Fluorescent Rocks Lesson Plan

Amount of time Demo takes: 3-5 mins.
Try this at home!

Materials
- Tray with 11 rock specimens
- Small plane polarizing filter (in the carton)
- Stamp (in the carton)
- UV light(s)
- Dark box

Set-up Instructions
1. Gently unwrap any specimens you want to use. Some especially good ones are: #1 (nuevo leon calcite), #3 (agrellite), and #11 (another calcite).
2. Place the dark box on the table. Test the UV light(s) to make sure they work.

SAFETY!
- This is less safety and more security; it may be tempting for participants to pocket a rock. Check frequently to be sure they're all there. You won't be able to watch the rocks the whole time, just do your best to keep them from walking off.

Lesson's Big Ideas
- Some rocks emit visible light, ‘glow in the dark’, when they are stimulated by an ultraviolet light. This is because the rocks contain trace amounts of other minerals called activators. The rocks emit different colors based on the minerals present inside them.
- The rocks glow differently under shortwave UV and longwave UV.

Background information
- **Fluorescence** is the property of a mineral to emit light when stimulated by UV radiation (the black light). The light comes from other minerals within the rock being energized by the UV light. **Stoke's Law** governs the fluorescence of materials; the wavelength absorbed is always shorter (higher frequency and higher energy) than the one emitted. This directly
follows a basic law: conservation of energy. Some energy is absorbed by
the material when the light hits it.

- Some of the emitted light from calcite samples is **polarized**; the light waves are traveling in one
  orientation or another (‘up and down’ or ‘side to side’ or any other direction). This is because the
  electric fields of the activated (glowing) atoms are aligned with the lines in the crystal. We can use the
  polar filter to examine this feature, since the filter will let only one ‘direction’ of light wave through.
  The light comes through differently depending on the orientation of the filter.

**Instructional Procedure**

1. Invite students to examine some of the specimens and discuss the
   properties of the rocks (what color is it, is it clear, etc.). Ask students if they
   know what fluorescence means and have them guess what color the rocks
   will glow.
2. Have students place the rocks in the dark box and turn on the UV light!
3. Some of the minerals (the calcites) have polar fluorescence. There is a
   small polar filter in the kit, which you can use to examine such specimens.
   The filter will let light through when held on way, but if you rotate it 90
   degrees... observe the change.
4. There are also tons of real-world examples of things with fluorescent
   material in them provided in the MESTA booklet.

**Assessment/sample questions you can ask**

1. Why do some minerals glow under a UV light?
2. What is polarization?

**Clean Up**

- Turn off the black light and gently wrap the rocks back up in paper towel.
  Put them back in the egg carton and back into the kit.

**References**

- PhysicsClassroom.com
- MESTA Fluorescence guide
Next Generation Science Standards

- K-5
  - 1-PS4-2
  - 4-PS3-2
- 6-8
  - MS-PS4-2
- 9-12
  - HS-PS4-1