



**Reading Supports**

**Teacher’s Guide:**

**“Rocking Shades   
in the Winter”**

*December 2018/January 2019*

<http://www.acs.org/chemmatters>



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# Reading Supports

The pages that follow include reading supports in the form of an Anticipation Guide, a Graphic Organizer, and Student Reading Comprehension Questions. These resources are designed to help students prepare to read the article, and then locate and analyze information from the article.

* **Anticipation Guide (p. 5):** The Anticipation Guide helps to engage students by activating prior knowledge and stimulating student interest before reading. If class time permits, discuss students’ responses to each statement before reading each article. As they read, students should look for evidence supporting or refuting their initial responses.

**Or** consider the following ideas to engage your students in reading:

**Rocking Shades in the Winter**

* Before reading, ask students why they might need sunglasses or goggles when going outside on a snowy day.
* As they read, students can compare their original ideas to information in the article. Ask students to write how chemistry can help protect their eyes when they are outside.
* **Graphic Organizer (p. 6):** The Graphic Organizer is provided to help students locate and analyze information from the article. Student understanding will be enhanced when they explore and evaluate the information themselves, with input from the teacher, if students are struggling. Encourage students to use their own words and avoid copying entire sentences from the article. The use of bullets helps them do this.

If you use the aforementioned organizers to evaluate student performance, you may want to develop a grading rubric such as the one below.

|  |  |  |
| --- | --- | --- |
| **Score** | **Description** | **Evidence** |
| 4 | Excellent | Complete; details provided; demonstrates deep understanding. |
| 3 | Good | Complete; few details provided; demonstrates some understanding. |
| 2 | Fair | Incomplete; few details provided; some misconceptions evident. |
| 1 | Poor | Very incomplete; no details provided; many misconceptions evident. |
| 0 | Not acceptable | So incomplete that no judgment can be made about student understanding |

* **Student Reading Comprehension Questions (p. 7):** The Student Reading Comprehension Questions are designed to encourage students to read the article (and graphics) for comprehension and attention to detail, to provide the teacher with a mechanism for assessing how well students understand the article and/or whether they have read the assignment, and, possibly, to help direct follow-up, in-class discussion, or additional, deeper assignments.

Some of the articles in this issue provide opportunities, references, and suggestions for students to do further research on their own about topics that interest them.

To help students engage with the text, ask students which article **engaged** them most and why, or what **questions** they still have about the articles. The “Web Resources for More Information” section of the Teacher’s Guide: Tools and Resources provides sources for additional information that might help you answer these questions.

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

## Anticipation Guide

**Directions: *Before reading***, in the first column, write “A” or “D” indicating your agreement or disagreement with each statement. As you read, compare your opinions with information from the article. In the space under each statement, cite information from the article that supports or refutes your original ideas.

|  |  |  |
| --- | --- | --- |
| **Me** | **Text** | **Statement** |
|  |  | 1. Your eyes need protection from UV radiation. |
|  |  | 1. Each color of visible light has a different wavelength. |
|  |  | 1. The longer the wavelength of light, the higher the energy of light. |
|  |  | 1. The atmosphere blocks most of the UV radiation coming from the sun. |
|  |  | 1. Polarized lenses block all UV radiation. |
|  |  | 1. The most energetic type of UV ray is UVA. |
|  |  | 1. Polycarbonate lenses block UV radiation. |
|  |  | 1. Polycarbonate lenses reduce glare. |
|  |  | 1. Photochromic lenses become dark when UV light is absorbed. |
|  |  | 1. The American Academy of Ophthalmologists recommends eyewear that provides 95% protection from UV rays. |

## Graphic Organizer

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: As you read the article, complete the graphic organizer below to describe the materials used to make outdoor eyewear.

|  |  |  |
| --- | --- | --- |
| **Lenses** | **What are they made of?** | **How do they work?**  **Are they UV protective?** |
| **Polarized lenses** |  |  |
| **Polycarbonate lenses** |  |  |
| **Photochromic lenses** |  |  |

**Summary:** On the back of this paper, write a short email to a friend describing your choice for outdoor eyewear, with reasons.

## Student Reading Comprehension Questions

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Directions**: Use the article to answer the questions below.

* 1. How should people protect their eyes from UV radiation?
  2. What are photons?
  3. How are (a) wavelength and (b) frequency of an electromagnetic wave defined?
  4. (a) Name the process of separating white light into different colors, and (b) explain how a prism can separate white light into those colors.
  5. In an electromagnetic wave, what is the relationship between its wavelength and its energy?
  6. What four injuries may occur to people’s eyes when they spend long hours in the sun or when their eyes are exposed to highly reflective surfaces like snow or water?

**Student Reading Comprehension Questions, cont.**

* 1. (a) How does polarization work to reduce glare, and (b) is polarization effective in protecting eyes from UV rays? Explain your answer to part (b).
  2. (a) Name the three types of UV light, and (b) identify the type that is primarily responsible for causing sunburns.
  3. List four reasons why polycarbonate is commonly used for lenses.
  4. Explain how the photochromic compound naphthopyran works to darken sunglasses in sunlight.
  5. What are five advantages of using naphthopyrans as darkeners in glasses?

**Critical-Thinking Questions**

***Write your answers on the back of this sheet or on a separate sheet of paper.***

1. List and explain five factors from the article that a wise consumer should consider when purchasing sunglasses to prevent possible cataract damage.
2. What part of the Earth’s atmosphere plays a role in the formation of cataracts in the human eye, and how does it do this?

## Answers to Reading Comprehension Questions

1. **How should people protect their eyes from UV radiation?**

To protect their eyes from UV radiation people should wear the right sunglasses or goggles that shield against UV rays.

1. **What are photons?**

Photons are bundles of energy that travel at the speed of light in electromagnetic waves.

1. **How are (a) wavelength and (b) frequency of an electromagnetic wave defined?**
2. The wavelength of an electromagnetic wave is the distance between one wave’s crest and the next.
3. The frequency of an electromagnetic wave is the number of cycles (or complete waves) that pass a reference point during a specified time period.
4. **(a) Name the process of separating white light into different colors, and (b) explain how a prism can separate white light into its different colors.**
5. A prism separates white light into different colors by the process of dispersion
6. The individual colors in white light have different wavelengths, frequencies, and energies, all of which allow the prism to bend or refract the individual colors differently. This bending causes the white light to separate into its different colors.
7. **In an electromagnetic wave, what is the relationship between its wavelength and its energy?**

In electromagnetic waves, as the wavelength gets shorter, the energy gets higher.

1. **What four injuries may occur to people’s eyes when they spend long hours in the sun or when their eyes are exposed to highly reflective surfaces like snow or water?**

Four injuries that may occur to people’s eyes when they spend long hours in the sun, snow, or water are

1. cataracts,
2. growths on the eyes,
3. cancers, and
4. blindness.
5. **(a) How does polarization work to reduce glare, and (b) is polarization effective in protecting eyes from UV rays? Explain your answer to part (b).**
6. Polarization works to reduce glare by filtering out some of the light waves.
7. Polarization is *not* effective in protecting eyes from UV rays; it only reduces the quantity of light reaching the eyes and does not block the wavelengths of UV that cause damage.
8. **(a) Name the three types of UV light, and (b) identify the type that is primarily responsible for causing sunburns.**
9. The three types of UV light are
10. UVA,
11. UVB, and
12. UVC, and
13. UVB is the type of UV light that is responsible for causing sunburns.
14. **List four reasons why polycarbonate is commonly used for lenses.**

Four reasons that polycarbonate is commonly used for lenses are that it is

1. clear,
2. lightweight,
3. durable (or impact resistant), and
4. a natural UV filter.
5. **Explain how the photochromic compound naphthopyran works to darken sunglasses in sunlight.**

Naphthopyran works to darken sunglasses in sunlight by absorbing sunlight’s energy, which causes the molecule’s structure to change. This change produces a new structure that absorbs the visible light and darkens the sunglasses.

1. **What are five advantages of using naphthopyrans as darkeners in glasses?**

Five advantages of using naphthopyrans as darkeners in glasses are

1. they are very sensitive to light,
2. they can be synthesized easily,
3. they are low cost,
4. they can be used in a variety of applications, and
5. their reaction to darkening is reversible.

**Critical-Thinking Questions**

1. **List and explain five factors from the article that the wise consumer should consider when purchasing sunglasses to prevent possible cataract damage.**

Factors that a wise consumer should consider when purchasing sunglasses to protect the eyes could include

1. the ability of the sunglasses to block 100% of both UVA and UVB rays because these rays are known to cause cataracts;
2. the composition of the sunglass lenses because lens materials like polycarbonate are natural UV inhibitors, as well as being shatter resistant;
3. the design and size of the sunglass lenses because styles that fully cover the eyes and restrict any light leaking into the eyes from around the edges of the glasses offer better protection;
4. the comfort of the glasses because glasses that are more comfortable will encourage people to wear them longer and more often;
5. the style of the sunglasses because, if people like and feel good wearing the glasses, they will be more likely to wear them;
6. whether the glasses are photochromic because, if they darken automatically in sunlight, they will offer effortless protection without needing to remember to put on special glasses; and
7. whether the sunglasses are polarized because polarization reduces glare (not UV) and makes it easier to see clearly and avoid accidents.
8. **What part of the Earth’s atmosphere plays a role in preventing the formation of cataracts in the human eye, and how does it do this?**

The Earth’s stratospheric ozone layer acts as a protective layer and filters out most of the UV rays traveling toward Earth. The UVC rays are absorbed by the atmosphere before they reach the surface, so, even though they are the highest energy UV rays, they are not as great of a concern for cataract formation. However, UVA and UVB rays do reach the surface of the Earth. UVA rays account for 95% of the UV rays reaching the surface, and they can penetrate to the second layer of the skin. Therefore, with this penetrating ability, they may be more likely to reach the lens of the eye where cataracts are formed. The UVB rays are not as numerous, but are higher in energy, so they, too, are concerns for cataract formation in human eyes. Without the ozone layer, which would allow UVC rays to reach Earth, there would certainly be many more cataracts and eye problems.