

Fluorescent Minerals Kit



HOME SCIENCE TOOLS
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Explore some minerals' amazing ability to glow under ultraviolet light!

The following materials are included:

- Mineral samples (longwave or shortwave)
- 1 ultraviolet lamp (longwave or shortwave)
- "The Story of Fluorescence" booklet

Safety

Never look directly at the UV lamp when it's on or shine it in anyone's eyes; **ultraviolet light can damage your vision** if you don't use it properly. Shortwave UV, in particular, can "sunburn" your eyes.

Fluorescence, Ultraviolet, & Energy

Electromagnetic Radiation	Visible light, x-rays, radio waves, and the ultraviolet light from the lamp in this kit are all forms of <i>electromagnetic radiation</i> . This is a stream of tiny particles carrying energy; the particles travel in waves at the speed of light – 186,000 miles per second! <i>Visible light</i> ranges from red to violet (all the colors of the rainbow), in wavelengths that the human eye can detect. <i>Ultraviolet</i> (UV) has a shorter wavelength than violet visible light, so it is invisible to our eyes.
	
Radio waves	
Microwaves	
Infrared	
Visible light	
Ultraviolet	Ultraviolet radiation is divided up based on wavelength: longwave UV is closest to visible light. Midwave UV causes suntans (or sunburns). Shortwave UV is used for some medical purposes.
X-rays	
Gamma rays	

Luminescence is the conversion of non-heat energy into visible light. It looks more "glow in the dark" than very bright light. *Chemiluminescence* is energy released in a chemical reaction. Most glow light sticks use this form of energy. *Bioluminescence* is from living organisms. Some marine creatures, like ostracods, emit blue light when the chemicals they release react together in water. *Tribooluminescence* converts mechanical energy to visible light. (Demonstrate this with a wintergreen Lifesaver candy; crush the Lifesaver in a dark room and see the energy converted to bluish light!)

Fluorescence occurs when an object absorbs energy (usually ultraviolet light) and then emits energy at a larger wavelength of electromagnetic

radiation, usually as visible light. Fluorescent minerals, like the ones in this kit, absorb UV and emit visible light.

How do fluorescent light bulbs work? The electric energy flowing through the bulb causes atoms inside the bulb to get “excited,” and as they collide with each other, light energy is given off. This energy is in the form of ultraviolet light, so people can’t see it. But the bulb is coated inside with *phosphor*, which absorbs the UV light and then emits visible light.

UV lamps work similarly, except they have dark purple filters that block most of the visible light and let UV through. Shortwave UV can’t travel through glass very well, so special shortwave lamps have to use very specific types of glass and are thus more expensive.

Experiment 1 – Glowing Rocks

1. Predict what will happen when you shine the UV lamp on the mineral samples in a dark room. What color do you think each mineral will glow?
2. Turn off the room light and shine the UV lamp on the minerals one at a time. What happens? Are the colors what you expected? Can you use the colors of a mineral in natural light to accurately predict what color that mineral will be under ultraviolet light?
3. If you have other rock collections, use the UV light to test them for fluorescence. Use the light to quickly identify any fluorescent minerals you find on rock hunting expeditions.

Not all kinds of fluorescent minerals glow under a longwave lamp (also called a “black light”); some fluoresce only under shortwave UV light. Some minerals, like agates, calcite, corundum, fluorite, gypsum, opal, quartz, scapolite, and talc, only fluoresce when certain impurities (like sulfur) are present. The impurities work as *activators*, absorbing ultraviolet and emitting visible light.

Experiment 2 – Fluorescence Hunt

1. Test objects inside and outside your house to see if they fluoresce under the UV lamp. Some things you might examine are paper products, clothes, plants, and food. Look around your kitchen, bedroom, garage, and yard. Which has the most fluorescent items?

There are many things around you that glow under ultraviolet light. Fluorescence is used in TV screens and PC monitors, laundry detergent, lights, and much more!

Experiment 3 – Brighteners

Many liquid and white powdered laundry detergents make clothes appear brighter using fluorescence. The “optical brighteners” in the detergent are

pigments that absorb UV light and reflect back visible light, making your white clothes look brighter. The blue tinge of the brightener makes your clothes look much better than the yellowish color of old or dirty clothes!

1. Test this with two similar white t-shirts or socks. First, look at them both under the UV light to see how they compare. Then for several washings, use a brightening detergent on one and a non-brightening detergent on the other. Now look at the shirts again. Does the one washed with a brightening agent glow brighter?

Other Experiment Ideas

- Some paper money has designs printed on it in fluorescent dye that is invisible under normal lighting. (This makes counterfeit money easier to identify.) Look at a new \$20 bill under the UV light. You'll see a bright fluorescent strip along one side! If you have large bills in other nations' currency, check those out too.
- Water and glass don't block the UV light - stick one of the minerals in a cup of water and it still fluoresces. Can you find anything see-through that does block UV rays?
- Test how well your sunglasses block UV light! Set them between one of the mineral samples and the UV lamp. Does the mineral fluoresce the same as it does without the shades in front of it?
- Experiment with different strengths of sunscreen to see if one is more effective at blocking UV rays. Spread a coat of sunscreen over a mineral and observe if the fluorescence is lessened.
- Your teeth glow under UV light, but does your toothpaste as well? Compare different toothpastes to see which fluoresce.
- Each kind of mineral has distinctive properties. Examine the outside of each sample in this kit and observe the mineral's transparency: *transparent* minerals are see-through, *translucent* ones let some light through, and *opaque* ones don't let any light through.

You can also test for *hardness*. Minerals in each level of the Mohs hardness scale can be scratched by another mineral of the same or higher level. Talc is the softest mineral; it's very easy to scratch. Diamonds are the hardest and can only be scratched by other diamonds. Use a copper penny (3.5 hardness) and an iron nail (5.5) to scratch each sample. If there's a mark left, the mineral is softer than the object (or other mineral) that scratched it.

Each kind of mineral produces a "streak," the color when it's finely powdered, that is always the same even when the color of the mineral varies. Rub each mineral across a piece of porcelain tile or smooth cement, and examine the color it leaves behind.