inc., or UV Systems, Inc. (See the web page of the Fluorescent Mineral Society www.uvminerals.org for dealers that sell these and other lamps.) These lamps are available with long-wave and short-wave UV bulbs. Although they are expensive, these lamps can be used for a wide variety of demonstrations and they will give good results even with minerals that are only weakly fluorescent.