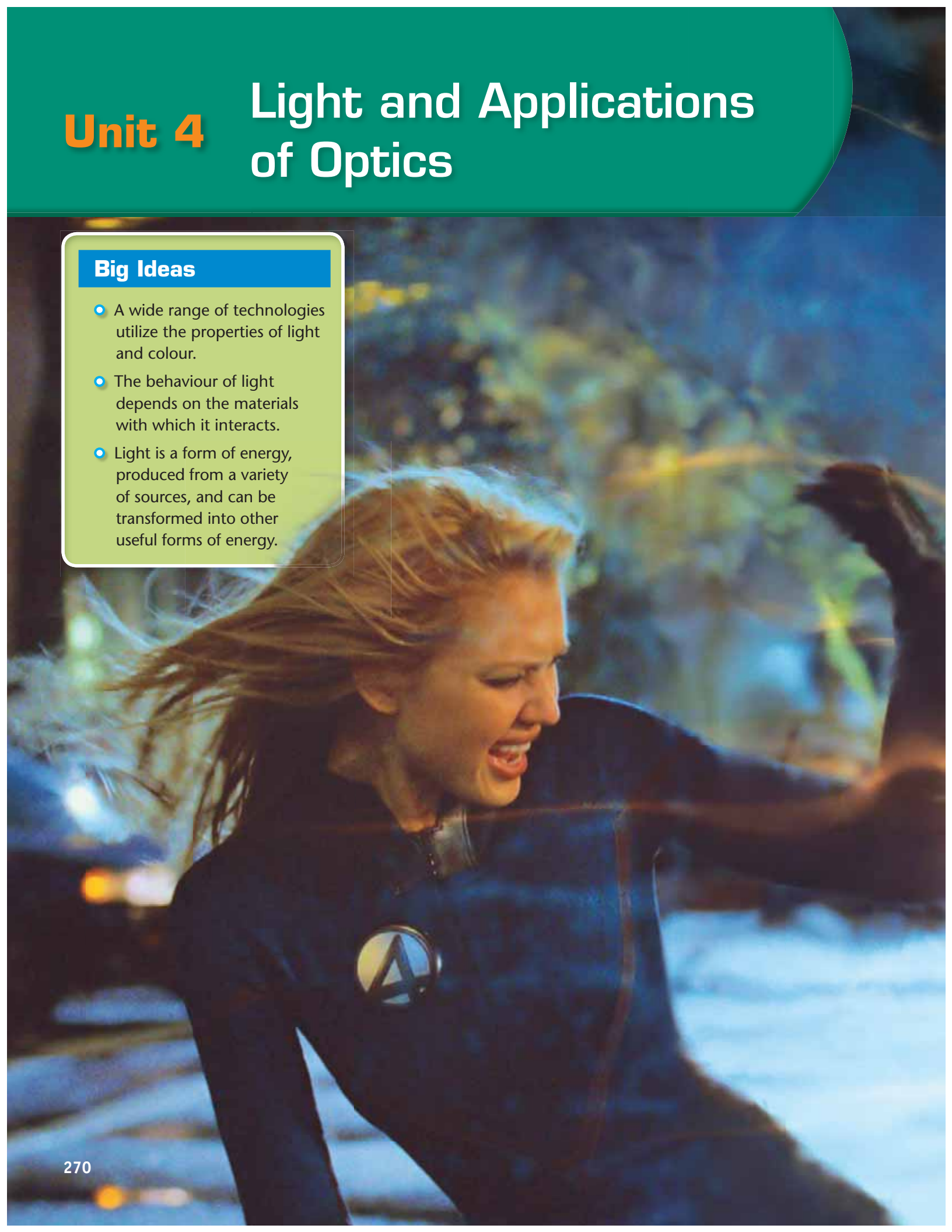


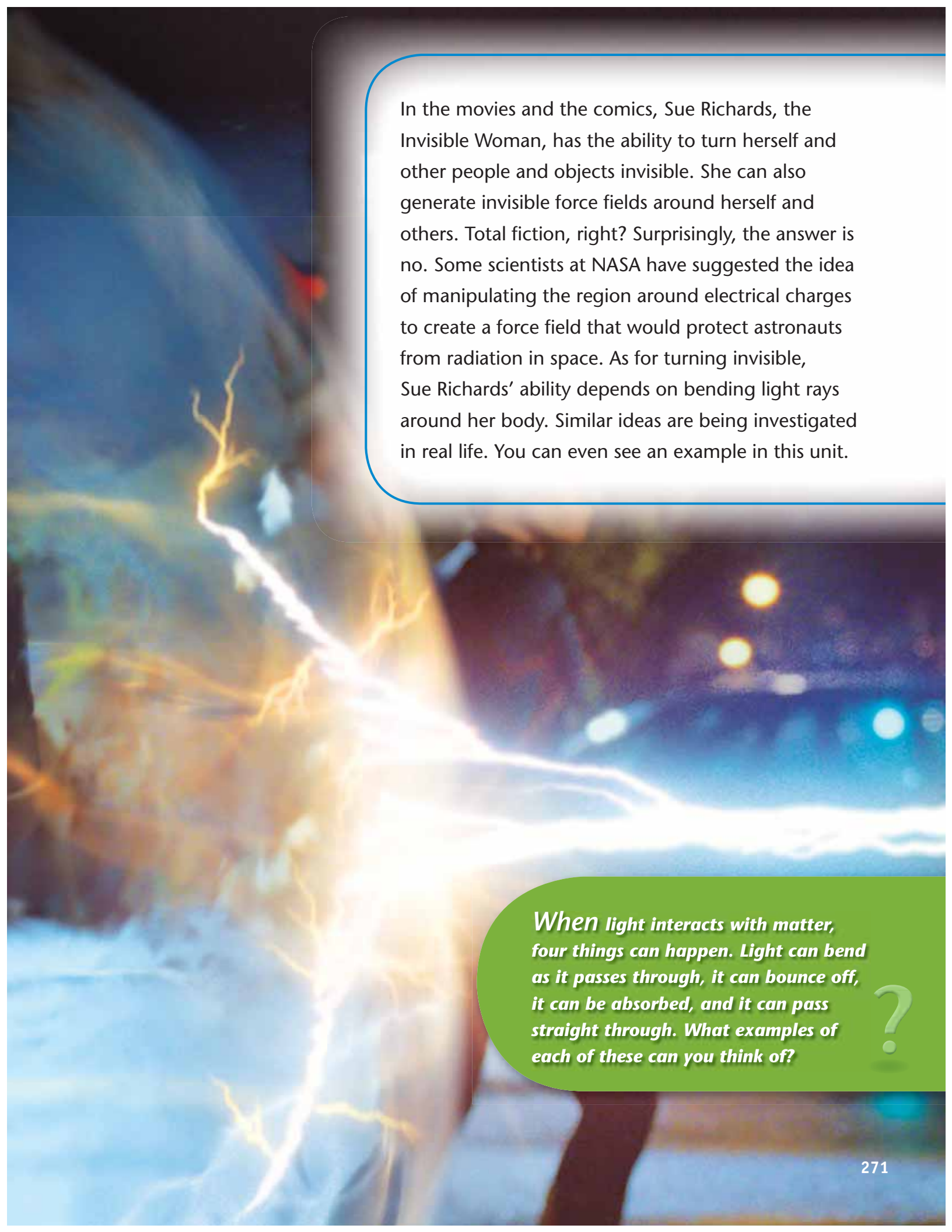
Unit 4

Light and Applications of Optics

Big Ideas

- A wide range of technologies utilize the properties of light and colour.
- The behaviour of light depends on the materials with which it interacts.
- Light is a form of energy, produced from a variety of sources, and can be transformed into other useful forms of energy.





In the movies and the comics, Sue Richards, the Invisible Woman, has the ability to turn herself and other people and objects invisible. She can also generate invisible force fields around herself and others. Total fiction, right? Surprisingly, the answer is no. Some scientists at NASA have suggested the idea of manipulating the region around electrical charges to create a force field that would protect astronauts from radiation in space. As for turning invisible, Sue Richards' ability depends on bending light rays around her body. Similar ideas are being investigated in real life. You can even see an example in this unit.

When light interacts with matter, four things can happen. Light can bend as it passes through, it can bounce off, it can be absorbed, and it can pass straight through. What examples of each of these can you think of?



Unit 4 At a Glance

In this unit you will learn about light as a form of energy that is produced from a variety of sources and that can be transformed into other useful forms of energy. You will also learn how light behaves when it interacts with different materials and how some of these interactions result in the colours that you see in the world around you. In addition, you will learn about various technologies that depend on properties of light and colour.

Think about answers to each question as you work through the topic.

Topic 4.1: What is light and how is it produced?



Key Concepts

- Many technologies produce light by converting other forms of energy.
- Light is energy and travels like a wave.

Light and Applications of Optics

Topic 4.6: What are lenses and what are some of their applications?



Key Concepts

- Lenses have at least one curved surface and refract light in predictable ways.
- Converging lenses can be used to produce different types of images.

Topic 4.5: What is refraction and how can it be used?



Key Concepts

- Refraction is the bending of light when it crosses a boundary between two substances.
- Refraction is used in communications and other technologies.

Topic 4.2: How does light interact with objects to give them colour?



Key Concepts

- Light can be reflected, absorbed, or transmitted by objects.
- Objects can absorb some colours and reflect or transmit others.



Topic 4.3: How can you mix colours to make different colours?

Key Concepts

- Colours can be added together to form a variety of colours.
- Pigments can subtract colours from light.

Topic 4.4: What is the law of reflection and how do mirrors form images?



Key Concepts

- The angle of reflection is equal to the angle of incidence.
- Plane mirrors form images that are nearly identical to the object.
- Concave mirrors can form real, inverted images.
- Concave mirrors can form upright, virtual images.
- Convex mirrors always form images that are smaller than the object.

Looking Ahead to the Unit 4 Projects

At the end of this unit, you have an opportunity to apply what you have learned. In your unit projects, you will design a way to bring natural light into a room without windows and you will analyze the costs and benefits of LED lighting technology.



Get Ready for Unit 4

Concept Check

1. Examine the illustration below, and answer the following questions in your notebook.

- Identify two sources of natural light and two sources of artificial light.
 - Name one source of natural light that is not shown in the illustration.
 - Identify six objects that reflect light.
2. Light is a form of energy, and it has specific properties. In your notebook, complete each sentence with a word from the box.

colours	prism	refracts
light	reflects	straight

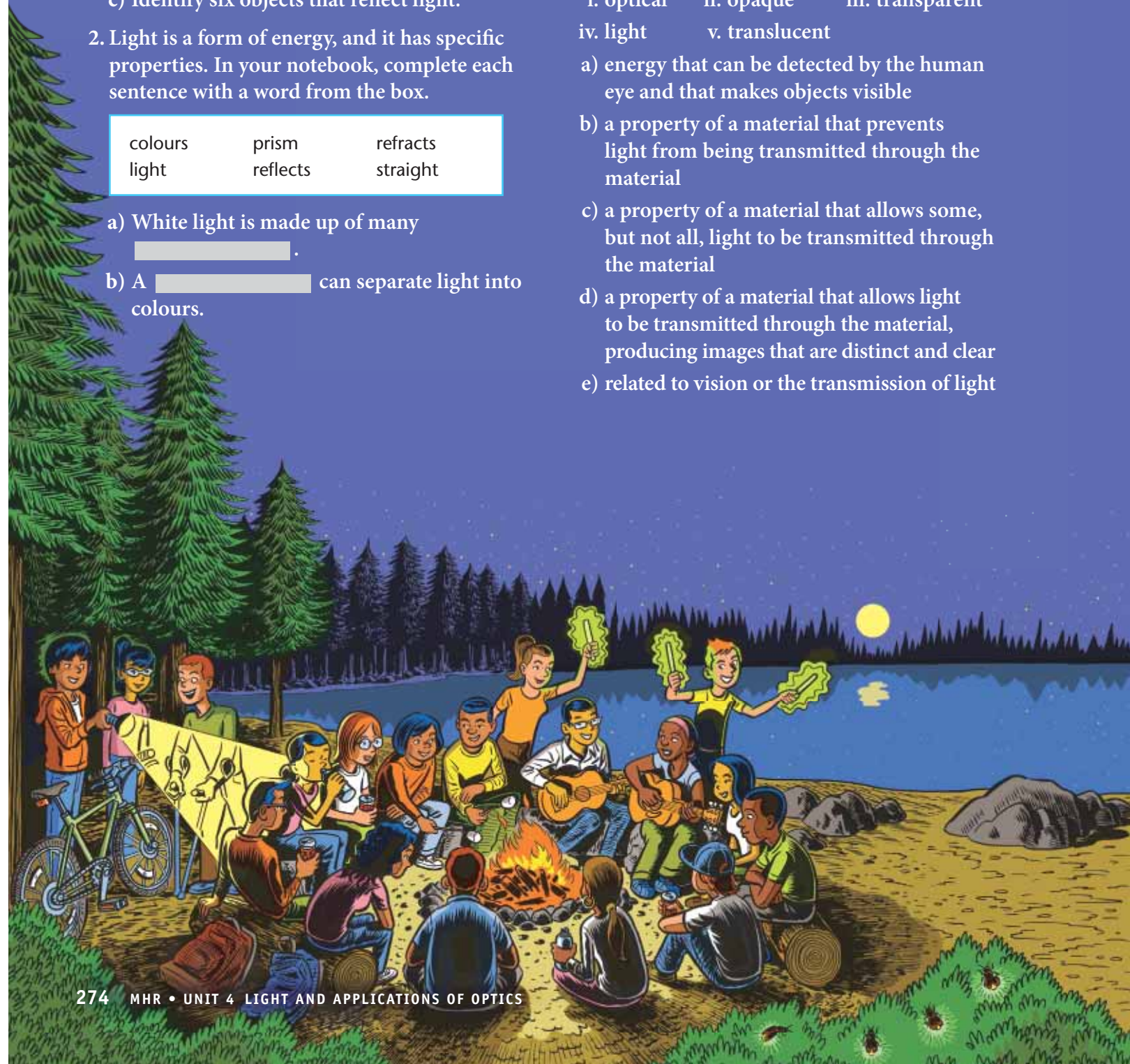
- White light is made up of many _____.
- A _____ can separate light into colours.

- Light travels in a _____ path in one medium.
- Light _____ off shiny surfaces.
- Light _____ when passing through a lens.

3. In your notebook, match each word listed below with its correct definition.

- i. optical ii. opaque iii. transparent
iv. light v. translucent

- energy that can be detected by the human eye and that makes objects visible
- a property of a material that prevents light from being transmitted through the material
- a property of a material that allows some, but not all, light to be transmitted through the material
- a property of a material that allows light to be transmitted through the material, producing images that are distinct and clear
- related to vision or the transmission of light



Inquiry Check

4. **Predict** You want to do a painting, but you have only three colours of paint available to you: red, blue, and yellow.
- Predict at least three other colours you can make for yourself using these three colours.
 - Use paint, coloured pencils, or coloured markers to test your predictions.

5. **Analyze** Examine the following words:

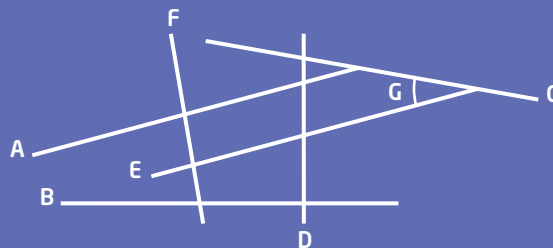
MOM DAD

Will these words read correctly from left to right in a mirror? Test your prediction.

6. **Interpret** Write a lowercase letter “r” in your notebook. Beside it, write the letter as it would appear if it were inverted.

Numeracy and Literacy Check

7. **Identify** In the diagram below, identify two lines that
- are parallel to each other
 - are perpendicular to each other
 - intersect each other
- Write your answers in your notebook.



8. **Measure Angles** Use a protractor and a ruler to answer these questions.
- What is the measure of $\angle G$ in the diagram?
 - Draw two lines that have an interior angle of 75° . Label the angle $\angle A$.
9. **Categorize Words** Put these words into three categories: *image*, *kaleidoscope*, *microscope*, *mirror*, *reflection*, *direction*, *straight*, *telescope*, and *ray*. Give each category a title, and explain your reasoning.