



⚡ Lesson Plan: Light

Grade Level: 8

Subject: Physical Science

Duration: 45–60 min

NGSS MS-PS4-2: Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.

🎯 Learning Objectives

By the end of this lesson, students will be able to:

- **Describe** light as an electromagnetic wave of vibrating electric and magnetic fields that needs no medium and travels at about 300,000 kilometers per second in a vacuum.
- **Explain** how wavelength and frequency change across the electromagnetic spectrum, from



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visible light, ultraviolet rays, X-rays, and gamma rays, and only the narrow visible-light band can be seen by the human eye.

- **Wavelength:** The distance from one peak of a wave to the next peak. Within visible light the wavelength sets the color we see: shorter wavelengths look blue or violet and longer wavelengths look red.
- **Frequency:** The number of wave cycles that pass a given point each second. As wavelength gets shorter the frequency gets higher, and the higher-frequency waves such as X-rays and gamma rays carry more energy, which is why they can penetrate the human body.



- **Photon:** A tiny particle of energy that carries light. In the particle model of light, a beam is described as a stream of photons rather than as a smooth, continuous wave.
- **Reflection:** The bouncing of light off a surface instead of passing into it. A smooth surface such as a plane mirror bounces the light back evenly, so the pattern of the light is preserved and we see an image.
- **Refraction:** The bending of light as it crosses the boundary between two materials of different density, such as air and water. Refraction makes a straw look broken at the water line and spreads a white beam into separate colors when it passes through a glass prism.
- **Opaque:** Describes a material that lets no light pass through it at all, such as a solid brick wall. The light that strikes an opaque object is either reflected off it or absorbed by it, so the object casts a full shadow.

 **Materials Needed:** (all links are included in this PDF)



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- Colored cellophane filters to show which wavelengths pass through and which are absorbed
- Protractor for measuring the angle of a light beam striking and leaving a mirror

Lesson Procedure

Step 1: Introduction (8 minutes)

- Ask students: sound cannot travel through empty space, so how does sunlight cross millions of kilometers of vacuum to reach Earth?



- Darken the room and shine the flashlight through a glass prism onto a white wall so students see one white beam split into red, orange, yellow, green, blue, and violet.
- Collect student predictions about why one beam becomes many colors, and tell them the lesson will trace the answer back to wavelength.

Step 2: Direct Instruction (15 minutes)

- Use the study guide to define an electromagnetic wave as vibrating electric and magnetic fields at right angles that need no medium, then contrast the wave model with the particle model in which light travels as a stream of photons.
(<https://newpathworksheets.com/api/guide/study-guide-science-grade-8-light-1.pdf>)
- Walk the electromagnetic spectrum diagram from left to right - radio waves, microwaves, infrared, visible light, ultraviolet, X-rays, gamma rays - showing that wavelength shortens and frequency rises across it. (<https://newpathworksheets.com/api/guide/study-guide-science-grade-8-light-1.pdf>)
- Demonstrate reflection by tracing the flashlight beam from the plane mirror to a student's eye, then stand a straight straw in a clear glass of water so the class sees the straw appear



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and the aluminum foil lets none through (opaque).

- Hold colored cellophane filters over the flashlight and have students state which wavelengths are passing through and which are being absorbed.

Step 4: Independent Practice (12 minutes)

- Have students complete the vocabulary matching sheet, pairing prism, photon, opaque, gamma ray, infrared rays, microwaves, electromagnetic wave, and electromagnetic spectrum with their definitions.
(<https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-8-light-1-1.pdf>)



- Assign the practice worksheet on AM and FM radio waves, radar guns, and ultraviolet exposure so students apply the spectrum to real technologies.
(<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-8-light-1-1.pdf>)
- Ask each student to write one sentence explaining why a green leaf looks green, using both the word reflects and the word absorbs.

Step 5: Assessment (8 minutes)

- Administer the ten-question practice worksheet covering the speed of light, the breakup of white light by a prism, the two fields in an electromagnetic wave, and the wavelength-frequency relationship. (<https://newpathworksheets.com/api/worksheet/worksheet-science-grade-8-light-1-0.pdf>)
- Have students classify a car windshield, a frosted bathroom window, and a wooden door as transparent, translucent, or opaque, and state whether light is mostly transmitted, absorbed, or reflected in each case.
- Check the study guide's lesson checkpoint orally: ask students to explain the wave model and the particle model of electromagnetic waves in their own words.



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instead of recalling the sequence.

- Let students re-test the clear plastic, waxed paper, and aluminum foil samples by hand with the flashlight before they commit to a written classification.



Extension Activities



- Build a simple spectroscope from a cardboard tube and a slice of an old CD, then compare the spectrum of a fluorescent bulb, an LED lamp, and daylight and record how the color bands differ.
- Use the flashlight, the plane mirror, and a protractor to measure the angle at which the beam strikes the mirror and the angle at which it leaves, repeat for four different angles, and report whether the two angles match.
- Research how infrared rays are used in heat lamps and cameras and how microwaves are used for cooking and communication, then present which property of each wave makes it useful for that job.

Complete List of Available Resources:

- NewPathWorksheets: Light (<https://newpathworksheets.com/science/grade-8/light-1>)
- Study Guide PDF (<https://newpathworksheets.com/api/guide/study-guide-science-grade-8->



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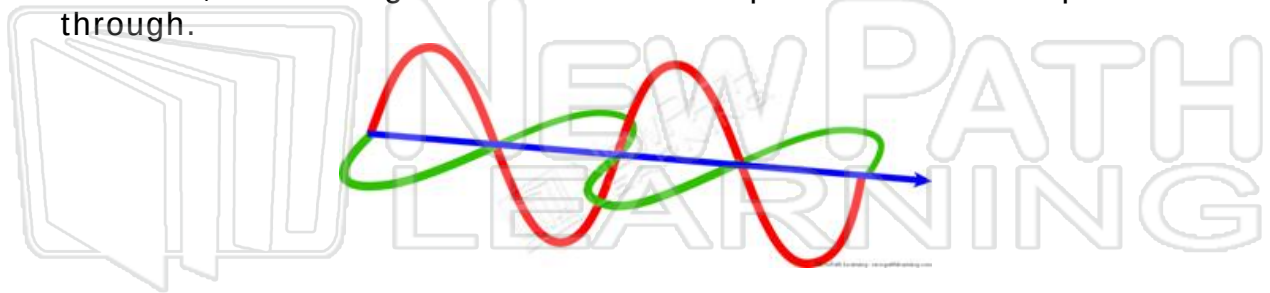
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LIGHT

Overview

An **electromagnetic wave** is made up of vibrating electrical and magnetic fields that travel as quickly as light. Unlike many other types of waves, electromagnetic waves do not require a **medium** to pass through.



Models of Light Wave Action

The diagram above is one of two models of electromagnetic waves.

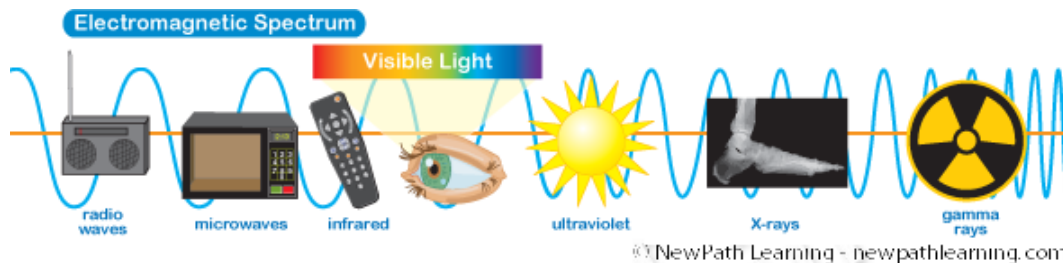


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The speed of an electromagnetic wave is calculated by multiplying the wavelength by the frequency. In a vacuum, all electromagnetic waves travel at the same speed even though they have different wavelengths. The variations in wavelength are compensated by variations in frequency leaving the speed the same.

The diagram below shows the **electromagnetic spectrum** or complete range of all electromagnetic wavelengths.



The diagram above shows the various types of electromagnetic radiation and the differences in their wavelengths and frequencies. Notice that the radio waves on the left have larger wavelengths and lower frequencies while the gamma rays on the far right, have shorter wavelengths and greater frequencies.

LESSON CHECKPOINT:

What types of waves are in the electromagnetic



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LESSON CHECKPOINT: *How do these differences in wavelengths result in seeing different colors?*

When light hits an object, it either goes through easily, partially, or not at all. An object that lets *most* of the light through is said to be **transparent**. An example would be a window. Objects that allow only *some* light to get through are called **translucent**. An example of this is frosted glass. An **opaque** object prevents *all* light from getting through it and an example would be a solid brick wall.

LESSON CHECKPOINT: *What is the difference between transparent, translucent, and opaque objects?*

Colors

The colors we see depend upon which wavelengths of visible light get reflected back to our eyes. For example, when ordinary light is shone on a green object, the green pigment of the object absorbs all the



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LESSON CHECKPOINT: *Explain how the makeup of light causes us to see different colors.*





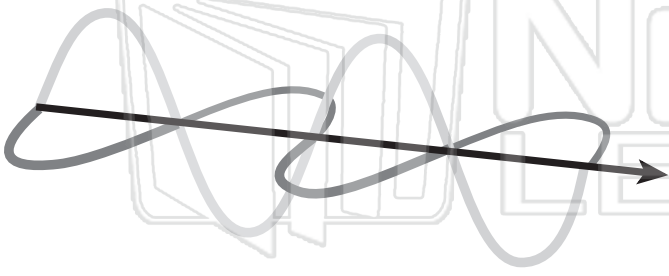
Light

Name _____ Class _____ Date _____

Light is everywhere. It is produced by **luminous** objects, such as fires, light bulbs and the Sun. Unlike sound, light does not require matter through which to travel, and it can travel through a vacuum such as space. Light travels at **300 million m/s**, faster than anything scientists have yet to discover.



Light is an **electromagnetic wave** that is made of vibrating **electric** and **magnetic** fields which are at right angles to each other. The light that we can see is called **visible light**, but there is also light that we cannot see, including **ultraviolet light** and **infrared light**.

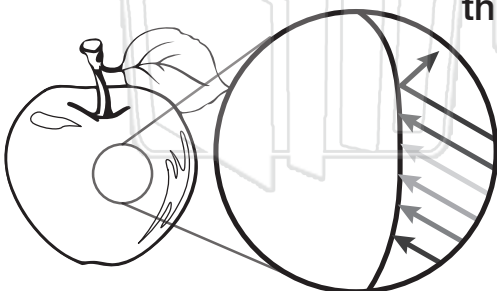


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Visible light makes up just a small part of the electromagnetic spectrum, but it too can be broken up into different **wavelengths**. When passed through a glass prism, an ordinary light beam **refracts** into the many different colors or wavelengths of light.

The **color** of an object is determined by the **wavelengths** of light that reach our eye. A red-colored object appears red because only red light is **reflected** while the other colors of light are **absorbed**.





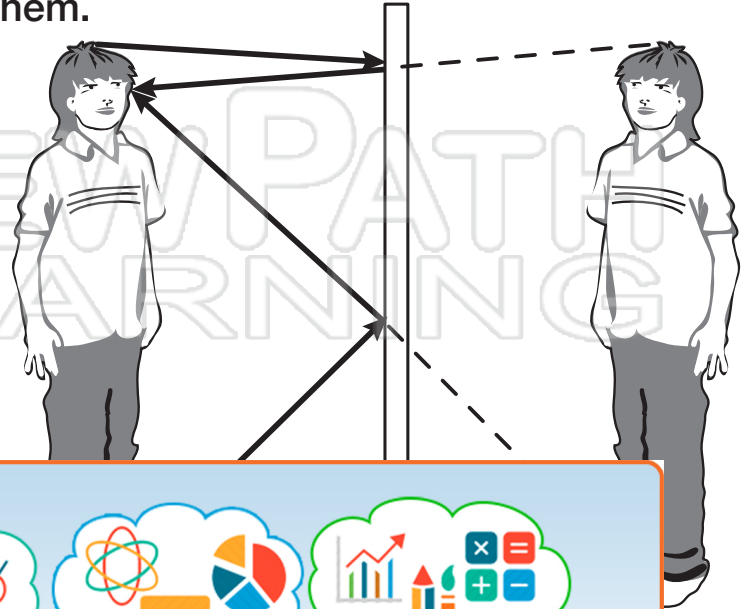
Light

Name _____ Class _____ Date _____

Reflection of Light

Light that bounces off surfaces is called **reflection**. Because **mirrors** reflect light evenly, we can see an image in them.

A mirror with a flat surface is called a **plane mirror**. It is usually made from a sheet of flat glass, with a thin coating of aluminum or silver on the back to reflect the light.



Refr
Altho
betw



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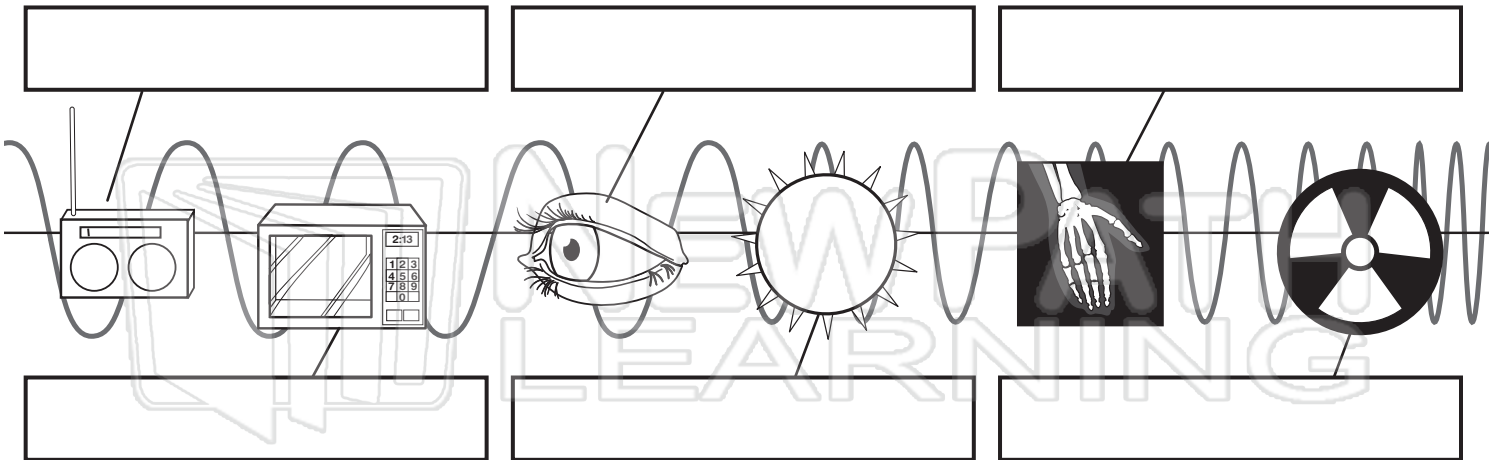




Light

Name _____ Class _____ Date _____

Label the different wavelengths on the **electromagnetic spectrum**.



We can only see wavelengths and frequencies of colors in the **visible spectrum**.
Color _____



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Light that bounces off surfaces is called _____. Because _____ reflect light evenly, we can see an image in them.

Although **light** normally travels in **straight lines**, it can bend at the **boundary** between two materials with different _____.

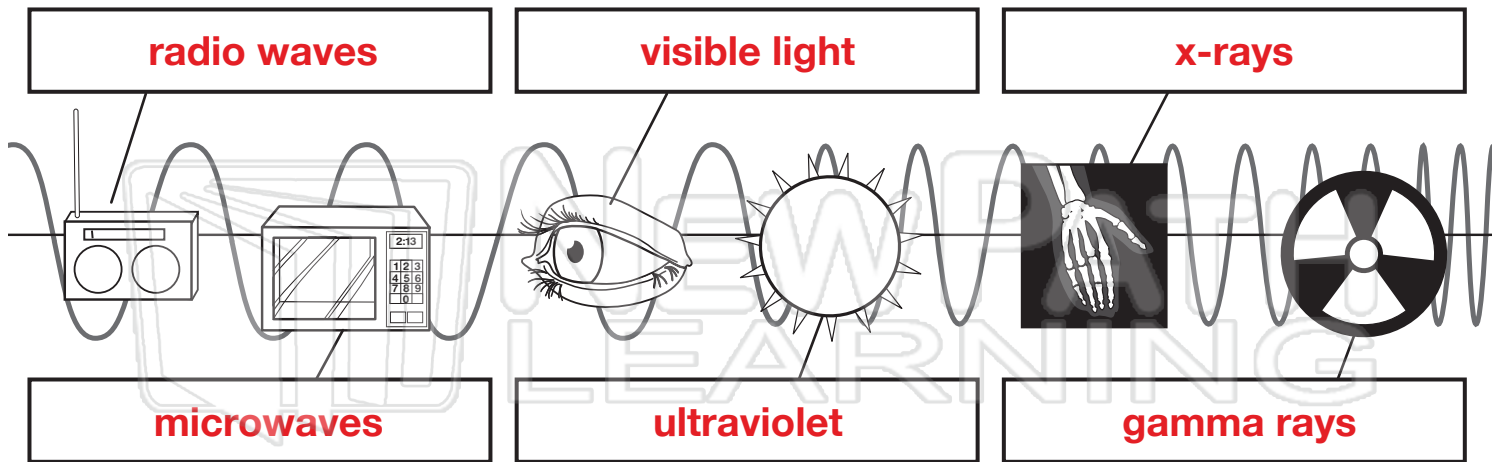
This is called _____.



Light

Answer Key

Label the different wavelengths on the **electromagnetic spectrum**.



We can only see wavelengths and frequencies of colors in the **visible spectrum**.
Color



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Light that bounces off surfaces is called **reflection**. Because **mirrors** reflect light evenly, we can see an image in them.

Although **light** normally travels in straight lines, it can bend at the boundary between two materials with different **densities**.

This is called **refraction**.



Name _____ Class _____ Date _____

1 What is the **speed** at which light travels?

- A 5,500 kilometers per minute
- B 300,000 kilometers per second
- C 5,500 kilometers per second
- D 1,000 kilometers per second



2 In the diagram below, light has passed through a glass **prism** and broken up into different colors. This **breakdown** into different colors is called _____.

- A reflection
- B transmission
- C refraction
- D diversion



3 In the diagram below, visible light has been **refracted** into different colors. This **separation occurs** because these different colors of light have different _____.

- A amplitudes
- B powers



4 In the diagram below a **rainbow** has formed. What is the cause of this rainbow?



- A sunlight is refracted through raindrops
- B sunlight is reflected through raindrops



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9 What is the reason why **gamma rays** and **X-rays** are more harmful to humans than radio waves?

- A they have lower frequencies but more energy
- B they have higher frequencies and more energy
- C they have more amplitude
- D they are less penetrating

10 These waves have the **longest wavelengths** and the **lowest frequencies** on the electromagnetic spectrum. What **kind of waves** are shown here?

- A microwaves
- B gamma rays
- C X-rays
- D radio waves





Name _____ Class _____ Date _____

1 What is the **speed** at which light travels?

- A 5,500 kilometers per minute
- B 300,000 kilometers per second
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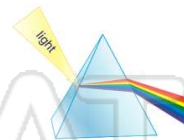


(B)

2

In the diagram below, light has passed through a glass **prism** and broken up into different colors. This **breakdown** into different colors is called _____.

- A reflection
- B transmission
- C refraction
- D diversion



(C)

3 In the diagram below, visible light has been **refracted** into different colors. This **separation occurs** because these different colors of light have different _____.

- A amplitudes
- B powers



(D)

4

In the diagram below a **rainbow** has formed. What is the cause of this rainbow?



- A sunlight is refracted through raindrops
- B sunlight is reflected through raindrops

(A)

5



(A)

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(C)

9

What is the reason why **gamma rays** and **X-rays** are more harmful to humans than radio waves?

- A they have lower frequencies but more energy
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- C they have more amplitude
- D they are less penetrating

(B)

10

These waves have the **longest wavelengths** and the **lowest frequencies** on the electromagnetic spectrum. What **kind of waves** are shown here?

- A microwaves
- B gamma rays
- C X-rays
- D radio waves



(D)



Name _____ Class _____ Date _____

1

In the diagrams below, _____.

A AM waves are being frequency modulated



B FM waves are being amplitude modulated

C AM and FM waves look the same

D AM waves are amplitude modulated

2

Using the diagram below, determine how the FM waves **look different** than the AM waves.



A FM waves show areas where the wavelengths are different

B AM waves show areas where the wavelengths are different

C AM waves vary in their frequencies

D FM frequencies are the same

3

Why do **FM radio** broadcasts **sound better** than AM radio broadcasts?

A AM broadcasts at different frequencies

B AM broadcasts are louder

C FM broadcasts are louder



4

In the picture below, a policeman is beaming a **radar gun** on moving traffic. What **kind of waves** are used by the radar gun?

A microwaves

B gamma rays



5



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A ultraviolet rays

B orange light

C X-rays

D gamma rays

B lower frequencies than ultraviolet rays

C higher frequencies than ultraviolet rays

D less energy than ultraviolet rays

9

Ultraviolet rays can cause a person's skin to tan. What is another possible effect of ultraviolet rays?

A common colds

B skin allergies

C skin cancer

D acne



10

Using the chart below, determine which type of broadcast can send out the **highest frequency**.

A UHF

B VHF

C AM

D FM

Broadcast Frequencies	
Type of Broadcast	Frequency Range
AM radio broadcast	535 kHz to 1,605 kHz
VHF television	54 MHz to 216 MHz
FM radio broadcast	88 MHz to 108 MHz
UHF television	470 MHz to 806 MHz



Name _____ Class _____ Date _____

1

In the diagrams below, _____.

- A** AM waves are being frequency modulated
- B** FM waves are being amplitude modulated
- C** AM and FM waves look the same
- D** AM waves are amplitude modulated



D

2

Using the diagram below, determine how the FM waves **look different** than the AM waves.

- A** FM waves show areas where the wavelengths are different
- B** AM waves show areas where the wavelengths are different
- C** AM waves vary in their frequencies
- D** FM frequencies are the same

A

3

Why do **FM radio** broadcasts **sound better** than AM radio broadcasts?

- A** AM broadcasts at different frequencies
- B** AM broadcasts are louder
- C** FM broadcasts are louder



D

4

In the picture below, a policeman is beaming a **radar gun** on moving traffic. What **kind of waves** are used by the radar gun?

- A** microwaves
- B** gamma rays

C

5



C

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C

- A** ultraviolet rays
- B** orange light
- C** X-rays
- D** gamma rays

- B** lower frequencies than ultraviolet rays
- C** higher frequencies than ultraviolet rays
- D** less energy than ultraviolet rays

9

Ultraviolet rays can cause a person's skin to tan. What is another possible effect of ultraviolet rays?

- A** common colds
- B** skin allergies
- C** skin cancer
- D** acne



C

10

Using the chart below, determine which type of broadcast can send out the **highest frequency**.

- A** UHF
- B** VHF
- C** AM
- D** FM

Broadcast Frequencies	
Type of Broadcast	Frequency Range
AM radio broadcast	535 kHz to 1,605 kHz
VHF television	54 MHz to 216 MHz
FM radio broadcast	88 MHz to 108 MHz
UHF television	470 MHz to 806 MHz

A



Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Prism

Microwaves

Electromagnetic wave

Photon

Electromagnetic spectrum

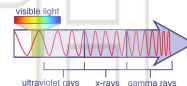
Gamma ray

Infrared rays

Opaque

1. wavelengths

- the combination of all electromagnetic



2. magnetic field and electrical field without the need for a medium

- a type of wave that carries both a



3. highest



4. wavelength lamps

5. with some

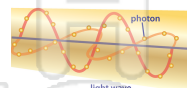
6. not all

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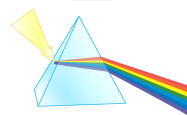
7. electromagnetic waves

- a particle of energy thought to exist in



8. break up light into its different wavelengths

- a triangular shaped glass device used to





Name _____ Class _____ Date _____

Match each of the following terms to its definition:

Prism

Microwaves

Electromagnetic wave

Photon

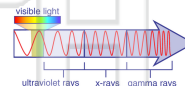
Electromagnetic spectrum

Gamma ray

Infrared rays

Opaque

1. **electromagnetic spectrum** - the combination of all electromagnetic wavelengths



2. **electromagnetic wave** - a type of wave that carries both a magnetic field and electrical field without the need for a medium



3. **gamma rays** - high energy electromagnetic waves that can penetrate through most materials



4. **infrared rays** - electromagnetic waves that can be felt as heat and are used in night vision cameras

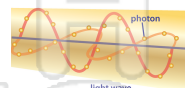
5. **microwaves** - electromagnetic waves used in microwave ovens

6. **opaque** - a material that does not allow light to pass through it

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7. **photon** - a particle of energy thought to exist in electromagnetic waves



8. **prism** - a triangular shaped glass device used to break up light into its different wavelengths

