

Goal • Use this page to review the main points of Unit 2, Optics.

Chapter 4 Many properties of light can be understood using a wave model of light.

- Waves are disturbances that transmit energy from one place to another. (4.1)
- Waves have amplitude, wavelength, and frequency. (4.1)
- As the wavelength decreases, the frequency increases. (4.1)
- Different colours of light have different wavelengths. (4.2)
- White light is a mixture of many wavelengths of light. (4.2)
- A prism can separate and recombine different colours of light. (4.2)
- The electromagnetic spectrum is made up of waves that are similar to light waves that have much longer or shorter wavelengths. (4.3)
- Radio waves, microwaves, and infrared waves have longer wavelengths than visible light. (4.3)
- Ultraviolet waves, X rays, and gamma rays have shorter wavelengths than visible light. (4.3)

Chapter 5 Optical systems make use of mirrors and lenses.

- Ray diagrams help explain how beams of light travel in straight lines and how various materials can be opaque, translucent, or transparent. (5.1)
- Mirrors reflect light according to the law of reflection, which states that the angle of incidence equals the angle of reflection. (5.1)
- Light rays bend when they pass between two materials of different density. (5.1)
- Simple mirrors can be plane (flat), convex (curving out), or concave (curving in). (5.2)
- The image formed by a concave mirror depends on the distance of the object from the mirror. (5.2)
- Convex mirrors form images that are upright and smaller than the object. (5.2)
- Concave lenses are thinner in the middle than at the edge and diverge light rays. (5.3)
- Convex lenses are thicker in the middle than at the edge and converge light rays. (5.3)

Chapter 6 Human vision can be corrected and extended using optical systems.

- Light is detected by the eye using the cornea-lens-retina system. (6.1)
- Rod cells detect dim light but are not sensitive to colour. (6.1)
- Cone cells dominate in bright light and distinguish between colours. (6.1)
- Vision deficiencies include near-sightedness, far-sightedness, astigmatism, and deficiencies in distinguishing between different colours. (6.2)
- Eyes, cameras, microscopes, and telescopes have some similarities in the way they operate. (6.3)
- Lasers and optical fibres are used to transmit data using light. (6.3)

Goal • Use this page to help you review the key terms for Unit 2, Optics.

Chapter 4 Key Terms

- amplitude
- crest
- energy
- frequency
- trough
- wave
- wavelength
- light
- reflection
- refraction
- spectrum
- visible light
- wave model of light
- electromagnetic radiation
- gamma rays
- infrared rays
- microwaves
- radio waves
- ultraviolet waves
- X rays

Chapter 5 Key Terms

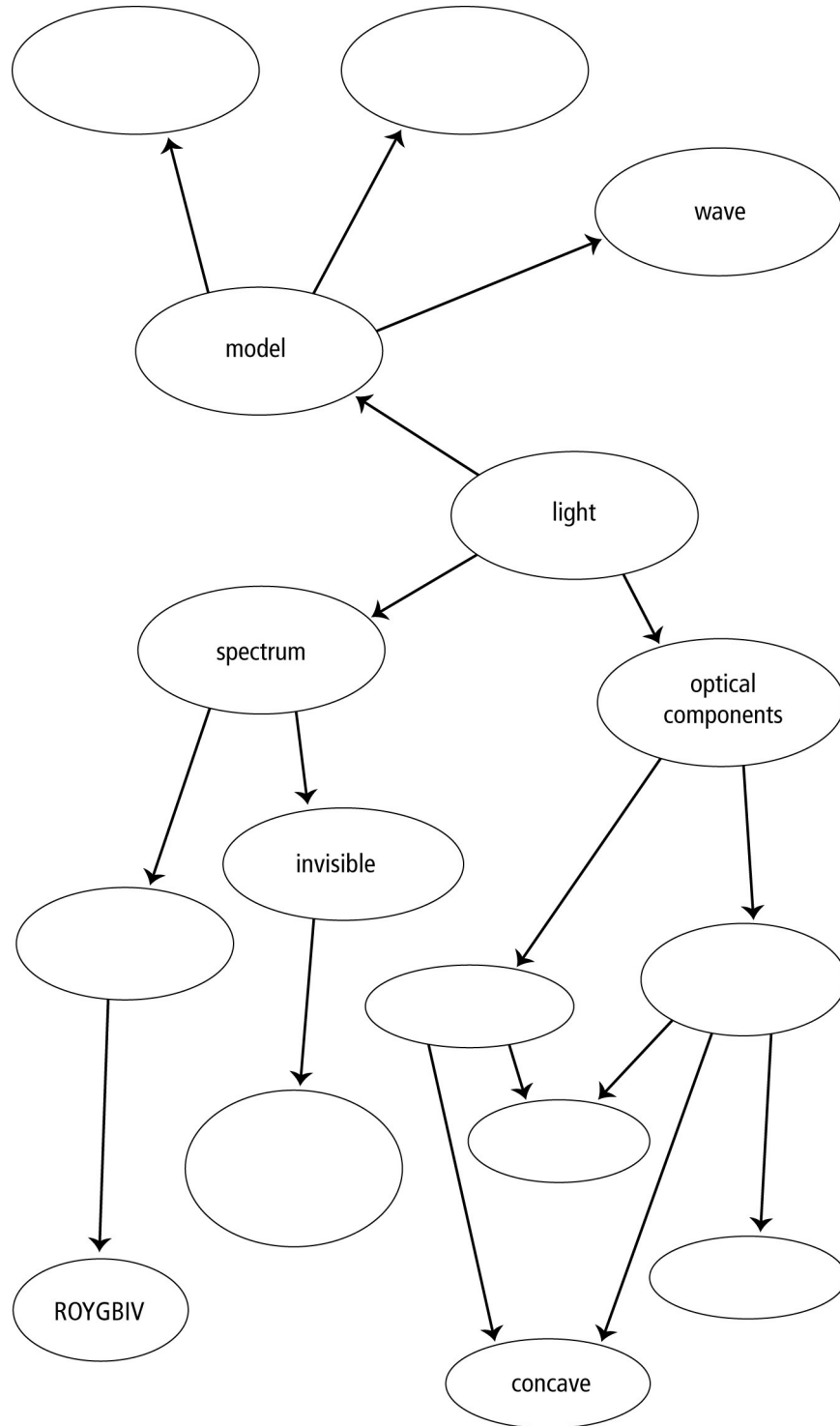
- angle of incidence
- angle of reflection
- angle of refraction
- normal
- opaque
- translucent
- transparent
- concave
- converging
- convex
- diverging
- focal point
- concave lens
- convex lens
- focal length
- lens

Chapter 6 Key Terms

- astigmatism
- blind spot
- cornea
- iris
- optic nerve
- pupil
- retina
- sclera
- laser light
- optical fibres
- refracting telescope
- reflecting telescope
- total internal reflection

What to Do

Complete this concept map about light.



Goal • Test your understanding of the concepts in Unit 2.

What to Do

Circle the letter of the best answer.

1. Which describes the wavelength of a water wave?
 - A. the height of a wave crest above the wave trough
 - B. the height of a wave crest above the rest position of the wave
 - C. the distance from one point on a wave to the same point on the next wave
 - D. the number of times per second that the crest of a wave passes a fixed point
2. The complete range of all wavelengths of radiant energy is called
 - A. the visible spectrum
 - B. the invisible spectrum
 - C. the colour spectrum
 - D. the electromagnetic spectrum
3. A mirror changes the direction of a ray of light in a process called
 - A. diffusion
 - B. refraction
 - C. reflection
 - D. absorption
4. Ultraviolet rays are electromagnetic rays associated with
 - A. heat
 - B. light
 - C. radar
 - D. sunburns
5. The ray model of light explains why shadows formed in sunlight have sharp edges. This is because
 - A. light rays travel in straight lines
 - B. the angle of incidence equals the angle of reflection
 - C. the light rays spread out as they travel
 - D. the light rays are blocked by objects between the light source and the observer
6. In a transparent material, the light rays
 - A. are absorbed and no clear image is seen through the material
 - B. are scattered and no clear image is seen through the material
 - C. are transmitted without scattering but no image is seen through the material
 - D. are transmitted without scattering and a clear image is seen through the material

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7. When light rays pass from water into air,
- they bend toward the normal as they move into a material with greater density
 - they bend away from the normal as they move into a material with greater density
 - they bend toward the normal as they move into a material with lower density
 - they bend away from the normal as they move into a material with lower density
8. Light rays that are made to come together to a point after passing through a lens are described as
- merging
 - diverging
 - conjoining
 - converging
9. The lens in a healthy living human eye is
- opaque and hard
 - opaque and flexible
 - transparent and hard
 - transparent and flexible
10. Near-sightedness is a vision problem that
- makes it difficult to focus on nearby objects
 - makes it difficult to focus on distant objects
 - causes multiple blurry images of an object to be seen
 - allows a scene to be clear directly ahead but the edges of the scene are fuzzy

Match the Term on the left with the best Descriptor on the right.
Each Descriptor may be used only once.

Term	Descriptor
_____ 11. amplitude	A. part of the eye that does most of the focussing
_____ 12. energy	B. a transparent material that can focus light
_____ 13. refraction	C. all waves transfer this
_____ 14. concave	D. the shape of a lens or mirror in which the surface bends inwards
_____ 15. lens	E. the height of a wave
_____ 16. translucent	F. permits light to pass but the image is not clear
_____ 17. astigmatism	G. causes several fuzzy images to form on the retina
_____ 18. cornea	H. the length of a wave
_____ 19. pupil	I. connects the retina to the brain
_____ 20. optic nerve	J. transparent part of eye surrounded by the iris and which appears to be black
	K. the shape of a lens or mirror in which the surface bends inwards
	L. the bending of light as it passes from air into glass

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21. Draw a sketch of a light wave. Label the amplitude, wavelength, trough, and crest.
22. Calculate the frequency, in hertz, of each of the following:
- (a) the tic-toc sound of a wind up clock, which starts a new sound 60 times in one minute

 - (b) a heart rate of a cyclist, which beats 300 times in 100 seconds

 - (c) the frequency of a water wave, which laps up on the shore 6 times in one minute

23. For each of the following parts of the invisible spectrum, list one way in which the radiation is used to create some sort of image.
- (a) X rays _____
 - (b) infrared rays _____
 - (c) microwaves _____
24. Compare and contrast the reflection of light from a white sheet of paper with the reflection of light from a mirror. Ray diagrams may be useful in your answer.
25. A magnifying glass uses sunlight to light a piece of paper on fire. Draw a ray diagram to show how light rays from the sun are refracted by the lens of the magnifying glass. Be sure to show the general shape of the lens used in the magnifying glass.

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26. The rear view mirror of a car on the passenger side usually has this warning: "Objects in the mirror are closer than they appear."

(a) Sketch and label the kind of mirror used in this application.

(b) Identify one other common use for this type of mirror.

27. Draw a sketch of a human eye from the as viewed from the front. Label the iris, sclera, pupil.

28. A swimmer uses goggles to see clearly underwater. Explain why the goggles are needed to see clearly underwater and why objects appear fuzzy if the goggles are removed.

29. Compare and contrast a refracting telescope and a microscope.

30. (a) Explain how laser light is different from sunlight. Refer to wavelength in your answer.

(b) How can two different data signals be sent using lasers down the same optical fibre cable, without the signals getting mixed up?
