

Unit Review Sc8.2: Optics

Review Sc8.2.1: Light

Vocabulary

diffuse reflection	wavelength	refraction
dispersion	rectilinear propagation	spectrum
frequency	reflection	specular reflection

1. rectilinear propagation: property of light that says it travels in a straight line.
2. Reflection: When light hits a surface and rebounds in another direction.
3. Specular reflection: Type of reflection; occurs on a smooth surface, reflects clear images.
4. diffuse reflection: Type of reflection; occurs on rough surfaces, does not form an image.
5. refraction: When light changes directions passing from one medium to another.
6. dispersion: When the different colours of white light are separated into the colours of the rainbow.
7. frequency: the number of oscillations (wavelengths) that occur in a second.
Measured in Hertz.
8. wavelength: the distance between two crests or two troughs of a wave.
9. Electromagnetic spectrum: The series of electromagnetic waves in every wavelength and every amount of energy.

Questions

1. What was Pythagoras' theory of light?
Beams of light were made of tiny particles. Eyes can detect these particles to see the object
2. Why didn't Galileo succeed in measuring the speed of light?
his method was not accurate enough.

Who was the first to succeed at measuring the speed of light?

Michelson

3. What is the speed of light, in a vacuum?

1 000 000 000 km/hr

4. What travels faster, light or sound?

light

When we see a flash of lightning, why is there a few seconds or so before we hear the thunder?

because light travels faster than sound

5. Name 5 examples of optical technologies.

microscope, telescope, periscope, binoculars
fibre optics, camera, contact lenses, lasers
projectors for movies + overhead projectors

6. Name the 6 properties of light.

① light travels in a straight line (rectilinear propagation)
② light reflects ③ light refracts, ④ light disperses (ex prism)
⑤ light travels through a vacuum ⑥ Travels through objects
to different degrees (transparent translucent opaque)

7. Which property of light is demonstrated by each example?

Situation	Property of light
The light from a faraway star reaches Earth.	vacuum
Light passes through air.	Travels through objects
You see your image in a mirror.	reflection
We see a rainbow after it rains.	dispersion
You see your shadow.	rectilinear propagation
The colour of an apple is red.	reflects
When you look at a sheet of paper, the light is not absorbed, but you don't see your image.	reflects

8. What is the difference between diffuse reflection and specular reflection, and give an example of each.

Diffuse - reflection off a rough surface ex paper

specular - reflection off a shiny surface ex mirror

9. Explain wavelength and frequency. What is the relationship between them?

Wavelength - distance between 2 crests or troughs of a wave

frequency = # of wavelengths that occur in a second

the shorter the wavelength the higher the frequency
the longer the wavelength the lower the frequency

10. If a wave has a high frequency,

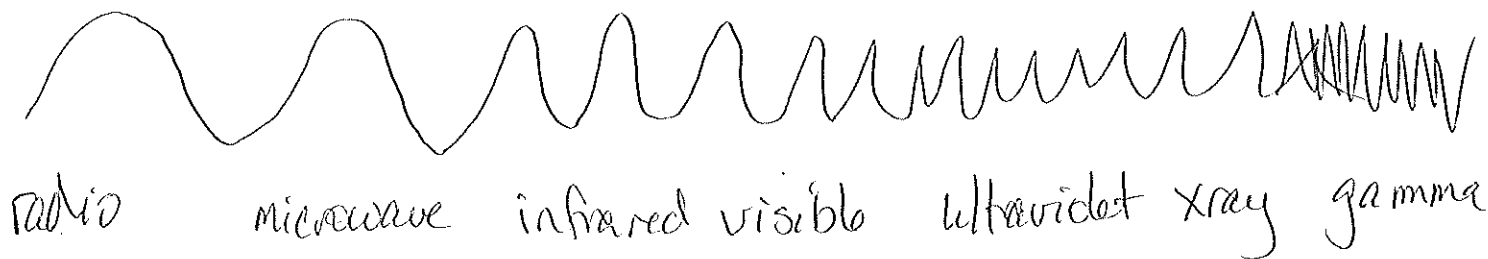
a. Is its wavelength longer or shorter?

shorter

b. Does it have more or less energy?

less

11. Draw a diagram of the electromagnetic spectrum that represents the types of electromagnetic radiation from radio to gamma waves.



12. In the Electromagnetic Spectrum

a. Which type of waves have the longest wavelength?

radio

b. Which type of waves have the shortest wavelength?

gamma

c. Which type of wave has the least amount of energy?

radio

d. Which type of wave has the highest amount of energy?

gamma

13. Name the uses and possible dangers (if applicable) of each type of radiation.

radiation	uses	dangers
radio	MRI	
microwave	telecommunication, radar microwave ovens	
infrared	remote controls, heat lamps motion sensors	
visible	allows us to see	
ultraviolet	kills bacteria, sun light	skin cancer
xrays	takes pics of bones, security screening at airports	can lead to cancer
gamma	nuclear reactions, on the sun, medical treatment	

Review Sc8.2.2 : Reflection

Vocabulary

principal axis	focal point	normal	reflection
concave	incidence	plane	reflected
convex	incident	real	virtual

1. incident ray : the ray that hits the mirror.
2. reflected ray : the ray that rebounds off of the mirror
3. normal : an imaginary line perpendicular to the surface of the mirror.
4. incident angle : the angle between the incident ray and the normal.
5. reflected angle : the angle between the reflected ray and the normal.
6. plane : a flat surface.
7. concave : hollow, like the interior of a sphere.
8. convex : bulging, like the exterior of a sphere.
9. focal point : The point at which the reflected rays converge (come together), parallel to the principal axis of a curved mirror.
10. principal axis : An imaginary line, perpendicular to the mirror, that passes through the focal point of the mirror.
11. real image : an image formed when the reflected rays intersect in front of the mirror.
12. virtual image : an image formed when the reflected rays do not intersect in front of the mirror, but on the opposite side of the mirror by extending the reflected rays.

Questions

1. What is the law of reflection?

angle of incidence equals the angle of reflection

2. Name three types of mirrors and explain two uses for each.

plane - bathroom, rear view mirror in cars, dentist mirror, periscope

Concave - makeup mirror, inside a metal spoon, flashlight, lighthouse, satellite dish.

convex - safety mirrors on the side of a bus, side mirrors on cars, security mirrors in stores

3. Explain the significance of each letter in "S.P.O.T."

S - size - how big is the image

P - position - how far away is the image from the mirror

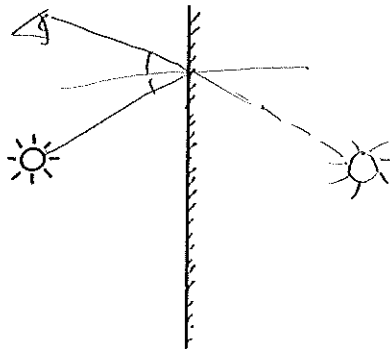
O - orientation - right side up or upside down

T - Type - real or virtual

4. Explain the difference between a virtual image and a real image.

Real - reflected rays (not extended) meet in front of the mirror
 Virtual - extended rays meet behind the mirror

5. Make a ray diagram to find the image of the sun in a plane mirror. Give the characteristics of S.P.O.T. for the image.

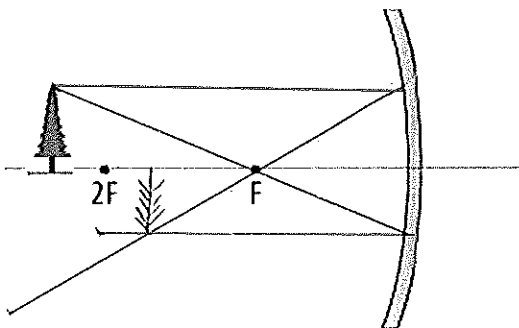


S - image is same size as object
 P - image is same distance as object
 O - image is right side up
 T - image is virtual.

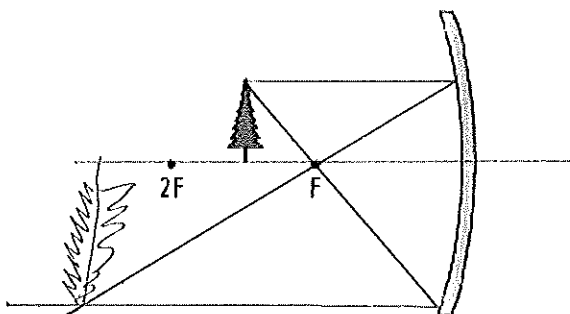
6. Describe the two important rays that must be used when drawing a ray diagram for a curved mirror.

incidence + reflected

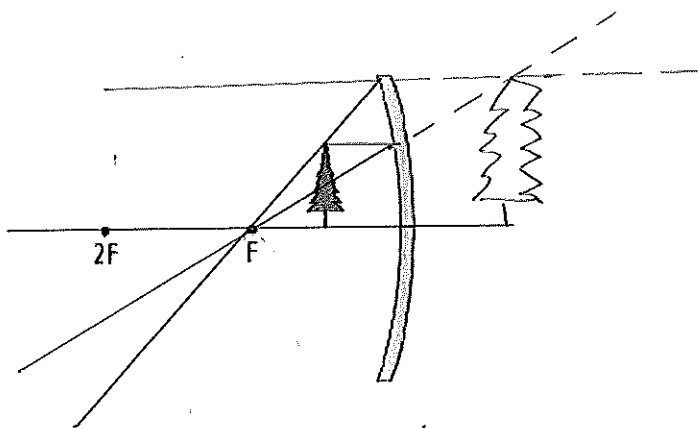
7. Draw the ray diagrams for the objects in the curved mirrors, below. Describe each image using S.P.O.T.



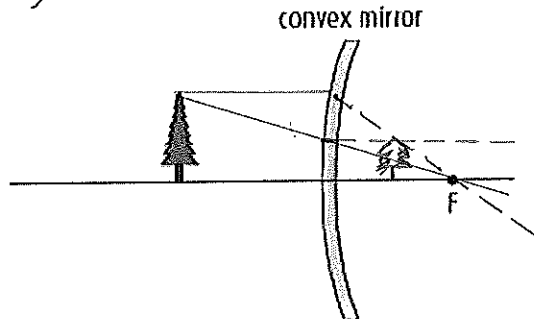
	Description
S	image is smaller
p	image is close
o	image is upside down
t	image is real



	Description
S	image is bigger
p	image is farther away
o	image is upside down
t	image is real



	Description
S	image is bigger
p	image is farther away
o	image is right side up
t	virtual



	Description
S	image is smaller
p	image is closer
o	image is right side up
t	virtual

8. What type of mirror produces an image with the following characteristics?

Characteristics	Type of mirror (plane, concave, or convex)
An upright image, smaller than the object.	Convex
An upright image, always the same size as the object.	plane
An image that is upside down, but smaller than the object.	concave
A mirror that can concentrate the rays of light from the sun, on a solar oven.	concave
An upright image, always the same distance from the mirror as the object, but behind the mirror.	plane
A mirror used to see a large field of view behind you.	convex
A mirror to see your face up close, for makeup or shaving.	concave
An upright image, bigger than the object.	concave
A mirror used to direct light in a flashlight.	concave

Review Sc8.2.3: Refraction

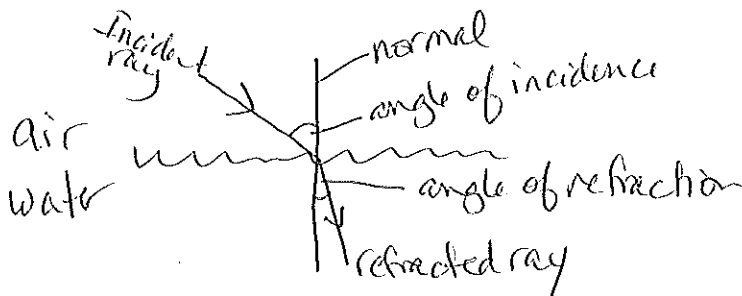
Vocabulary

convergent	divergent	-lens	near-sighted	far-sighted
refracted	-refraction			

1. refracted ray: the ray after refraction occurs.
2. Angle of refraction: the angle between the refracted ray and the normal.
3. lens: A curved piece of glass that refracts light to form images.
4. Convergent: to come together.
5. divergent: to separate.
6. near-sighted: When you are able to see objects up close, but not far away.
7. far sighted: When you are able to see objects that are far away clearly, but not as they become closer.

Questions

1. Give two examples of refraction.
pencil in water, prism, rainbow, concave or convex lense, light going from air to water
2. Create a diagram to represent a ray of light that is refracting as it passes between air and water. On your diagram, include:
 - Air, water, incident ray, refracted ray, normal, angle of incidence, angle of refraction



3. When a ray of light passes from air and to a denser substance, in what direction does the light refract?
toward the normal

4. When a ray of light passes from a more dense substance to air, in what direction does the light refract?

away from the normal

5. What effect does the density of a substance have on the speed of light?

slows it down

What effect does it have on a ray of light that enters it?

bends it

6. What colour of light is refracted the most as it passes through a prism, red or violet?

violet

7. What wavelength is refracted the most as it passes through a prism, a longer wave or a shorter wave?

shorter

8. Draw a picture of each of the following:

- A convex mirror



- A concave mirror



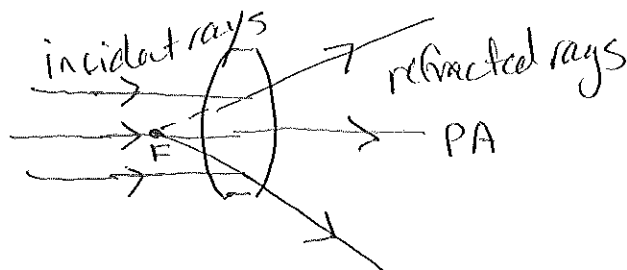
- A convex lens



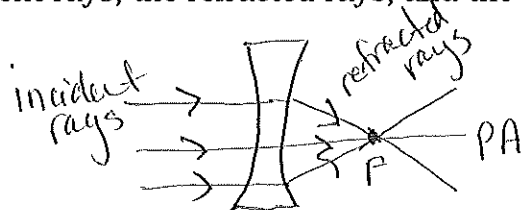
- A concave lens



9. Draw a diagram to represent refraction in a convex lens. Label the principal axis, the incident rays, the refracted rays, and the focal point.



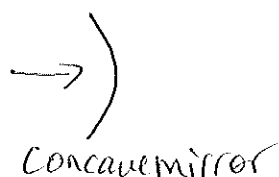
10. Draw a diagram to represent the refraction of a concave lens. Label the principal axis, the incident rays, the refracted rays, and the focal point.



11. What type of **mirror** is convergent? *Convex*

What type of mirror is divergent? *Concave*

Draw a small diagram of each mirror.



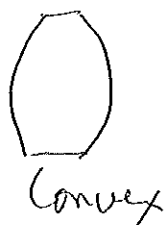
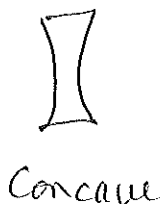
12. What type of **lens** is convergent?

Concave

What type of mirror is divergent?

Convex

Draw a small diagram of each lens.



13. What type of lens is necessary for a person who is near sighted? Explain how this lens will help.

Convex - Focuses the light rays on the retina.

near sighted focal point is in front of the retina

14. What type of lens is necessary for a person who is far sighted? Explain how this lens will help.

Concave - Focuses the light rays on the retina

far-sighted focal point is behind the retina.

15. Name three types of optical instruments that use lenses.

microscopes, telescopes, cameras

binoculars, magnifying glasses,

contact lenses, flashlights, eyeglasses