Objective: Students will investigate why the sky is blue and the sunset is red.

Warm Up: Why do you think that we see the sky as blue?

Materials:
* A Clear Tall Glass
* A flashlight
* Skim Milk
* Blank white card

Background Information:

The sun produces white light, which is made up of light of all colors: red, orange, yellow, green, blue, indigo, violet. Light is a wave, and each of these colors corresponds to a different frequency, and therefore wavelength, of light. The colors in the rainbow spectrum are arranged according to their frequency: violet, indigo, and blue light have a higher frequency than red, orange, and yellow light.

When the white light from the sun shines through the earth’s atmosphere, it collides with gas molecules. These molecules scatter the light.

The shorter the wavelength of light, the more it is scattered by the atmosphere. Because it has a shorter wavelength, blue light is scattered ten times more than red light.

Blue light also has a frequency that is closer to the resonant frequency of atoms than that of red light. That is, if the electrons bound to air molecules are pushed, they will oscillate with a natural frequency that is even higher than the frequency of blue light. Blue light pushes on the electrons with a frequency that is closer to their natural resonant frequency than that of
red light. This causes the blue light to be reradiated out in all directions, in a process called \textit{scattering}. The red light that is not scattered continues on in its original direction. When you look up in the sky, the scattered blue light is the light that you see.

Why does the setting sun look reddish orange? When the sun is on the horizon, its light takes a longer path through the atmosphere to your eyes than when the sun is directly overhead. By the time the light of the setting sun reaches your eyes, most of the blue light has been scattered out. The light you finally see is reddish orange, the color of white light minus blue.

Violet light has an even shorter wavelength than blue light: It scatters even more than blue light does. So why isn't the sky violet? Because there is just not enough of it. The sun puts out much more blue light than violet light, so most of the scattered light in the sky is blue.

\textbf{Procedure:}

1. Students will write a hypothesis on their \textit{“Blue Sky Lab Sheet”}. They need to explain why they think that the sky is blue and sunsets are red in their paragraph. Take volunteers to read their hypothesis aloud.

2. Fill the tall clear glass with water. Place the flashlight so that the beam shines through the glass. Add a tiny amount of skim milk; stir until you can clearly see the beam shining through the liquid.

3. Look at the beam from the side of the glass and then from the end of the glass. You can also let the light project onto a white card, which you hold at the end of the glass. From the side, the beam looks bluish-white; from the end, it looks yellow-orange.

If you have added enough milk to the water, you will be able to see the color of the beam change from blue-white to yellow-orange along the length of the beam.
4. Students will write down their observations on the "Blue Sky Lab Sheet." And then write a conclusion based on their results.

**Evaluation:** Observation of Lab Work and Review of "Blue Sky Lab Sheet".

**Homework:** Finish conclusion for "Blue Sky Lab Sheet"
Write your hypothesis about the blue sky and red sunsets below.

Hypothesis: ______________________________________________________
________________________________________________
________________________________________________

Write down any observations you saw when doing the experiment in the boxes below. Tell what you saw as well as where you saw it in the glass.

Observations:

<table>
<thead>
<tr>
<th>Blue Sky</th>
<th>Observations</th>
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</thead>
<tbody>
<tr>
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<table>
<thead>
<tr>
<th>Red Sunset</th>
<th>Observations</th>
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Conclusion: ______________________________________________________
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