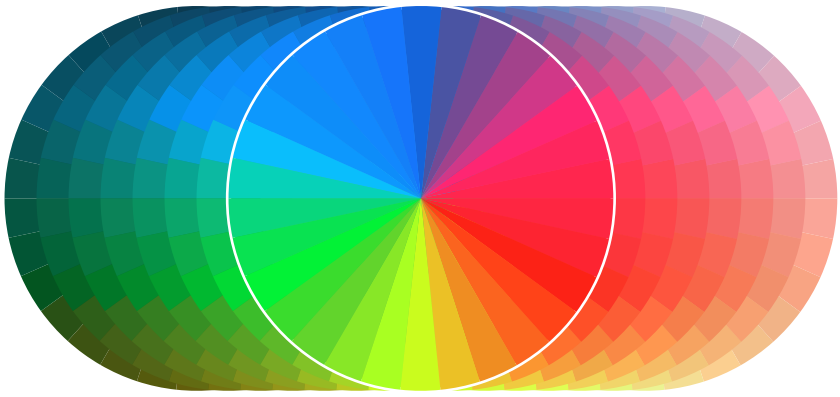
BIG IDEA

5.0

The visible light spectrum is made up of different colours. Colours hold special meaning for First Nations and Métis peoples.

We live in a world filled with colour. From sunsets to clothing to the images seen in movies and television, colour defines and accents what people see. But what is colour? Why are there different colours? Why do certain lights change the colour of an object? Why are colour television images different from images in photographs and on film?

So far, you have learned how light travels, reflects, and refracts. You have been considering the brightness of light and the images it forms. But these properties are only part of the story of light. You need to explore this world in colour.



The human eye can see millions of colours.

How many colours can you see in this sunset?

5.1 The World in Colour

EXPLORE

Make a list of all of the words you could use to describe a colour to someone else. Compare your list with others, adding any new words. Which words did most people include in their lists? Circle any words that have to do with light. How do you know that the words have anything to do with light?

Light and Colour

Think of what it is like to wake up just before sunrise. There is enough light to see what is around you, but everything appears either grey or black. Then, when the sun rises, or you turn on a light, the room is filled with colour. So, light is necessary for your eyes to see colour, but why?

Think about a light source such as the Sun. Your eye can detect light either directly from a light source or when this light source is reflected back to your eye by some object. What colour is a beam of sunlight? You probably answered, "White." However, that's not quite the whole picture. In the next activity, you will use refraction to find out for yourself.

PROBLEM SOLVER

The Colour of Light

A **prism** is a transparent body often made of glass, with ends that are equal and parallel triangles, and other faces that are parallelograms. Recall what you have learned about the refraction of light through glass: *Light changes direction when it enters or leaves glass.*

In a small group, collaborate on the following procedures and questions.

- Shine a light ray through a prism. What does your group observe?
- Place a second prism in the path of light leaving the first prism. What does your group observe?
- Turn the second prism in different ways. Compare the results.
- Draw a coloured sketch in your Science Journal.

1. What colours did your group find in the light ray?
2. With your group, create a mnemonic that will help you remember the order in which the colours appear.
3. What happened when your group used two prisms in combination?

*info*BIT

Sundogs and Haloes

A *sundog*, or solar halo, is a glowing, coloured image sometimes seen near the Sun. Small ice crystals that are present in the high atmosphere act like prisms and refract light from the Sun. This creates two patches of colour on either side of the Sun. Sundogs are so named probably because the Sun and the patches move together in much the same way as a person walking a dog. Haloes can also be seen around the Moon.

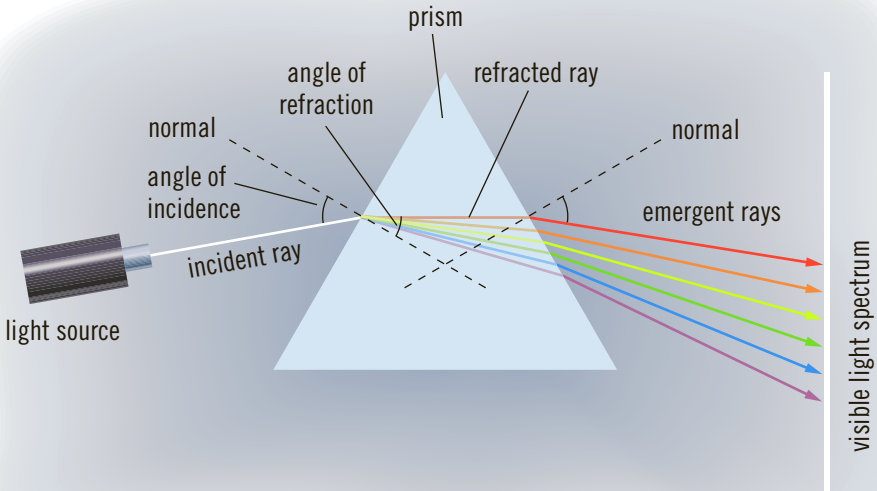
CAUTION!
To best see a sundog, you should wear protective glasses (not sunglasses!) to view the Sun directly.

DEVELOP

The Colour Spectrum

When you used a prism to refract a light ray, you were able to split light into its colours. A rainbow is created in the same way. A **rainbow** is formed as sunlight changes direction as it enters single raindrops. Inside the raindrop, the coloured rays are bounced off the inside wall, which acts like a mirror and reflects the rays back out again. As the rays leave the raindrop and return to the air, they change direction again. The result is a band of colours across the sky.

The colours of light together form the **visible light spectrum** red, orange, yellow, green, blue, violet (ROYGBV). Every colour you see is a mixture of these colours. How can the spectrum produce hundreds of thousands of different colours? In the next activity, you will investigate this for yourself.



Follow the path taken by light as it moves through this prism. Why were normals included in this diagram? Compare this with what happens when you shine a light along the normal into a glass block and at other angles of incidence.

INVESTIGATOR

Mixing Coloured Lights

Before You Start ...

Have you ever mixed coloured paints together to make different colours? For example, when you mix red paint and yellow paint together, you make orange paint. What do you think would happen if you mixed the same coloured lights? Would you get the same results?

In the following experiment, you and your group members will work together to set up the equipment, collaborate on the questions in the Analyzing and Interpreting section, and reach a conclusion.

The Question

What colours can you make using red, green, and blue light?

Materials & Equipment

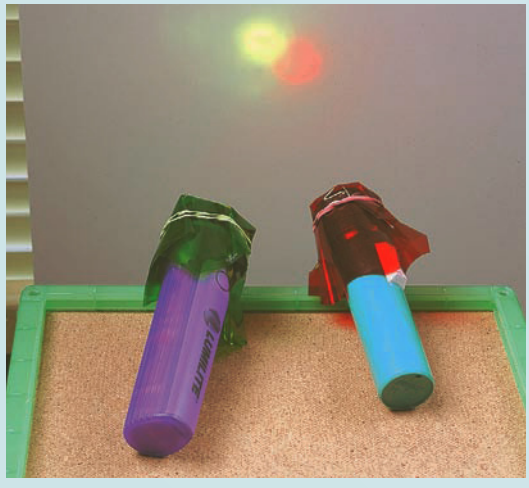
- 3 light sources of equal intensity (flashlights or ray boxes)
- 3 coloured filters of equal thickness (red, green, and blue)
- white paper to act as a screen
- red, green, and blue coloured pencils

Procedure

1. Predict what colours you would make by combining:
   a) red and green lights
   b) blue and green lights
   c) red and blue lights
   Record your predictions in your Science Journal.

Ready to investigate colour

2. Work with two partners. If you are using ray boxes, slide the coloured filter ahead of the one-slit baffle. If you are using flashlights, use coloured tissue paper or coloured plastic film to make filters for each. Experiment with your apparatus until you get the brightest possible light on the white paper screen.



Step 2

3. Combine all three coloured lights (red, green, blue) and shine them on the screen so that their beams overlap. What do you observe?

4 Try different combinations of lights. Record your observations in a table.

Keeping Records

5 Use coloured pencils to record your observations.

Analyzing and Interpreting

6 How accurate were your predictions about how coloured lights would combine?

7 What did you need to do in order to make your light more visible?

8 What, if anything, surprised you about some of the results?

Forming Conclusions

9 Make a diagram showing what each combination of colours produces. How does your diagram explain why sunlight appears white?

COMMUNICATE

1 What colours are produced when white light is shone through a prism?

2 What do you think would happen if light of one colour, such as red, was shone through a prism? Explain your answer.

3 Imagine you have a choice of using any combination of red, green, or blue spotlights to decorate the front of your home for the holidays. Predict what would happen if you shone each of these combinations against a white wall.
a) red and green
b) red and blue
c) green and blue
d) all three colours combined

4 Explain why you can see a rainbow. Do you think it is possible to reach the end of a rainbow? Why or why not?

5 Using the list of descriptive words you made at the beginning of this section (see page 137), write a note describing your favourite colour. In your note, talk about how this colour makes you feel. Where would you use this colour: for clothing, in your room, in some other way? Why?