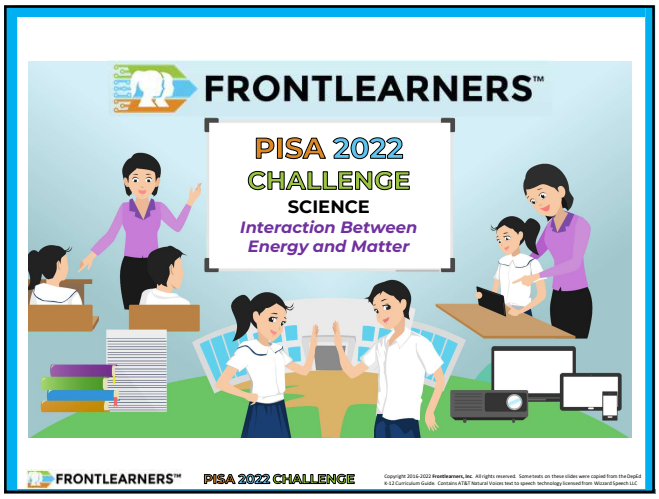
FRONTLEARNERS™
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SCIENCE
Interaction Between Energy and Matter
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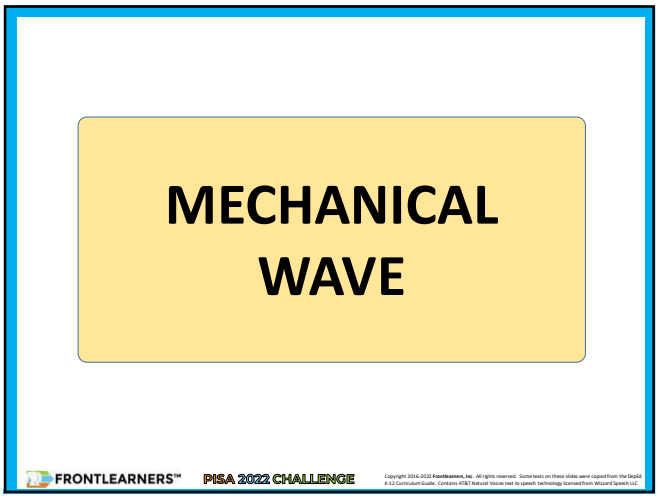
1


MECHANICAL WAVE
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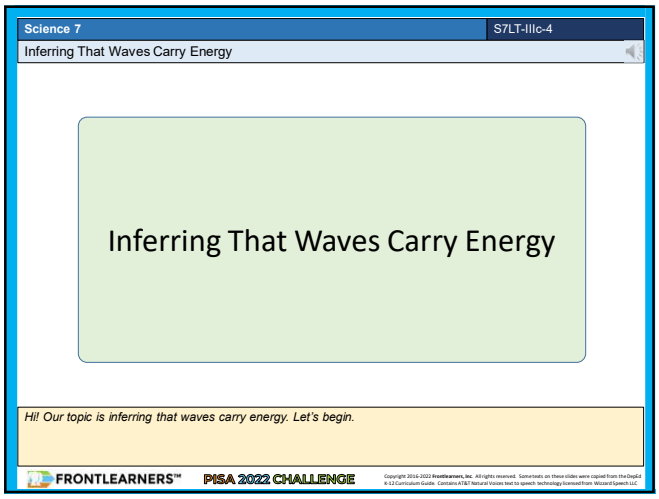
Science 7
S7LT-IIIc-4
Inferring That Waves Carry Energy
Inferring That Waves Carry Energy
Hi! Our topic is inferring that waves carry energy. Let's begin.
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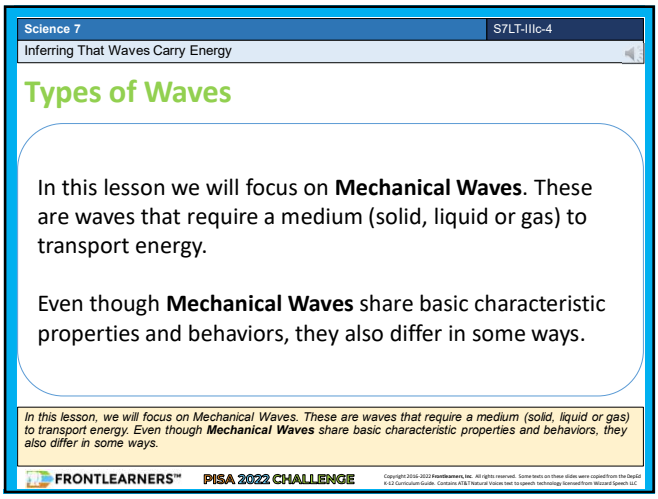
3


Science 7
S7LT-IIIc-4
Inferring That Waves Carry Energy
Types of Waves
In this lesson we will focus on Mechanical Waves. These are waves that require a medium (solid, liquid or gas) to transport energy.
Even though Mechanical Waves share basic characteristic properties and behaviors, they also differ in some ways.
In this lesson, we will focus on Mechanical Waves. These are waves that require a medium (solid, liquid or gas) to transport energy. Even though Mechanical Waves share basic characteristic properties and behaviors, they also differ in some ways.
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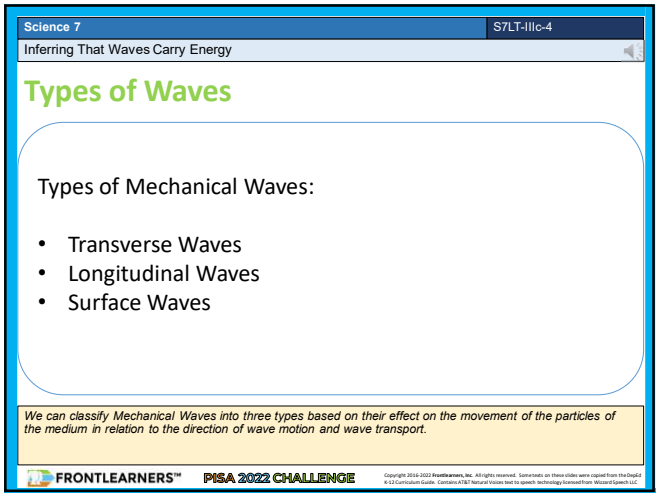
Science 7
S7LT-IIIc-4
Inferring That Waves Carry Energy
Types of Waves
Types of Mechanical Waves:
• Transverse Waves
• Longitudinal Waves
• Surface Waves
We can classify Mechanical Waves into three types based on their effect on the movement of the particles of the medium in relation to the direction of wave motion and wave transport.
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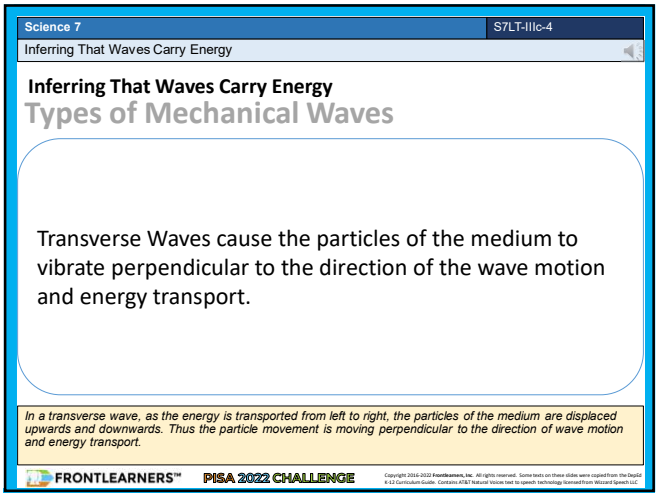
Science 7
S7LT-IIIc-4
Inferring That Waves Carry Energy
Inferring That Waves Carry Energy
Types of Mechanical Waves
Transverse Waves cause the particles of the medium to vibrate perpendicular to the direction of the wave motion and energy transport.
In a transverse wave, as the energy is transported from left to right, the particles of the medium are displaced upwards and downwards. Thus the particle movement is moving perpendicular to the direction of wave motion and energy transport.
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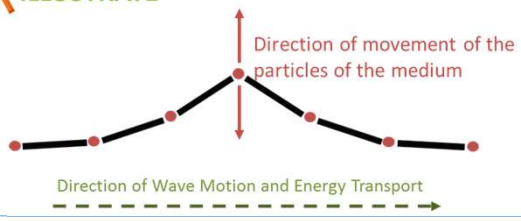
Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

Types of Mechanical Waves

Transverse Waves

ILLUSTRATE



In a transverse wave, as the energy is transported from left to right, the particles of the medium are displaced upwards and downwards. Thus the particle movement is moving perpendicular to the direction of wave motion and energy transport.

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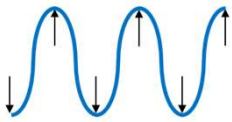
Inferring That Waves Carry Energy

Types of Mechanical Waves

Transverse Waves

Due to the upward and downward movement of the medium perpendicular to the wave motion, the formation of crests and troughs takes place. Thus, a transverse wave has a form like this:



Due to the upward and downward movement of the medium, the formation of the crest and trough takes place, so a transverse wave has a form like this.

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Inferring That Waves Carry Energy

Types of Mechanical Waves

Transverse Waves

EXAMPLE

- Radio waves
- Light waves
- Vibrations on strings

Some examples of transverse waves are radio waves, light waves, vibrations on strings.

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Inferring That Waves Carry Energy

Inferring That Waves Carry Energy

Types of Mechanical Waves

Longitudinal waves cause the particles of the medium to move parallel to the direction of the wave motion and energy transport.

The next type of wave is the longitudinal wave. Longitudinal waves cause the particles of the medium to move parallel to the direction of the wave motion and energy transport.

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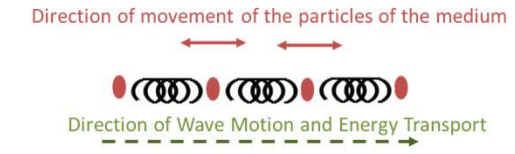
Inferring That Waves Carry Energy

Types of Mechanical Waves

Longitudinal Waves

ILLUSTRATE



In a longitudinal wave, as the energy is transported from left to right, the particles of the medium are displaced leftwards and rightwards. Thus the movement of the particles of the medium is parallel to the direction of the wave motion and energy transport.

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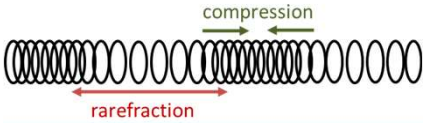
Inferring That Waves Carry Energy

Types of Mechanical Waves

Longitudinal Waves

Since there is no perpendicular movement of the particles of the medium relative to the wave motion, no crests and troughs are formed. Instead, compression and rarefaction take place.



Compression happens when the particles of the medium are forced or pressed together. On the other hand, rarefaction occurs when the particles are allowed to expand.

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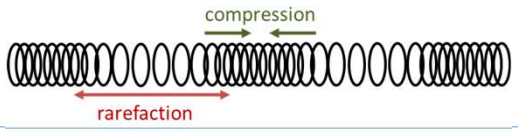
Inferring That Waves Carry Energy

Types of Mechanical Waves

Longitudinal Waves

Compression happens when the particles of the medium are forced or pressed together. On the other hand, rarefaction occurs when the particles are allowed to expand.



Since there is no perpendicular movement of the particles of the medium relative to the wave motion, no crests and troughs are formed. Instead, compression and rarefaction take place.

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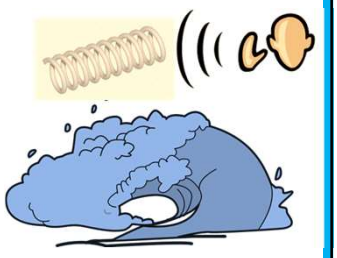
Inferring That Waves Carry Energy

Types of Mechanical Waves

Longitudinal Waves

EXAMPLE

- Sound waves
- Tsunami waves
- Spring oscillations



Examples of longitudinal waves are sound waves, tsunami waves and spring oscillations.

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Inferring That Waves Carry Energy

NOTE

- Waves traveling through a solid medium can be either transverse waves or longitudinal waves.
- Waves travelling through a liquid or a gas medium are always longitudinal

Waves traveling through a solid medium can be either transverse waves or longitudinal waves. Waves travelling through a liquid or a gas medium are always longitudinal

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Inferring That Waves Carry Energy

Inferring That Waves Carry Energy

Types of Mechanical Waves

Surface wave is a wave in which the particles of the medium move in a circular motion. It is sometimes called a circular wave because the particles of the medium undergo a motion in a complete circle.

The last type of wave to be discussed is the surface wave. A surface wave is a wave in which the particles of the medium move in a circular motion.

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Inferring That Waves Carry Energy

Types of Mechanical Waves

Surface Waves

Unlike in transverse and longitudinal waves wherein the entire bulk of the medium move as the waves move, in surface waves only the particles at the surface of the medium undergo the circular motion.

ILLUSTRATE

Unlike in transverse and longitudinal waves wherein the entire bulk of the medium move as the waves move, in surface waves only the particles at the surface of the medium undergo the circular motion.

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Inferring That Waves Carry Energy

Types of Mechanical Waves

Longitudinal Waves

EXAMPLE

- waves that travel along the surface of the ocean

An example of surface wave is the waves that travel along the surface of the ocean.

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Inferring That Waves Carry Energy

SUMMARY

Mechanical waves can be categorized into three types:

- Transverse waves
- Longitudinal waves
- Surface waves

Remember: Waves can be categorized into three types: transverse, longitudinal and surface waves.

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Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

SUMMARY

The three types of Mechanical Waves differ on their effect on the direction of vibration of the particles of the medium relative to the wave motion and energy transport.

Type of Mechanical Wave	Direction of vibration of particles of the medium
Transverse	Perpendicular to the direction of wave motion
Longitudinal	Parallel to the direction of wave motion
Surface	Particles on the surface of the medium vibrate in circular motion

The three types of Mechanical Waves differ on their effect on the direction of vibration of the particles of the medium relative to the direction wave motion and energy transport.

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Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

EXERCISES

Inferring That Waves Carry Energy

Now, let's answer some exercises. Are you ready?

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Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

Multiple Choice

Select all possible answers.

Which of the following is/are not an electromagnetic wave?

A. radio wave	C. ultraviolet wave
B. light wave	D. seismic wave

Identify the missing word. An example of a longitudinal wave is (blank).

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Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

Multiple Choice

Select all possible answers.

Which of the following is/are not an electromagnetic wave?

A. radio wave	C. ultraviolet wave
B. light wave	D. seismic wave

The answer is D. seismic wave.

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Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

Multiple Choice

Select the correct answer.

Sound is a mechanical wave. This means that:

A. Sound waves can transport through a vacuum.

B. Particles of sound can move quickly through empty space.

C. Sound waves require a medium to transport energy.

D. Sound waves are neither transverse nor longitudinal.

Sound is a mechanical wave. This means that:

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Science 7 | S7LT-IIIc-4

Inferring That Waves Carry Energy

Multiple Choice

Select the correct answer.

Sound is a mechanical wave. This means that:

A. Sound waves can transport through a vacuum.

B. Particles of sound can move quickly through empty space.

C. Sound waves require a medium to transport energy.

D. Sound waves are neither transverse nor longitudinal.

The answer is C. Sound waves require a medium to transport energy.

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Inferring That Waves Carry Energy

Multiple Choice

Select the correct answer.

Which of the following is NOT a characteristic of a mechanical wave?

A. It is not capable of moving through a vacuum.

B. It can travel in empty space.

C. It is created by a vibrating source.

D. It transports energy.

Which of the following is NOT a characteristic of a mechanical wave?

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Inferring That Waves Carry Energy

Multiple Choice

Select the correct answer.

Which of the following is NOT a characteristic of a mechanical wave?

A. It is not capable of moving through a vacuum.

B. It can travel in empty space.

C. It is created by a vibrating source.

D. It transports energy.

The answer is B. It can travel in empty space.

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Inferring That Waves Carry Energy

True or False

Select the correct answer.

Electromagnetic waves need a medium for them to flow or transport energy.

TRUE FALSE

True or False. Electromagnetic waves need a medium for them to flow or transport energy.

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Inferring That Waves Carry Energy

True or False

Select the correct answer.

Electromagnetic waves need a medium for them to flow or transport energy.

TRUE FALSE

The answer is FALSE.

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Inferring That Waves Carry Energy

True or False

Select the correct answer.

Electromagnetic waves are produced by the vibration of charged particles.

TRUE FALSE

True or False. Electromagnetic waves are produced by the vibration of charged particles.

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Inferring That Waves Carry Energy

True or False

Select the correct answer.

Electromagnetic waves are produced by the vibration of charged particles.

TRUE | FALSE

The answer is TRUE.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Hi! Our topic is about differentiating transverse from longitudinal waves, and mechanical from electromagnetic waves. Let's begin.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Mechanical waves require a medium to transport their energy from one place to another. The medium can be any solid, liquid or gas.

They cannot travel through empty space or vacuum.

Mechanical waves require a medium to transport their energy from one place to another. They cannot travel through empty space or vacuum.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Mechanical Waves

A mechanical wave is created by a vibrating source that causes a movement in the medium.

A mechanical wave is created by a vibrating source that causes a movement in the medium.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Mechanical Waves

EXAMPLE

- Water Waves
- Seismic Waves
- Slinky waves

Examples of mechanical waves are water waves, seismic waves and slinky waves. Water waves travels through water, seismic waves travel through the earth, and a slinky waves travel through the coils of a slinky.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Electromagnetic Waves do not require a medium to transport their energy from one place to another, but can travel through one anyway.

This means they are capable of transporting energy through empty space or vacuum.

On the other hand, Electromagnetic Waves do not require a medium to transport their energy from one place to another, but can travel through one anyway. This means they are capable of transporting energy through empty space or vacuum.

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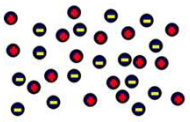
Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Electromagnetic Waves

Electromagnetic waves are produced by the vibration of charged particles.



Electromagnetic waves are produced by the vibration of charged particles.

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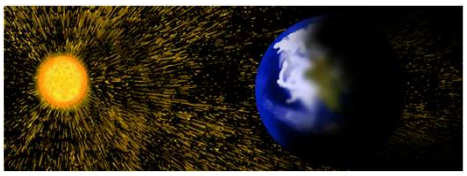
Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Electromagnetic Waves

ILLUSTRATE



A good illustration of an electromagnetic wave is the light coming from the sun. Light waves that are produced by the sun travel to Earth through the vacuum of the outer space.

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Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Electromagnetic Waves and Mechanical Waves

Electromagnetic Waves

EXAMPLE

- Radio Waves
- Television Waves

Other examples of electromagnetic waves are radio, television, and ultraviolet waves or rays.

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Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

NOTE

Sound waves are mechanical waves.
Sound waves can travel through any medium, like air, but it cannot travel through a vacuum.

This is the reason why there is no sound in outer space, since outer space is a vacuum.

Sound waves are mechanical waves. Sound waves can travel through any medium, like air, but it cannot travel through a vacuum. This is the reason why there is no sound in outer space, since outer space is a vacuum.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

SUMMARY

Waves can be categorized based on whether they require a medium or not.

Mechanical Waves	Electromagnetic Wave
▪ a medium is required ▪ cannot travel in vacuum	▪ no medium is required ▪ can travel in vacuum

Remember: Waves can be categorized based on whether they require a medium or not. Mechanical waves require a medium to propagate and cannot travel in vacuum. On the other hand, electromagnetic waves do not require a medium and can travel in vacuum.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

EXERCISES

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Now, let's answer some exercises. Are you ready?

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Multiple Choice

Select all possible answers.

Which of the following is/are not an electromagnetic wave?

A. radio wave	C. ultraviolet wave
B. light wave	D. seismic wave

Identify the missing word. An example of a longitudinal wave is (blank).

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Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Multiple Choice

Select all possible answers.

Which of the following is/are not an electromagnetic wave?

A. radio wave	C. ultraviolet wave
B. light wave	D. seismic wave

The answer is D. seismic wave.

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Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Multiple Choice

Select the correct answer.

Sound is a mechanical wave. This means that:

A. Sound waves can transport through a vacuum.

B. Particles of sound can move quickly through empty space.

C. Sound waves require a medium to transport energy.

D. Sound waves are neither transverse nor longitudinal.

Sound is a mechanical wave. This means that:

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Multiple Choice

Select the correct answer.

Sound is a mechanical wave. This means that:

A. Sound waves can transport through a vacuum.

B. Particles of sound can move quickly through empty space.

C. Sound waves require a medium to transport energy.

D. Sound waves are neither transverse nor longitudinal.

The answer is C. Sound waves require a medium to transport energy.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following is NOT a characteristic of a mechanical wave?

A. It is not capable of moving through a vacuum.

B. It can travel in empty space.

C. It is created by a vibrating source.

D. It transports energy.

Which of the following is NOT a characteristic of a mechanical wave?

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following is NOT a characteristic of a mechanical wave?

A. It is not capable of moving through a vacuum.

B. It can travel in empty space.

C. It is created by a vibrating source.

D. It transports energy.

The answer is B. It can travel in empty space.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

True or False

Select the correct answer.

Electromagnetic waves need a medium for them to flow or transport energy.

TRUE | FALSE

True or False. Electromagnetic waves need a medium for them to flow or transport energy.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

True or False

Select the correct answer.

Electromagnetic waves need a medium for them to flow or transport energy.

TRUE | FALSE

The answer is FALSE.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

True or False

Select the correct answer.

Electromagnetic waves are produced by the vibration of charged particles.

TRUE | FALSE

True or False. Electromagnetic waves are produced by the vibration of charged particles.

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Science 7 | S7LT-IIIc-5

Differentiating Transverse from Longitudinal Waves, and Mechanical from Electromagnetic Waves

True or False

Select the correct answer.

Electromagnetic waves are produced by the vibration of charged particles.

TRUE | FALSE

The answer is TRUE.

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Science 7 | S7LT-IIIc-6

Relating Characteristics of Waves

Relating Characteristics of Waves

Hi! Our topic is about relating characteristics of waves. Let's begin.

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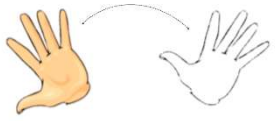
Science 7 | S7LT-IIIc-6

Relating Characteristics of Waves

Waves and their Characteristics

What motion do you do when you wave your hands?

When you are waving your hands, you are doing a repetitive back-and-forth or up-and-down movement.



Try waving your hands. What motion do you do when you wave your hands? When you are waving your hands, you are doing a repetitive back-and-forth or up-and-down movement.

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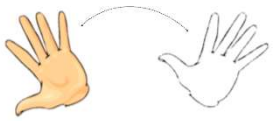
Relating Characteristics of Waves

Waves and their Characteristics

The repetitive motion that you do with your hands while waving is similar to a **vibration**. A vibration causes wave motion. When you observe a wave, the source is always a vibration.



The repetitive motion that you do with your hands while waving is called a vibration. A vibration causes wave motion. When you observe a wave, the source is always a vibration.

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Relating Characteristics of Waves

Waves and their Characteristics

Wave is a periodic disturbance that travels through matter or space, accompanied by a transfer of energy.

A wave is a periodic disturbance that travels through matter or space, accompanied by a transfer of energy.

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Relating Characteristics of Waves

Relating Characteristics of Waves

Inferring That Waves Carry Energy

There are two types of waves:

MECHANICAL WAVES need a medium to transport energy. The medium can be any solid, liquid or gas.

ELECTROMAGNETIC WAVES do not need a medium to transport energy. They can travel through vacuum or empty space.

There are two types of waves. Mechanical waves need a medium to transport energy. The medium can be any solid, liquid or gas. Electromagnetic waves do not need a medium to transport energy. They can travel through vacuum or empty space.

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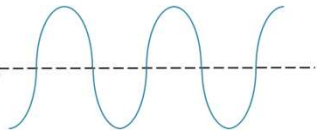
Relating Characteristics of Waves

Relating Characteristics of Waves

Parts of a Wave

RESTING POSITION – this is considered the spot where the wave begins disturbing the medium

The straight dashed line represents the resting position.



The first part is the resting position. The resting position is considered the spot where the wave begins disturbing the medium. In the illustration, the straight dashed line represents the resting position.

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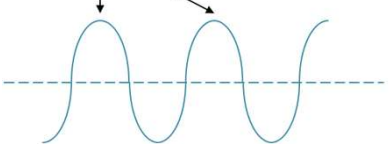
Relating Characteristics of Waves

Relating Characteristics of Waves

Parts of a Wave

CREST – the highest point/peak of the wave



The next part is the crest, which is the highest point or the peak of the wave.

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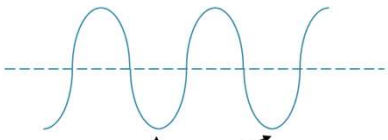
Relating Characteristics of Waves

Relating Characteristics of Waves

Parts of a Wave



TROUGH – the lowest point of the wave

And the last part is the trough, which is the lowest part of the wave.

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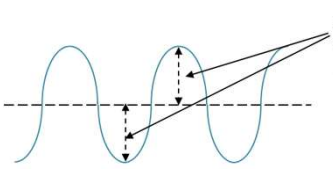
Relating Characteristics of Waves

Relating Characteristics of Waves

Characteristics of a Wave



AMPLITUDE
– the maximum displacement from the resting position to the highest or lowest point of the wave

– measured in meters (m)

The first is the wave's amplitude. The amplitude is the maximum displacement from the resting position to the highest or lowest point of the wave. It is measured in meters.

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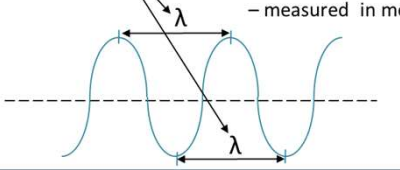
Relating Characteristics of Waves

Relating Characteristics of Waves

Characteristics of a Wave

WAVELENGTH (λ) – the distance between two corresponding parts of the wave (adjacent crests, adjacent troughs)
– measured in meters (m)



The next characteristic is the wavelength. Its symbol is the Greek letter lambda. It is the distance between two corresponding parts of the wave. It is also measured in meters.

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Relating Characteristics of Waves

Relating Characteristics of Waves

Characteristics of a Wave

FREQUENCY (*f*)

- the number of complete waves that pass a given point at a certain amount of time
- describes how many complete vibrations occur at a given time
- units are in **hertz** (Hz), which is equivalent to one cycle per second

Another characteristic is the wave's frequency. It is the number of complete waves that pass a given point at a certain amount of time. It also describes how many complete vibrations occur at a given time. Its units are in hertz (Hz), which is equivalent to one cycle per second.

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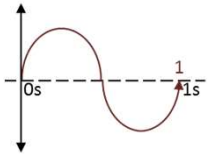
Relating Characteristics of Waves

EXAMPLE

One complete up-and-down motion in one second = frequency of 1 Hz



For example, in the figure, the wave makes a complete up-and-down motion in one second, so it has a frequency of 1 hertz or 1 cycle per second.

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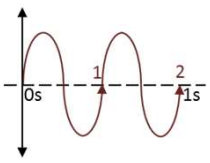
Relating Characteristics of Waves

EXAMPLE

Two complete up-and-down motions in one second = frequency of 2 Hz



In this example, the wave makes two complete up-and-down motions in one second, so it has a frequency of 2 hertz or 2 cycles per second.

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Relating Characteristics of Waves

Relating Characteristics of Waves

Characteristics of a Wave

PERIOD (*T*)

- the time needed to complete one vibration
- the time between two corresponding parts of the wave (i.e. adjacent crests, adjacent troughs)
- measured in seconds (s)

The next characteristic of a wave is the period. Its symbol is the big letter T. It is the time needed to complete one vibration. Thus it is the time between two adjacent crests or two adjacent troughs. It is measured in seconds.

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Relating Characteristics of Waves

Relating Characteristics of Waves
Characteristics of a Wave

Frequency and Period are reciprocals of each other, which means:

Frequency = 1/Period or $f = 1/T$

Period = 1/Frequency *or* $T = 1/f$

The two wave characteristics frequency and period are reciprocals of each other, which means frequency is equal to 1 over period and period is equal to 1 over frequency.

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Relating Characteristics of Waves

NOTE

Suppose a wave makes two vibrations per second, how much time is required to complete one vibration?

Suppose a wave makes two vibrations per second, how much is the time required to complete one vibration?

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Relating Characteristics of Waves

NOTE

Given: frequency = 2 vibrations per second or 2 Hz

Period = 1/Frequency
$T = 1/f$
= ½ Hz
= ½ *sec*

From the problem, we know that the frequency is 2 vibrations per second or 2 hertz. We also know that period equals 1 over frequency. Substituting 2 hertz to the frequency, we will get 1 over 2 hertz, or ½ second.

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Relating Characteristics of Waves

NOTE

Since the wave makes two vibrations per second, then the period or the time needed to complete one vibration is **½ second**.

Since the wave makes two vibrations per second, then the period or the time needed to complete one vibration is ½ second.

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Relating Characteristics of Waves

Relating Characteristics of Waves
Characteristics of a Wave

WAVE VELOCITY (*v*)
- the rate at which the wave travels at a particular point
- computed by dividing the distance travelled by the time it took the wave to travel that distance
- units are in m/s

Another wave characteristic is the wave velocity. It is the rate at which the wave travels at a particular point. It can be computed by dividing the distance travelled by the time it took the wave to travel that distance. Its units are in meters per second.

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Relating Characteristics of Waves

Relating Characteristics of Waves
Characteristics of a Wave

Wave velocity = distance travelled by the wave/travel time

since wavelength , λ = distance between two corresponding parts of the wave
and Period, T =time between two corresponding parts of the wave
Wave velocity can be expressed as:
Wave velocity = wavelength/*Period*
$v = \lambda/T$

Wave velocity is the distance travelled by the wave over the time it took to travel that distance. Since wavelength is the distance between two corresponding parts of the wave and period is the time between two corresponding parts of the wave, Wave velocity can be expressed as wavelength divided by the period.

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Relating Characteristics of Waves

Relating Characteristics of Waves

Characteristics of a Wave

Wave velocity = Wavelength/*Period*

$v = \lambda/T$

Since: Period = 1/Frequency

Wave velocity = Wavelength/(1/ Frequency)

= Wavelength x Frequency

$v = \lambda f$

And since period is equal to one over frequency, we can derive the equation: wave velocity is equal to wavelength times frequency.

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Relating Characteristics of Waves

SUMMARY

A **wave** is a periodic disturbance that travels through matter or space, accompanied by a transfer of energy.

A **wave** has different characteristics such as:

- amplitude
- wavelength,
- frequency
- period
- wave velocity

Now remember, a wave is a periodic disturbance that travels through matter or space, accompanied by a transfer of energy. Also, a wave has different characteristics such as amplitude, wavelength, frequency, period and wave velocity.

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Relating Characteristics of Waves

EXERCISES

Relating Characteristics of Waves

Now, let's answer some exercises. Are you ready?

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

What do you call the periodic disturbance that transfers energy from place to place?

A. vibration	C. frequency
B. peak	D. wave

What do you call the disturbance that transfers energy from place to place?

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

What do you call the periodic disturbance that transfers energy from place to place?

A. vibration	C. frequency
B. peak	D. wave

The correct answer is D, wave.

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

If we divide the distance travelled by the time it took the wave to travel that distance, we can get the _____.

A. amplitude	C. frequency
B. wave velocity	D. period

If we divide the distance travelled by the time it took the wave to travel that distance, we can get the (blank).

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

If we divide the distance travelled by the time it took the wave to travel that distance, we can get the _____.

A. amplitude	C. frequency
B. wave velocity	D. period

The correct answer is B, wave velocity.

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

A repeated back-and-forth or up-and-down motion is similar to a _____.

A. vibration	C. frequency
B. peak	D. wave

A repeated back-and-forth or up-and-down motion is similar to a (blank).

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

A repeated back-and-forth or up-and-down motion is similar to a _____.

A. vibration	C. frequency
B. peak	D. wave

The correct answer is A, vibration.

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

What part of the wave is this?

A. amplitude	C. crest
B. trough	D. up

What part of the wave is this?

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

What part of the wave is this?

A. amplitude	C. crest
B. trough	D. up

The correct answer is C, crest.

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

Mechanical waves can travel on these medium EXCEPT on _____?

A. solid	C. gas
B. liquid	D. empty space

Mechanical waves can travel on these medium except on (blank).

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Relating Characteristics of Waves

Multiple Choice

Select the correct answer.

Mechanical waves can travel on these medium EXCEPT on _____?

A. solid	C. gas
B. liquid	D. empty space

The correct answer is D, empty space.

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SOUND

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Science 7 | S7LT-IIIe-8

Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Hi! Our topic is about explaining sound production in the human voice box, and how pitch, loudness, and quality of sound vary from one person to another.

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Science 7 | S7LT-IIIe-8

Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

RECALL

Sound

- mechanical vibration as **waveform**
- longitudinal waves of pressure
- travels through compressible media (solid, liquid, gaseous, or made of plasma)
- does not travel in vacuum or outer space

Recall. Sound is a mechanical vibration in a waveform. It consists of longitudinal waves of pressure which travels through any compressible medias. It does not travel in vacuum because vacuum is a space free of any particles or matter.

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Science 7 | S7LT-IIIe-8

Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Put your hand on your neck while you speak.
Do you feel any vibration?

That is your voice box which produces sound when talking, humming, and/or singing.

Let's try this activity. Put your hand on your neck while you speak. Do you feel any vibration? That is your voice box which produces sound when talking, humming, and/or singing. Let's discuss more about the sound production in human voice box.

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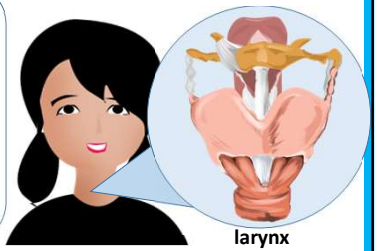
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

- **larynx**, located just above the wind pipe or trachea
- produces sound with varying **tone, quality, and loudness**



larynx

The human voice box is the larynx. It is located just above the wind pipe or trachea. It produces sound with varying pitch, quality, and loudness.

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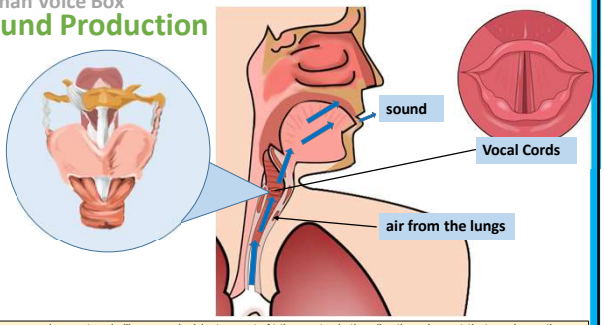
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production



The human voice system is like a musical instrument. At the center is the vibrating element that produces the sound with varying tone and loudness. That vibrating element is the vocal cord or vocal folds. It's the two elastic bands of muscles inside your larynx. When air is exhale from the lungs and through the larynx, it causes the vocal chord to vibrate.

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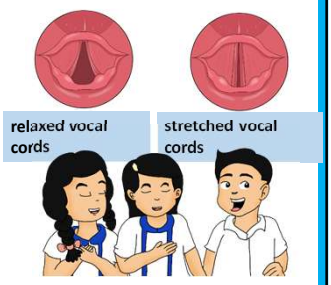
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

- higher pitch = tightly stretched vocal cords
- lower pitch = relaxed vocal cord
- shorter cords = higher the tones produced

Women and younger boys have higher pitched voices than men because their vocal chords are shorter.



During normal breathing, the vocal cords are held apart and no sound is produced. In the production of a high tone, the vocal cords are stretched tightly while they relax with the low tones. The shorter and tighter the chords, the higher the tones produced. Women and younger boys have higher pitched voices than men because their vocal chords are shorter.

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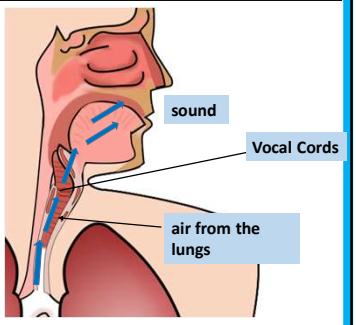
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

- **Loudness** = how fast the air moves past the cords

When we yell, we have to push the air rapidly through our vocal cords.



Loudness depends on how fast the air moves past the cords. When we yell, we have to push the air rapidly through our vocal cords.

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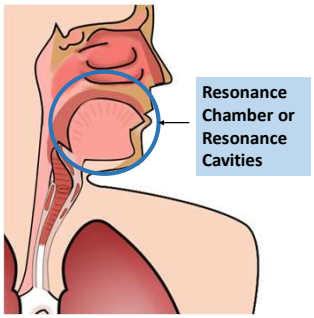
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

- space enclosed by the mouth, nose, and throat forms the resonance chamber or cavities

Resonance is the quality in a sound of being deep, full, and reverberating.



The space enclosed by the mouth, nose and throat forms the resonance chamber, which modulates and refines the sound. The vibrations when we speak travel through the this resonating cavities.

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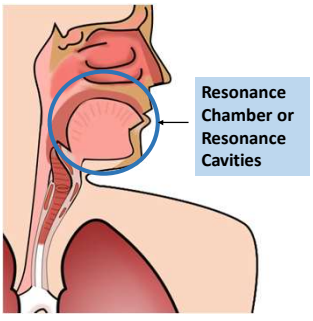
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

Sound of our voice vary from one another due to the size and shape of the cavities along with the size and shape of the vocal cords.
You can place the sound in different areas to adjust the resonance.



Every voice is unique due to the size and shape of these cavities along with the size and shape of the vocal cords. You can place the sound in different areas to adjust the resonance.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

Our voices that we hear through our own heads actually sound deeper and more resonant. It is because when we hear our own voice, we hear it travelling through our chambers directly to our ears.

When you hear it recorded, you're not hearing your as you've heard it your whole life. We're hearing it as other people hear it which is the sound travelling from our chambers through the air to their ears.

Our voices that we hear through our own heads actually sound deeper and more resonant. But the big difference is simply that when you hear it recorded, you're not hearing your as you've heard it your whole life. You're hearing it as other people hear it.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

Why men voices break and change when they go through puberty? Why do we have deeper voice when we are older?

Why men voices break and change when they go through puberty? Why do we have deeper voice when we are older?

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Human Voice Box

Sound Production

As our **larynx grows, our vocal cords grow longer and thicker.** Also, our facial bones begin to grow. Cavities in the sinuses, the nose, and the back of the throat grow bigger, creating more space in the face that gives your voice more room to echo. All of these factors cause your voice to get deeper.

As our larynx grows, our vocal cords grow longer and thicker. Also, our facial bones begin to grow. Cavities in the sinuses, the nose, and the back of the throat grow bigger, creating more space in the face that gives your voice more room to echo. All of these factors cause your voice to get deeper. Before our growth spurt, our larynx is relatively small and our vocal cords are relatively thin. So our voice is high and kid-like. But as bones, cartilage, and vocal cords grow, your voice starts to sound like an adult's.

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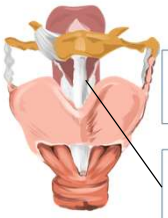
Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

SUMMARY



larynx

Human Voice Box= **Larynx**

Vocal Cords vibrating bands that produced sound

Variation of Sound from One Person to Another	
Pitch	• Length and pressure on the vocal cords • e.g. high pitch= shorter and tightly stretched vocal cords
Loudness	• how fast the air moves from the lungs when producing sound • Faster = louder
Quality	• size and shape of the resonance chambers (space enclosed by the mouth, nose, and throat)

Here's the summary of the lesson.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

EXERCISES

Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Now, let's answer some exercises. Are you ready?

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Modified True or False

Identify which among the given statements are true and/or false.

1: Larynx is the human voice box.
2: It is located in the middle of the wind pipe or trachea.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

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2: It is located in the middle of the wind pipe or trachea.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The correct answer is A. Statement 1 is true; Statement 2 is false.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Modified True or False

Identify which among the given statements are true and/or false.

1: The vibrating element inside the larynx is called vocal cords.
2: When air is exhale from the lungs and through the larynx, it causes the vocal chord to vibrate.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Modified True or False

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A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The answer is C. Both Statements 1 and 2 are true.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Modified True or False

Identify which among the given statements are true and/or false.

1: . The greater the tension in the vocal cords, the lower the pitch of the sound produced.
2: During normal breathing, the vocal cords are held apart and no sound is produced

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Modified True or False

Identify which among the given statements are true and/or false.

1: . The greater the tension in the vocal cords, the lower the pitch of the sound produced.
2: During normal breathing, the vocal cords are held apart and no sound is produced

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The answer is B. Statement 1 is false; Statement 2 is true.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Multiple Choice

Select the correct answer/s.

_____ depends on how fast the air moves past the cords.

A. Pitch

C. Quality

B. Loudness

D. Tone

Select the correct answer/s.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Multiple Choice

Select the correct answer/s.

_____ depends on how fast the air moves past the cords.

A. Pitch

C. Quality

B. Loudness

D. Tone

The correct answers are A. Vulcan and B. Loudness.

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Multiple Choice

Select the correct answer/s.

The space enclosed by the mouth, nose and throat forms the _____, which modulates and refines the sound.

A. resonators	C. epiglotis
B. cavities	D. larynx

Select the correct answer/s

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Explaining Sound Production in the Human Voice Box, and How Pitch, Loudness, and Quality of Sound Vary from One Person to Another

Multiple Choice

Select the correct answer/s.

The space enclosed by the mouth, nose and throat forms the _____, which modulates and refines the sound.

A. resonators	C. epiglotis
B. cavities	D. larynx

The correct answers are A. resonators.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Hi! Our topic is about describing the characteristics of sound using the concepts of wavelength, velocity, and amplitude. Let's begin.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Sound

RECALL

Sound is a **mechanical wave** that is created by **vibration of objects**. It is a **longitudinal wave** that requires a medium to propagate.

Characteristics of Sound

- Pitch
- Loudness
- Quality

Recall that sound is a mechanical wave that is created by vibration of objects. It is a longitudinal wave that requires a medium to propagate. In this lesson, we will describe three characteristics of sounds: pitch, loudness, and quality using the properties of soundwaves. First, let's discuss how sound is produced.

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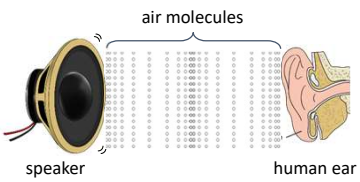
Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Do you wonder how the sound is produced?

To produce sound, this speaker **vibrates**. It causes the air molecules to vibrate as well. The air molecules vibrate back and forth which causes the sound that we hear.



In order to visualize, let us take this speaker as an example. To produce sound, this speaker vibrates. It causes the air molecules to vibrate as well. The air molecules vibrate back and forth which causes the sound the sound that we hear.

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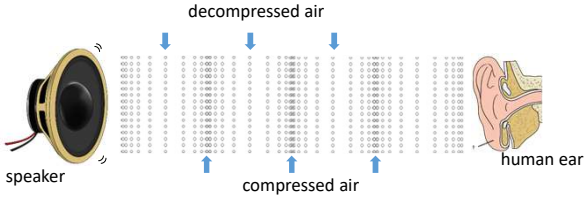
Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Since air molecules are **vibrating**, when they travel in the air, there are regions where the air molecules are compressed together and there are also regions where the air molecules are spread apart.



Since air molecules are vibrating, when they travel in the air, there are regions where the air molecules are compressed together and there are also regions where the air molecules are spread apart.

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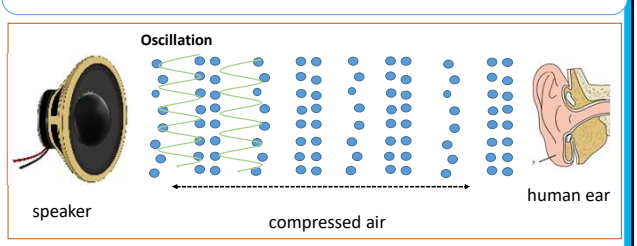
Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Air molecules are moving back and forth due to vibration. This movement of the air molecules is called **oscillation.** The oscillation forms a mechanical wave.



Air molecules are moving back and forth due to vibration which creates the sound. This movement of the air molecules is called oscillation. The oscillation forms a mechanical wave. Since sound comes in wave forms, let's discuss its characteristics using the properties of waves. Let's start with loudness.

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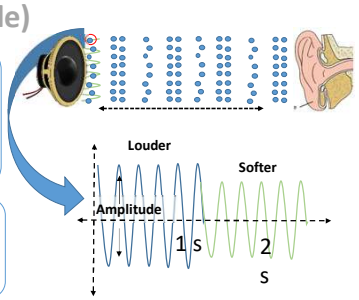
Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Characteristics of Sound

Loudness (Amplitude)

Loudness is determined by amplitude. **Amplitude** (Unit: **m**) is the **maximum distance** of a wave **from its rest position.**

The higher the amplitude of the soundwave, the louder the sound will be.



Loudness is determined by amplitude. Amplitude is the maximum displacement of the air molecule from its undisturbed position. It is also the size of vibration that determines the loudness of sound: the larger the vibration, the louder the sound will be. Amplitude is the origin of the word amplifier, a device which increases the amplitude of a waveform.

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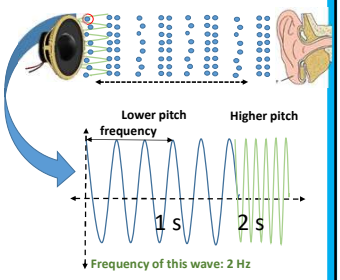
Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Characteristics of Sound

Pitch (Frequency)

Pitch is determined by frequency. **Frequency** (Unit: **Hz**) is the **number of complete wave** passing at a point every **one second**

The higher the frequency of the soundwaves, the higher the pitch will be.



Another characteristic of sound is the pitch. Pitch is determined by frequency. Frequency is the number of complete wave passing at a point every one second. The higher the frequency of the soundwaves, the higher the sound will be.

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Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Characteristics of Sound

Quality (Velocity)

The **quality of the sound or timbre** is the characteristic of the sound that makes the ear distinguish the sound's pitch and loudness.

The **quality of the sound** is determined by the **velocity** (Unit: **meter/second**) of the sound.

$$velocity = wavelength \times frequency$$
$$v = \lambda \times f$$

The quality of the sound or timbre is the characteristic of the sound that makes the ear distinguish the sound's pitch and loudness. The quality of the sound is determined by the velocity of the sound. The formula of velocity is wavelength times frequency. Let's further discuss what a velocity is.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Velocity

- The **velocity of sound** is the distance traveled per unit time by a sound wave propagating through a medium.
- The velocity of the sound is **343 meters per second** in dry air at normal atmospheric conditions.
- It can only be changed by altering the medium or the properties of the medium.

The velocity of sound is the distance traveled per unit time by a sound wave propagating through a medium. The velocity of the sound is 343 meters per second in dry air at normal atmospheric conditions. It can only be changed by altering the medium or the properties of the medium. Since velocity is made up of frequency and wavelength, it is important for us discuss wavelength.

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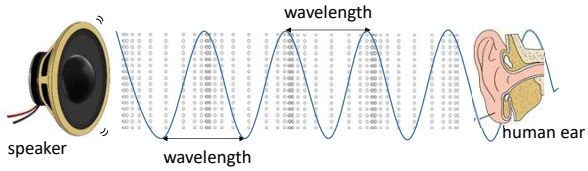
Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Wavelength

If we measure the distance between the two compressed regions of air molecules, that would be the **wavelength** of the sound. Wavelength is also equal to the distance between two decompressed regions of air.



If we measure the distance between the two compressed regions, that would be the wavelength of the sound. Wavelength is also equal to the distance between two decompressed regions of air.

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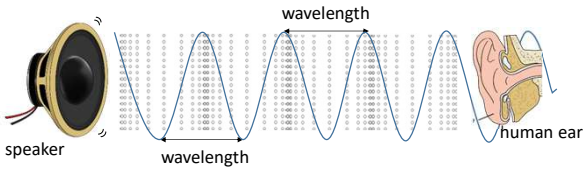
Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Wavelength

The symbol for wavelength is the Greek letter lambda, λ. It is measured in **meters** since wavelengths are determined by distance.



The symbol for wavelength is the Greek letter lambda. It is measured in meters since wavelengths are determined by distance.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Characteristics of Sound
Quality (Velocity)

TRY

Different materials have different velocity, that's why a saxophone, which is made up of steel, has a different sound quality compared to a flute, which is made up of wood.

Let's do a quick activity! Using a stick, tap the following materials and observe the quality of sound that it will produce:

- Wood
- Steel
- Glass

Going back to our discussion about velocity, it is important to note that different materials have different velocities, that's why a saxophone, which is made up of steel, has a different sound quality compared to a flute, made up of wood. Let's do a quick activity! Using a stick, tap the following materials and observe the quality of sound that it will produce.

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Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Characteristics of Sound
Quality (Velocity)

From the materials that you have tapped, which produced the best quality of sound? Relate your observation to the table provided.

Material	Velocity (m/s)
Wood	4000
Steel	5000
Glass	5000-6000

From the materials that you have tapped, which produced the best quality of sound? Relate your observation to the table provided.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

SUMMARY

Sound

-mechanical vibration as waveform (longitudinal waves)

Characteristics

WAVELENGTH
- distance between the maximum compressions
- related to pitch as to frequency

VELOCITY
- speed of the disturbance as it moves through the medium's molecules not the speed of the molecules.

AMPLITUDE
- maximum displacement of the air molecule from its undisturbed position
- loudness of sound

Here's the summary of the characteristics of sound using the concepts of wavelength, velocity, and amplitude.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

EXERCISES

Describe the characteristics of sound using the concepts of wavelength, velocity, and amplitude

Now, let's answer some exercises. Are you ready?

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Modified True or False

Identify which among the given statements are true and/or false.

1: Sound is a mechanical vibration in waveform.
2: Soundwaves are transverse waves of pressure

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

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A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The correct answer is A. Statement 1 is true; Statement 2 is false.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Modified True or False

Identify which among the given statements are true and/or false.

1: The higher the frequency, the shorter the wavelength is.
2: Higher frequency produced high pitched sounds.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

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A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The correct answer is C. Both Statements 1 and 2 are true.

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Science 7 | S7LT-IIId-7

Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Modified True or False

Identify which among the given statements are true and/or false.

1: Velocity of sound is the speed of the disturbance as it moves through the medium's molecules.
2: Velocity of sound in the air is faster than in solids and liquids.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Modified True or False

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A. Statement 1 is true; Statement 2 is false.

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D. Both Statements 1 and 2 are false.

The correct answer is A. Statement 1 is true; Statement 2 is false.

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Describing the Characteristics of Sound Using the Concepts of Wavelength, Velocity, and Amplitude

Multiple Choice

Select the correct answer.

What is the speed of sound in the air at room temperature of 20 degrees Celsius and normal atmospheric condition?

A. 344 m/s

C. cannot be determined

B. 273 m/s

D. 786 m/s

Select the correct answer.

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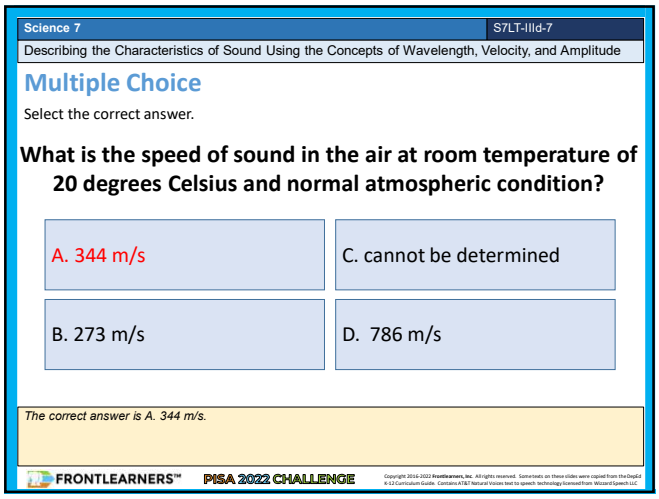

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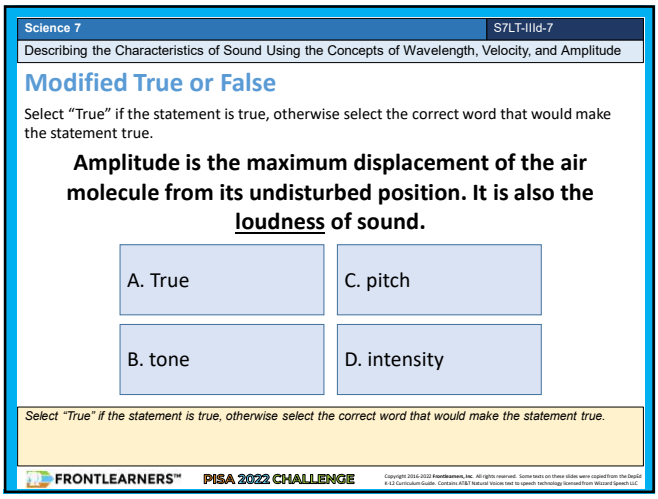

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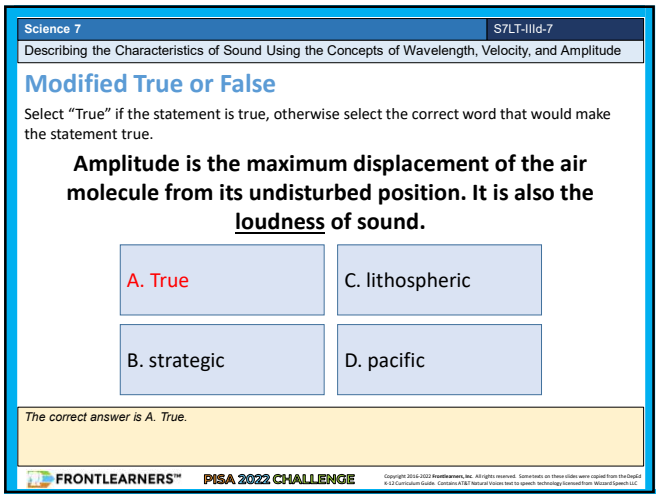

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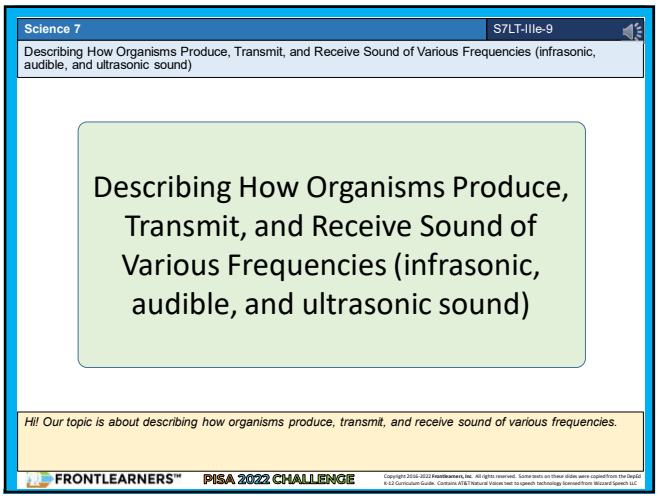

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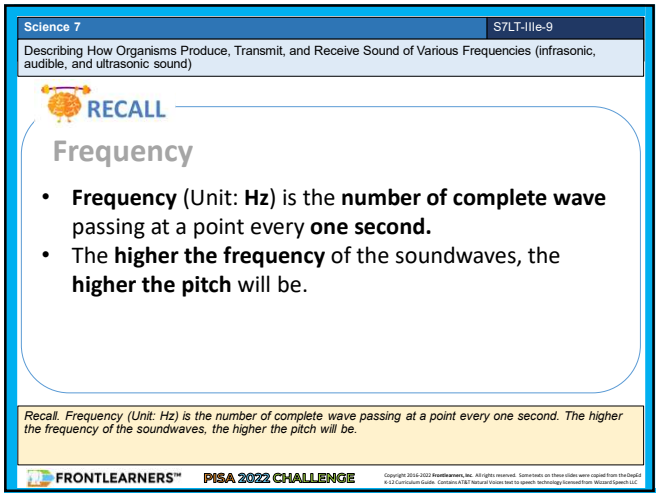

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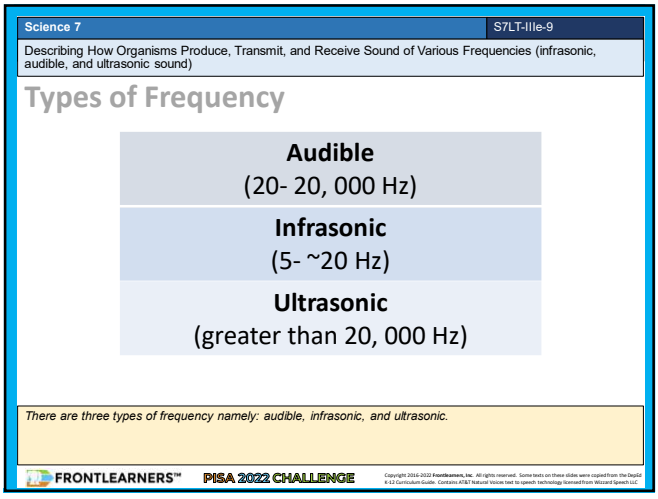

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Types of Frequency

Audible (20 Hz- 20, 000 Hz)

- frequency that the **human** can hear
- transmitted through the air to the ears

Human can produced up to **11,000 Hz** frequency of sound and can hear up to **20,000 Hz.**

The first type is the audible frequency. It ranges from 20 hertz to 20,000 hertz. It is the frequency range that human can hear. It is transmitted through the air to the ears. Human can produced up to 11,000 Hz frequency of sound and can hear up to 20,000 Hz.

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Science 7 | S7LT-IIIe-9

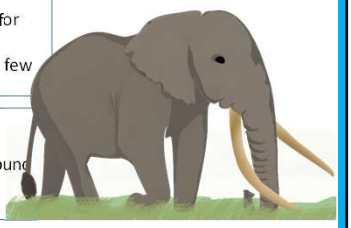
Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Types of Frequency

Infrasonic (5 Hz- ~20 Hz)

- has the special characteristic of travelling well in water
- dissipates less rapidly in air, ideal for long distance communication
- produced and perceived by only a few animals

One of the animals that is known to produce and/or receive infrasonic sound are **African elephants.**



Next type is the infrasonic frequency. It ranges from 5 hertz to approximately 20 hertz. It has the special characteristic of travelling well in water. It dissipates less rapidly in air, ideal for long distance communication. It is produced and perceived by only a few animals. One of those few animals are the African elephants.

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Science 7 | S7LT-IIIe-9

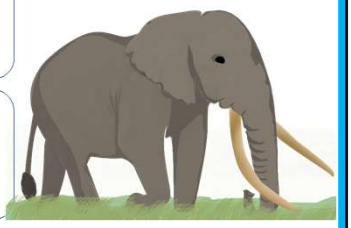
Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Infrasonic Sound

Elephants

- hearing range is **17 Hz – 10. 5 Hz**
- use air and ground as mediums
- Infrasonic sound as communication form

Infrasonic sound aids in keeping herds together in coordinated movements without losing contact or meeting with scarce resources.



The hearing range of elephants is 17 hertz up to 10.5 hertz. It uses air and ground as mediums. Elephants use infrasonic sound as communication form. Infrasonic sound aids in keeping herds together in coordinated movements without losing contact or meeting with scarce resources.

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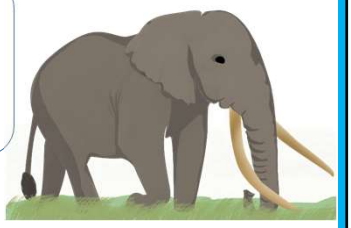
Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Infrasonic Sound

Elephants

- produce sound in the **throat where sinuses and trunks** may manipulate the sound texture.
- **forehead skin will flutter** and vibrate as air is passed through the nasal passage.



Elephants produce sound in the throat where sinuses and trunks may manipulate the sound texture. Their forehead skin will flutter and vibrate as air is passed through the nasal passage.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Types of Frequency

Ultrasonic (>20, 000 Hz)

- Commonly used by most animals for navigation and communications

Some of the animals that use ultrasonic sound are **bats, dogs, cats, and whales and dolphins.**

The last type is the ultrasonic frequency which is the frequency greater than the audible. It is commonly used by most animals for navigation and communications. Some of the animals that use ultrasonic sound are bats, dogs, cats, and whales and dolphins.

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Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Ultrasonic Sound

Bats

- hearing range is **12 kHz – 150 kHz**
- very sensitive hearing to cope with their nocturnal activity
- Navigate and locate their preys in the dark using echolocation

Echolocation is the ability to locate objects by bouncing sound waves off of them.

Let's know more about bats. The hearing range of bats is 12,000 hertz up to 150,000 hertz. They have very sensitive hearing to cope with their nocturnal activity. They use infrasonic sound to navigate and locate their preys in the dark using echolocation. Echolocation is the ability to locate objects by bouncing sound waves off of them.

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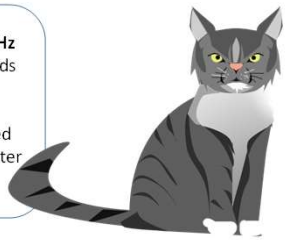
Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Ultrasonic Sound
Cats

- hearing range is **30 Hz – 50 kHz**
- can hear higher pitched sounds than dogs or humans
- use it in hunting
- hearing sensitivity is enhanced by the cat's large movable outer ears



Next organism that can perceived ultrasonic sound are cats. Their hearing range is 30,000 hertz to 50,000 hertz. They can hear higher pitched sounds than dogs or humans. They use the sound in hunting since most of the rodents creates ultrasonic sound. Cats hearing sensitivity is enhanced by the cat's large movable outer ears.

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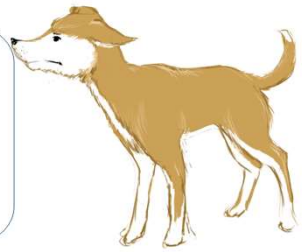
Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Ultrasonic Sound
Dogs

- hearing range is **50 Hz – 46 kHz**
- varies with breed and age
- move their ears towards the source of the sound to maximize reception
- many breeds have upright and curved ears for amplification



Dogs can also perceive ultrasonic sound. Their hearing range is from 50 hertz to 46,000 hertz although this range varies with breed and age. Dogs move their ears towards the source of the sound to maximize reception. Many breed have upright and curved ears for amplification.

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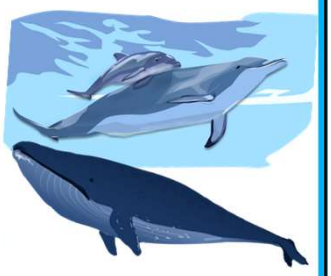
Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Ultrasonic Sound
Whales and Dolphins

- hearing range is **1kHz -130kHz**
- use water as a medium
- use ultrasonic sound to communicate, detect, and characterize objects
- they also use echolocation
- sound is channeled to the ear by the tissues in the area of the lower jaw



Lastly, we have whales and dolphins. Their hearing range is from 1000 hertz to 130,000 hertz. They use water as a medium. They use ultrasonic sound to communicate, detect, and characterize objects. Like bats, they also use echolocation. The sound is channeled to the ear by the tissues in the area of the lower jaw.

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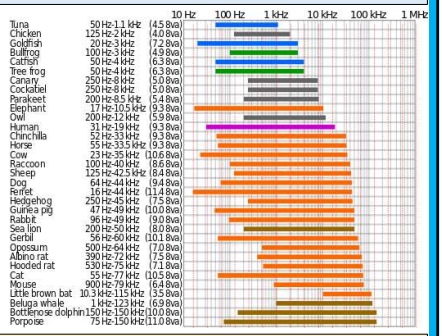
Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Animal Hearing Frequency Range

(cmglee, 2016)



Here are other organisms with their hearing frequency range.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

SUMMARY

Audible
(20- 20, 000 Hz)
Human

Infrasonic
(5- ~20 Hz)
Example: Elephants

Ultrasonic
(greater than 20, 000 Hz)
Examples: Cats, Dogs, Bats, Dolphins, Whales

Here's the summary of the lesson.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

EXERCISES

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies

Now, let's answer some exercises. Are you ready?

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Modified True or False

Identify which among the given statements are true and/or false.

1: Audible is the frequency range that human can perceive.
2: Human can produced up to 11,000 Hz frequency of sound.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Modified True or False

Identify which among the given statements are true and/or false.

1: Audible is the frequency range that human can perceive.
2: Human can produced up to 11,000 Hz frequency of sound.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The correct answer is C. Both Statements 1 and 2 are true.

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Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Matching Type

Match the correct answer to the following questions.

1	6 Hertz	A. Audible
2	18, 000 Hertz	B. Infrasonic
3	150,000 Hertz	C. Ultrasonic

Match the correct answer to the following frequency.

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Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Matching Type

Match the correct answer to the following questions.

1	6 Hertz	B. Infrasonic
2	18, 000 Hertz	A. Audible
3	150,000 Hertz	C. Ultrasonic

Here are the correct answers

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Matching Type

Match the correct answer to the following questions.

1	Bats	
2	Dolphins	A. Audible
3	Human	B. Infrasonic
4	Elephants	C. Ultrasonic
5	Dogs	

Match the organisms with the type of frequency they can perceived.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Matching Type

Match the correct answer to the following questions.

1	Bats	B. Ultrasonic
2	Dolphins	B. Ultrasonic
3	Human	A. Audible
4	Elephants	C. Infrasonic
5	Dogs	B. Infrasonic

Here are the correct answers.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Multiple Choice

Select the correct answer/s.

How do most organisms produce sound?

A. from the lungs through their larynx	C. echolocation
B. by hunting their preys	D. by flying

Select the correct answer/s.

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Science 7 | S7LT-IIIe-9

Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Multiple Choice

Select the correct answer/s.

How do most organisms produce sound?

A. from the lungs through their larynx	C. echolocation
B. by hunting their preys	D. by flying

The correct answers are A. from the lungs through their larynx.

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Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Multiple Choice

Select the correct answer/s.

What is the ability to locate objects by bouncing sound waves off of the organisms?

A. resonance location	C. sounding
B. frequency perception	D. echolocation

Select the correct answer/s

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Describing How Organisms Produce, Transmit, and Receive Sound of Various Frequencies (infrasonic, audible, and ultrasonic sound)

Multiple Choice

Select the correct answer/s.

What is the ability to locate objects by bouncing sound waves off of the organisms?

A. resonance location	C. sounding
B. frequency perception	D. echolocation

The correct answer is D. echolocation.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Inferring How the Movement of Particles of an Object Affects the Speed of Sound Through It

Hi! Our topic for today is Inferring how the movement of particles of an object affects the speed of sound through it. Let's begin.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Sound

A longitudinal wave produced by **vibrations of molecules** in a medium

Media of Propagation
- solid
- liquid
- gas

Speed
- **elasticity-** tendency to maintain its shape when force is applied
- **density-** mass per unit volume

Sound is a longitudinal wave produced by vibrations of molecules in a medium. A medium is necessary for sound to propagate. It can be in the form of solid, liquid, or gas. The speed of sound during propagation depends on the elasticity and density of the medium. The elastic property of a medium describes its tendency to maintain its shape when force is applied to it while density describes the mass per unit volume.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Sound

Speed of Sound

$$v = \sqrt{\frac{E}{\rho}}$$

where:

E: Elastic modulus

ρ: density of the medium

NOTE **Elastic modulus** is the ratio of the force applied per unit area to the change in its size, shape, or volume.

The general formula for the speed of sound is $v = \sqrt{\frac{E}{\rho}}$, where E is the elastic modulus while ρ is the density of the medium. Note that Elastic modulus is the ratio of the force applied per unit area to the change I its shape, size, or volume.

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Science 8 | S8FE-Ie-24

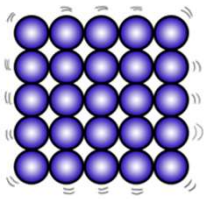
Inferring how the movement of particles of an object affects the speed of sound through it

Sound

Speed of sound in solid

Sound propagates **fastest** in solid.

The molecules in a solid medium are **closer** so they **collide faster with each other** as sound moves through them.



solid molecules

The speed of sound is fastest in solid even though it is denser compared to liquid and gas. This is because the molecules in a solid are closer such that they collide faster with each other as the sound moves through them.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Sound

Speed of sound in solid

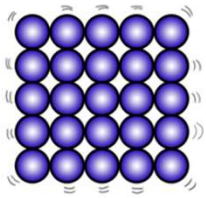
$$v = \sqrt{\frac{Y}{\rho}}$$

where:

Y: Young's modulus

ρ: density of the medium

NOTE **Young's modulus** is the elastic modulus in solid.



solid molecules

The formula for the speed of sound in solid is $v = \sqrt{\frac{Y}{\rho}}$, where Y is the Young's modulus while ρ is the density of the solid. The Young's modulus of solid is greater than the elastic moduli of liquid and gas and it has greater effect on the speed of sound than the density.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Sound

Speed of sound in solid

SOLVE

A wooden table has a density of 525 kg/m^3 and Young's modulus of 1.3x10^{10} N/m^2.

Find the speed of sound in the table.

SOLUTION

$$v = \sqrt{\frac{Y}{\rho}}$$

$$v = \sqrt{\frac{1.3 \times 10^{10} N/m^2}{525\ kg/m^3}}$$ ← Substitute

$$v = 4976.13\ m/s$$

Let's try solving this problem. Find the speed of sound in the table. To solve this, we are going to use the formula for the speed of sound in solid. We simply substitute the given values for the Young's modulus and the density of wood and get a speed of sound of 4976.13 m/s.

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Science 8 | S8FE-Ie-24

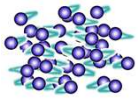
Inferring how the movement of particles of an object affects the speed of sound through it

Sound

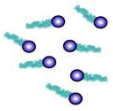
Speed of Sound in Fluid

Sound propagates **slower** in fluid such as liquid and gas.

The gas molecules in liquid and gas are **farther** to each other compared to solid. The gas molecules **collide slower with each other** as sound moves through them.



water molecules



gas molecules

Sound also travels in liquids and gas. The gas molecules of fluids are farther to each other compared to solids so they collide slower with each other as the sound moves through them.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Sound

Speed of sound in fluid

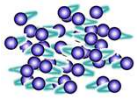
$$v = \sqrt{\frac{\beta}{\rho}}$$

where:

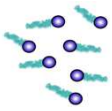
β: bulk modulus

ρ: density of the medium

NOTE **Bulk modulus** is the elastic modulus in fluids.



water molecules



gas molecules

The formula for the speed of sound in fluid is $v = \sqrt{\frac{\beta}{\rho}}$, where is the bulk modulus while ρ is the density of the fluid. This time, bulk modulus refers to the elastic modulus in fluids.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Sound

Speed of sound in fluid

SOLVE

What is the speed of sound in water if its bulk modulus is 2.15x10^9 N/m^2 and its density is 1000 kg/m^3?

SOLUTION

$$v = \sqrt{\frac{\beta}{\rho}}$$

$$v = \sqrt{\frac{2.15 \times 10^9 N/m^2}{1000\ kg/m^3}}$$ Substitute

$$v = 1466.29\ m/s$$

Let's try solving another problem. To solve this, we are going use the formula for the speed of sound in fluid. Then, we simply substitute the given values for the bulk modulus and the density of water. By doing this, we get a speed of sound of 1466.29 m/s.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

SUMMARY

Solid	Fluid
Sound propagates **fastest** in solid because the **molecules are closer** causing a **faster collision** with each other as sound moves through them.	Sound propagates **slower** in fluid because the **molecules in liquid and gas are farther** to each other causing a **slower collision** with each other as sound moves through them.

Here is the summary inferring how the movement of particles of an object affects the speed of sound through it.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

EXERCISES

Inferring How the Movement of Particles of an Object Affects the Speed of Sound Through It

Now, let's answer some exercises. Are you ready?

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Which of the following is necessary for sound to propagate?

A. light	C. heat
B. medium	D. current

Which of the following is necessary for sound to propagate?

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Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Which of the following is necessary for sound to propagate?

A. light	C. heat
B. medium	D. current

The correct answer is: B. medium.

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Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

The speed of sound is dependent on the _____ and density of the material where it propagates.

A. size	C. elasticity
B. shape	D. volume

The speed of sound is dependent on the (blank) and density of the material where it propagates.

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Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

The speed of sound is dependent on the _____ and density of the material where it propagates.

A. size	C. elasticity
B. shape	D. volume

The correct answer is C. elasticity.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Why does sound travel fastest in solid?

A. because its molecules collides faster with each other

B. because it has higher density compared to fluids

C. because its molecules are bigger compared to fluids

D. because it has more molecules to fluids

Why does sound travel fastest in solid?

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Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Why does sound travel fastest in solid?

A. because its molecules collides faster with each other

B. because it has higher density compared to fluids

C. because its molecules are bigger compared to fluids

D. because it has more molecules to fluids

The correct answer is: A. because its molecules collides faster with each other.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Steel has a Young's modulus of 2.0×10^{11} N/m2. Its density is known to be 7860 kg/m^3. What is the speed of sound in steel?

A. 2.54×10^{7} m/s	C. 3930 m/s
B. 1.98×10^{-4} m/s	D. 5044.33 m/s

Steel has a Young's modulus of 2.0×10^{11} N/m2. Its density is known to be 7860 kg/m^3. What is the speed of sound in steel?

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Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Steel has a Young's modulus of 2.0×10^{11} N/m2. Its density is known to be 7860 kg/m^3. What is the speed of sound in steel?

A. 2.54×10^{7} m/s	C. 3930 m/s
B. 1.98×10^{-4} m/s	D. 5044.33 m/s

The correct answer is: D. 5044.33 m/s

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Seawater has a bulk modulus of 2.34×10^{9} N/m^2 and density of 1027 kg/m^3. Find the speed of sound in seawater.

A. 6.62×10^{-4} m/s	C. 3018.93 m/s
B. 1509.46 m/s	D. 2.28×10^{6} m/s

Seawater has a bulk modulus of 2.34×10^{9} N/m^2 and density of 1027 kg/m^3. Find the speed of sound in seawater.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Multiple Choice

Select the correct answer.

Seawater has a bulk modulus of 2.34×10^9 N/m² and density of 1027 kg/m³. Find the speed of sound in seawater.

A. 6.62×10^{-4} m/s	C. 3018.93 m/s
B. 1509.46 m/s	D. 2.28×10^6 m/s

The correct answer is: B. 1509.46 m/s.

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Science 8 | S8FE-Ie-24

Inferring how the movement of particles of an object affects the speed of sound through it

Citation

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Science 8 | S8FE-Ie-25

Investigating the effect of temperature to speed of sound through fair testing

Investigating the Effect of Temperature to Speed of Sound Through Fair Testing

Hi! Our topic for today is investigating the effect of temperature to speed of sound through fair testing. Let's begin.

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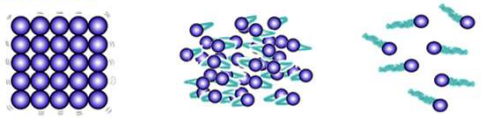
Science 8 | S8FE-Ie-25

Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound

As the speed of **collision increases**, the speed of **sound** also **increases**

ILLUSTRATE



In the previous lesson, we discussed that the speed of sound varies in different media. The molecules in a solid material collide faster with each other so sound moves faster in solid. On the other hand, the molecules in a fluid, may it be liquid or gas, collide slower causing a slower move of sound. This means that as the speed of collision increases, the speed of sound also increases.

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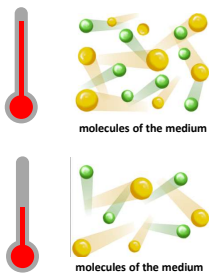
Science 8 | S8FE-Ie-25

Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound
Temperature

Temperature also affects the **speed of sound** especially in **gases**.

As the **temperature increases**, the energy in the gas increases causing **faster collision** among the molecules. Therefore, when temperature increases, the **speed of sound** also **increases**.



Another factor affecting the speed of sound is temperature; however, the effect is more significant in gases than in solid and liquid. As the temperature increases, the energy in the gas increases causing faster collision among the molecules. Therefore, when temperature increases, the speed of sound also increases.

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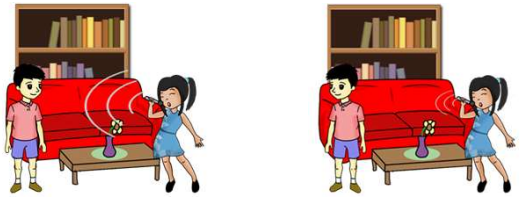
Science 8 | S8FE-Ie-25

Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound
Effects of Temperature



Usually, we hear sound traveling in the air. Notice that sound can be heard more clearly at the places with higher temperature than in lower temperature given that the distance from the source is the same.

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Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound

Effects of Temperature

$$v = 331\frac{m}{s} + \left(0.6\frac{m}{s \cdot °C}\right)T$$

For every one degree Celsius increase in the temperature, the speed of sound increases by **0.6 m/s**

The speed of sound at 0 °C is 331 m/s, thus, the speed of sound at different temperature can be computed using the formula v= 331 m/s + (0.6 m/s °C) T. This also means that for every one degree Celsius increase in the temperature, the speed of sound increases by 0.6 m/s.

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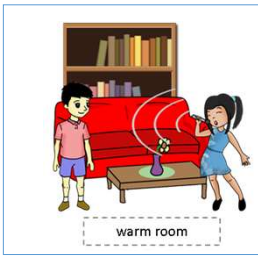
Speed of Sound

Effects of Temperature

When the temperature is **warm**, sound can be heard **clearly** because it travels **faster**.



When the temperature is warm, sound can be heard clearly because it travels faster towards the ears. If the temperature of the room is 28 °C, the speed of sound that can be measured should be 329.8 m/s.

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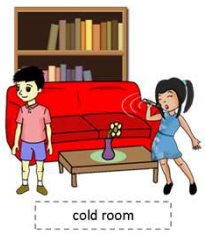
Speed of Sound

Effects of Temperature

When the temperature is **cold**, sound can be heard **less clearly** because it takes a **longer time** to reach the ears.



When the temperature is cold, sound can be heard less clearly because it takes a longer time to reach the ears. If the temperature of the room is 18 °C, the speed of sound that can be measured should be 323.8 m/s.

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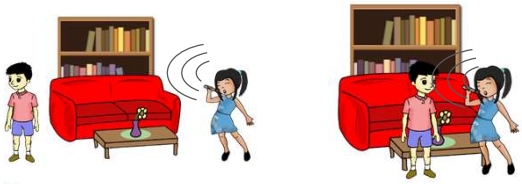
Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound

Effects of Temperature



NOTE Distance **does not affect** the speed of the sound.

Note that when the distance is varied, sound can be heard more clearly when the source of sound is nearer to the observer; however, it does not affect the speed of sound. As the distance between the source and the observer increases, sound takes longer time to reach our ears because the distance travelled by the sound also increases.

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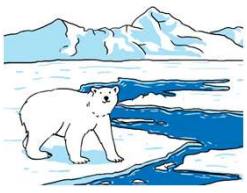
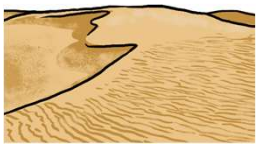
Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound

Effects of Temperature



cold place- slower speed of sound



hot place- faster speed of sound

The difference in the velocity of sound is more observed when the difference in temperature is higher. If the temperature in the arctic region is -1 °C, then the speed of sound is 330.4 m/s. On the other hand, if the temperature in the desert is 45 °C, then the speed of sound is 358 m/s.

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Investigating the effect of temperature to speed of sound through fair testing

Speed of Sound

Effects of Temperature

SOLVE

What is the speed of sound at 21°C?

SOLUTION

$$v = 331\frac{m}{s} + \left(0.6\frac{m}{s \cdot °C}\right)T$$

$$v = 331\frac{m}{s} + \left(0.6\frac{m}{s \cdot °C}\right)(21°C)$$

$$v = 343.6\ m/s$$

Let's try solving this problem. What is the speed of sound of 21°C? To solve this, we are going to used to substitute the given temperature to formula. After the computation, we will get a final answer of 343.6 m/s.

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Investigating the effect of temperature to speed of sound through fair testing

SUMMARY

The speed of sound in the air increases by 0.6 m/s for every one degree Celsius increase in the temperature.

The speed of sound in the air increases by 0.6 m/s for every one degree Celsius increase in the temperature.

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Investigating the effect of temperature to speed of sound through fair testing

EXERCISES

Investigating the Effect of Temperature to Speed of Sound Through Fair Testing

Now, let's answer some exercises. Are you ready?

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

When temperature increases, what happened to rate of collision of the molecules?

A. increases	C. remains the same
B. decreases	D. turn to zero

When temperature increases, what happened to rate of collision of the molecules?

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

When temperature increases, what happened to rate of collision of the molecules?

A. increases	C. remains the same
B. decreases	D. turn to zero

The correct answer is: A. increases.

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

When temperature increases, what happened to speed of sound?

A. increases	C. remains the same
B. decreases	D. turn to zero

When temperature increases, what happened to rate of collision of the molecules?

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Science 8 | S8FE-Ie-25

Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

When temperature increases, what happened to speed of sound?

A. increases	C. remains the same
B. decreases	D. turn to zero

The correct answer is: A. increases.

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

Why can we hear sound more clearly in warmer temperature?

A. because sound is louder in warmer temperature

B. because sound travels faster in warmer temperature

C. because there are more molecules of gas in warmer temperature

D. because the molecules becomes more compact

Why can we hear sound more clearly in warmer temperature?

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

Why can we hear sound more clearly in warmer temperature?

A. because sound is louder in warmer temperature

B. because sound travels faster in warmer temperature

C. because there are more molecules of gas in warmer temperature

D. because the molecules becomes more compact

The correct answer is: B. because sound travels faster in warmer temperature.

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

Find the speed of sound in the air if the temperature is 30°C.

A. 349 m/s

C. 301 m/s

B. 361 m/s

D. 381 m/s

Find the speed of sound in the air if the temperature is 30°C.

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

Find the speed of sound in the air if the temperature is 30°C.

A. 349 m/s

C. 301 m/s

B. 361 m/s

D. 381 m/s

The correct answer is: A. 349 m/s.

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

What is the speed of sound in the air if the temperature is -20°C?

A. 296.67 m/s

C. 342 m/s

B. 319 m/s

D. 363.33 m/s

What is the speed of sound in the air if the temperature is -20°C?

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Investigating the effect of temperature to speed of sound through fair testing

Multiple Choice

Select the correct answer.

What is the speed of sound in the air if the temperature is -20°C?

A. 296.67 m/s

C. 342 m/s

B. 319 m/s

D. 363.33 m/s

The correct answer is: B. 319 m/s.

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Citation

1. Navaza, D., & Valdes, B. (2011). *You and the Natural World Physics Third Edition*. Quezon City: Phoenix Publishing House, Inc.
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LIGHT

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Hi! Our topic for today is demonstrating the existence of the color components of visible light using a prism or a diffraction grating. Let's begin.

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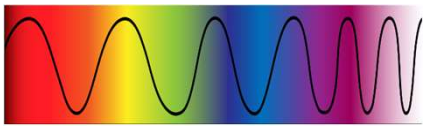
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Visible light or white light can be separated into its color components: **red, yellow, green, blue, indigo, and violet**. The color of light depends on the **frequency** of light.



spectrum of light

NOTE **Spectrum** is a band of light formed by the separation of colors of white light.

Visible light or white light can be separated into its color components: red, orange, yellow, green, blue, indigo, and violet. The color of light depends on the frequency of light. The band of colors produced is called spectrum

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Existence of Color Components

The different colors are arranged according to **frequency**.

Dispersion

Splitting of white light into different colors arranged according to frequency

The splitting of white light into its color components is called dispersion. The different colors are arranged according to frequency.

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Existence of Color Components

Light can be dispersed through prism and diffraction grating.

Prism

A triangular piece of glass that separates white light into its color components.

Diffraction Grating

A piece of glass with several fine parallel lines equally spaced with tiny spaces between them.

In order to see the color components, prism and diffraction grating can be used. Prism is a triangular piece of glass that separates white light into its color components while diffraction grating is a piece of glass with several fine parallel lines that are equally spaced with tiny space between them.

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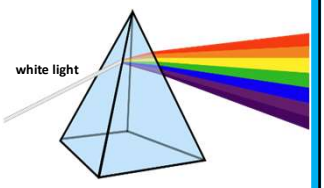
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Dispersion Using a Prism

When **white light** enters a **prism**, the **color components** are **bent** based from the **indices of refraction** of the medium for the different colors.



When white light enters a prism, the color components are bent based from the indices of refraction of the medium for the different colors. A prism can only produce one spectrum.

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Dispersion Using a Prism

In the formation of a rainbow, the water droplets serve as the prism.

EXAMPLE

An example of dispersion using a prism is the formation of rainbow. The water droplets in the air act as the prism.

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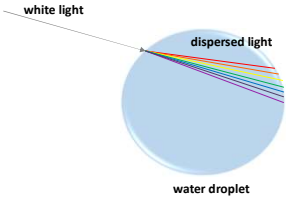
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Dispersion Using a Prism

When white light enters a water droplet, it is dispersed into different colors.

EXAMPLE



When white light enters a water droplet, it is dispersed into different colors.

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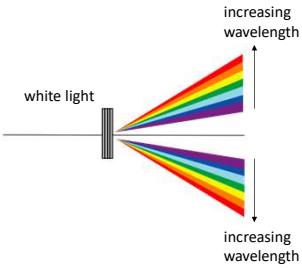
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Dispersion Using Diffraction Grating

White light is bent based from the different wavelengths of colors. The longer wavelengths are bent more than the shorter wavelengths.



When white light is illuminated on the diffraction grating, it is diffracted based from the different wavelengths of colors. The longer wavelengths are diffracted more than the shorter wavelengths. A diffraction grating can produce series of spectra.

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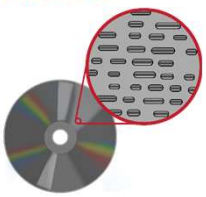
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Color components

Dispersion Using Diffraction Grating

In a compact disc, the grooves serve as the diffraction grating.

EXAMPLE



An example of diffraction is by using a compact disc. The grooves of the compact disc act as the diffraction grating.

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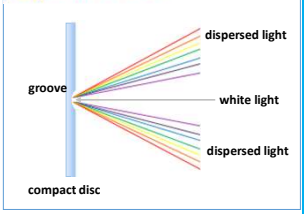
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Diffraction Using Diffraction Grating

When light is illuminated on the surface of a compact disc, it is dispersed forming series of spectra.

EXAMPLE



When light is illuminated on the surface of a compact disc, it is dispersed forming series of spectra.

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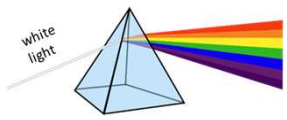
Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

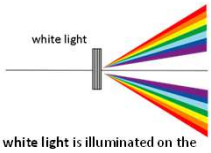
SUMMARY

Dispersion Using a Prism



When **white light** enters a **prism**, the **color components** are bent based from the **indices of refraction** of the medium for the different colors.

Dispersion Using Diffraction Grating



When **white light** is illuminated on the **diffraction grating**, it is dispersed based from the different **wavelengths of colors.**

When white light enters a prism, the color components are bent based from the indices of refraction of the medium for the different colors. On the other hand, when white light is illuminated on the diffraction grating, it is diffracted based from the different wavelengths of colors.

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

EXERCISES

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Now, let's answer some exercises. Are you ready?

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

What is formed when white light is splitted into different colors?

A. shadow	C. spectrum
B. color wheel	D. reflection

What is formed when white light is splitted into different colors?

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

What is formed when white light is separated into different colors?

A. shadow	C. spectrum
B. color wheel	D. reflection

The correct answer is: C. spectrum.

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

Which of the following is the process of separating the colors of light?

A. reflection	C. refraction
B. dispersion	D. diffraction

Which of the following is the process of using a prism to separate the color of light?

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Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

Which of the following is the process of separating the colors of light?

A. reflection	C. refraction
B. dispersion	D. diffraction

The correct answer is: B. dispersion.

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

When light enters a prism, how many spectrum can be formed?

a. one spectrum	c. a series of spectra
b. two spectra	d. none

When light enters a prism, how many spectrum can be formed?

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

When light enters a prism, how many spectrum/spectra can be formed?

a. one spectrum	c. a series of spectra
b. two spectra	d. none

The correct answer is: A. one spectrum.

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

What is the reason behind the formation of a spectrum of light in a prism?

A. difference in the index of refraction for each color

B. obstacles on the prism

C. filters in the prism

D. smooth surface of the prism

What is the reason behind the formation of a spectrum of light in a prism?

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

What is the reason behind the formation of a spectrum of light in a prism?

A. difference in the index of refraction for each color

B. obstacles on the prism

C. filters in the prism

D. smooth surface of the prism

The correct answer is: A. difference in the index of refraction for each color.

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

What is the reason behind the formation of a series of spectra on a diffraction grating?

A. difference in the index of refraction for each color

B. obstacles on the diffraction grating

C. filters in the diffraction grating

D. smooth surface of the diffraction grating

What is the reason behind the formation of a series of spectra on a diffraction grating?

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Science 8 | S8FE-If-26

Demonstrating the Existence of the Color Components of Visible Light Using a Prism or Diffraction Grating

Multiple Choice

Select the correct answer.

What is the reason behind the formation of a series of spectra on a diffraction grating?

A. difference in the index of refraction for each color

B. obstacles on the diffraction grating

C. filters in the diffraction grating

D. smooth surface of the diffraction grating

The correct answer is: B. obstacles on the diffraction grating

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Science 8 | S8FE-If-27

Explaining the Hierarchy of Colors in Relation to Energy

Explaining the Hierarchy of Colors in Relation to Energy

Hi! Our topic is about explaining the hierarchy of colors in relation to energy. Let's begin.

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Science 8 | S8FE-If-27

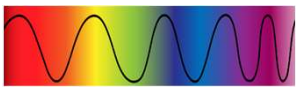
Explaining the Hierarchy of Colors in Relation to Energy

Colors of Light

White light can be separated into its **color components**. Each color of light corresponds to different frequencies.

Spectrum

The visible light spectrum is composed of colors such as red, yellow, orange, green, blue, indigo, and violet.



spectrum

In the previous lesson, we discussed that light can be separated into its color components. The visible light spectrum is composed of colors such as red, yellow, orange, green, blue, indigo and violet.

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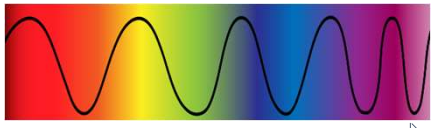
Explaining the Hierarchy of Colors in Relation to Energy

Hierarchy of Colors

Each color of light corresponds to different frequencies.



lowest — Frequency — highest

Each color of light corresponds to different frequencies. Red has the lowest frequency while violet has the highest frequency.

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Science 8 | S8FE-If-27

Explaining the Hierarchy of Colors in Relation to Energy

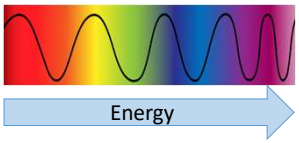
Hierarchy of Colors

Light contains energy which is dependent on its frequency.

Energy

E=hf

- h: Planck's constant
  h= 6.626X10^{-34} J-s
- f: frequency



Energy

Light contains energy which is dependent on its frequency. It can be expressed as E=hf, where h is the Planck's constant equal to 6.626X10^{-34} Joule-second and f is the frequency of light. Red light has the lowest frequency so it also has the least energy. On the other hand, violet has the highest frequency so it also has the highest frequency.

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Science 8 | S8FE-If-27

Explaining the Hierarchy of Colors in Relation to Energy

Hierarchy of Colors

EXAMPLE

blue flame

red flame

Blue flames are generally hotter than red flames. This implies that blue flames have higher energy than red flames.

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Science 8 | S8FE-If-27

Explaining the Hierarchy of Colors in Relation to Energy

Hierarchy of Colors

SOLVE

A beam of red light has a frequency of 4.48x10^{14} Hz. What is its energy?

NOTE

h= 6.626x10-34 J-s

SOLUTION

$$E = hf$$

$$E = (6.626 \times 10^{-34} J \cdot s)(4.48 \times 10^{14} Hz)$$

Substitute

$$E = 2.97 \times 10^{-19}\ \text{J}$$

Let's try to solve this problem to explain the relation of hierarchy of colors to its energy. A beam of red light has a frequency of 4.48x10^{14} Hz. What is its energy? To solve this, we are going to substitute the given value of the frequency to the formula, E=hf. The final answer is 2.97x10-19 J.

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Science 8 | S8FE-If-27

Explaining the Hierarchy of Colors in Relation to Energy

Hierarchy of Colors

SOLVE

A beam of blue light has a frequency of 6.59x10^{14} Hz. What is its energy?

$E = (6.626 \times 10^{-34} J \cdot s)$
(6.59×10^{14})
h= 6.626x10-34 J-s

SOLUTION

$E = hf$

$E = (6.626 \times 10^{-34} J \cdot s)$
(6.59×10^{14}) Substitute

$E = 4.37 \times 10^{-19}$

Let's try to solve another problem. A beam of blue light has a frequency of 6.59x10^{14} Hz. What is its energy? To solve this, we are going to substitute the given value of the frequency to the formula, E=hf. The final answer is 4.37x10-19 J.

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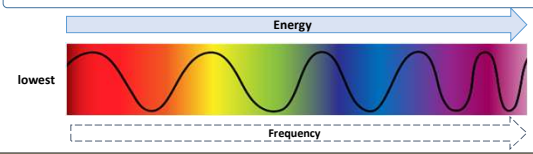
Explaining the Hierarchy of Colors in Relation to Energy

SUMMARY

The energies of the different colors of light depend on their frequencies. Higher frequency corresponds to higher energy.



The energies of the different colors of light depend on their frequency. Higher frequency corresponds to higher energy. Red has the lowest energy while violet has the highest energy.

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Science 8 | S8FE-If-27

Explaining the Hierarchy of Colors in Relation to Energy

EXERCISES

Explaining the Hierarchy of Colors in Relation to Energy

Now, let's answer some exercises. Are you ready?

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

How is the energy of color related to its frequency?

A. direct proportionality	C. direct square proportionality
B. inverse proportionality	D. inverse square proportionality

How is the energy of color related to its frequency?

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

How is the energy of color related to its frequency?

A. direct proportionality	C. direct square proportionality
B. inverse proportionality	D. inverse square proportionality

The correct answer is: A. direct proportionality.

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

Which of the following has the highest energy?

A. red	C. orange
B. green	D. yellow

Which of the following has the highest energy?

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

Which of the following has the highest energy?

A. red	C. orange
B. green	D. yellow

The correct answer is: B. green. Among the choices, green has the highest frequency so it has the highest energy.

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

Which of the following has the lowest energy?

A. blue	C. green
B. violet	D. orange

Which of the following has the lowest energy?

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

Which of the following has the lowest energy?

A. blue	C. green
B. violet	D. orange

The correct answer is: D. orange. Among the choices, orange has the highest frequency so it has the lowest energy.

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

A yellow light has a frequency of 5.26×10^{14} Hz. Find its energy.

A. 5.70×10^{-7} J	C. 3.49×10^{-19} J
B. 1.26×10^{-19} J	D. 7.94×10^{-19} J

A yellow light has a frequency of 5.26×10^{14} Hz. Find its energy.

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

A yellow light has a frequency of 5.26×10^{14} Hz. Find its energy.

A. 5.70×10^{-7} J	C. 3.49×10^{-19} J
B. 1.26×10^{-19} J	D. 7.94×10^{-19} J

The correct answer is: C. 3.49×10^{-19} J.

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

If a violet light has a frequency of 7.14×10^{14} Hz, what is its energy?

A. 5.70×10^{-19} J	C. 4.20×10^{-19} J
B. 1.08×10^{-19} J	D. 4.73×10^{-19} J

If a violet light has a frequency of 7.14×10^{14} Hz, what is its energy?

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Explaining the Hierarchy of Colors in Relation to Energy

Multiple Choice

Select the correct answer.

If a violet light has a frequency of 7.14×10^{14} Hz, what is its energy?

A. 5.70×10^{-19} J	C. 4.20×10^{-19} J
B. 1.08×10^{-19} J	D. 4.73×10^{-19} J

The correct answer is: D. 4.73×10^{-19} J.

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Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Relating the characteristics of light such as Color and Intensity to Frequency and Wavelength

Hi! Our topic is about relating characteristics of light such as color and intensity to frequency and wavelength. Let's begin.

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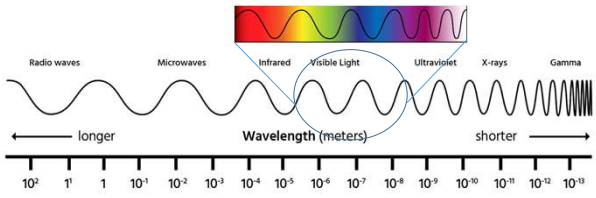
Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Light

Light is an **electromagnetic wave** composing of **photons**, thus, it can behave both as a **wave** and a **particle**. Unlike sound, light can **travel** in a **vacuum**. From the **electromagnetic spectrum**, **humans** can only **see** the **visible light**.



Light is an electromagnetic wave composing of photons, thus, it can behave both as a wave and a particle. Unlike sound, light can travel in a vacuum. From the electromagnetic spectrum, humans can only see the visible light.

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Science 7 | S7LT-IIIf-10

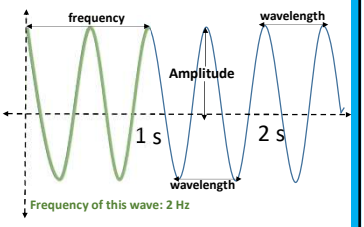
Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Light

Frequency (Unit: **Hz**)
Number of complete wave passing at a point every **one second**

Amplitude (Unit: **m**)
The **maximum distance** of a wave **from its rest position.**

Wavelength (Unit: **m**)
Distance between two successive **crests** or **troughs**



Since light behaves like a wave, light also has wavelength, frequency and amplitude. Let us use these properties of a wave to describe the characteristics of light, particularly, the visible light.

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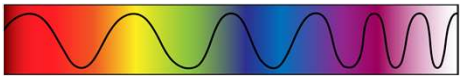
Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Characteristics of visible light
Color

Visible light has **wavelengths** of **400 nm to 750 nm**. These **wavelengths** are **represented** by what we know as **colors**. Moreover, **each color** also **corresponds** to a specific range of **frequency**.



	Red	Violet
Wavelength:	750 nm	400 nm
Frequency:	400 THz	790 THz

We can only see the light with wavelengths 400 nm to 750 nm. These wavelengths are represented by what we know as colors. Moreover, each color also corresponds to a specific range of frequency.

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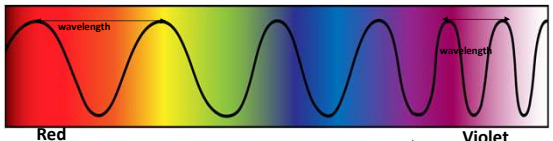
Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Characteristics of visible light
Color



	Red		Violet
Wavelength:	750 nm	Wavelength decreases	380 nm
Frequency:	400 THz	Frequency increases	790 THz

From a wavelength of around 750 nm and frequency of 400 THz, humans perceived the red color. As the wavelength decreases and the frequency increases, the color we perceived gradually changes from red to orange to yellow to green to blue then to violet.

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Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Characteristics of visible light

Color

Approximate Wavelengths and Frequencies of Different Colors.

Color	Wavelength (nm)	Frequency (THz)
Red	630-750	400-480
Orange	590-630	480-510
Yellow	560-590	510-540
Green	490-560	540-610
Blue	450-490	610-670
Violet	450-400	670-750

Here is a list of some colors and their corresponding wavelength and frequency.

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Characteristics of visible light

Color

Other colors like **cyan** and **magenta** are just **combinations** of other **wavelengths**. On the other hand, **color white** represents the **combination** of **all the wavelengths** of the visible light while **black** is the **absence** of the **wavelengths**.

Other colors like cyan and magenta are just combinations of other wavelengths. On the other hand, color white represents the combination of all the wavelengths of the visible light while black is the absence of the wavelengths.

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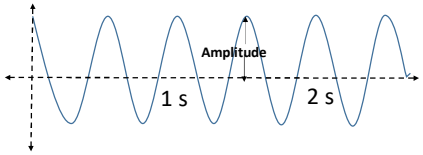
Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Characteristics of visible light

Intensity or Brightness

The **intensity** or **brightness of light** is related to the **wave's amplitude**.



Now let us discuss the next characteristic of light – the intensity or brightness. The intensity or brightness of light is related to the wave's amplitude.

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Characteristics of visible light

Intensity or Brightness

Higher amplitude corresponds to a **brighter light.**

Lower amplitude corresponds to a **dull light**.

The height of the amplitude tells the brightness of light. Higher amplitude corresponds to a brighter light while lower amplitude corresponds to a dull light.

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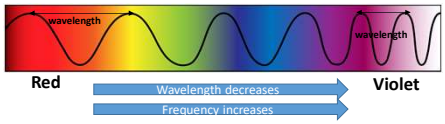
Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

SUMMARY

Color



Intensity/ Brightness

The **light** gets **brighter** as its **amplitude increases**.

In summary, we have learned that the characteristics of light such as color and intensity are related to the wavelength, frequency and amplitude of light. Colors are represented by wavelength or frequency. On the other hand, amplitude can be used to describe the brightness of light.

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

EXERCISES

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Now, let's answer some exercises. Are you ready?

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

The color of light is described by either _____ or _____.

A. wavelength, amplitude	C. wavelength, frequency
B. frequency, amplitude	D. wavelength, period

The color of light is described by either [blank] or [blank].

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

The color of light is described by either _____ or _____.

A. wavelength, amplitude	C. wavelength, frequency
B. frequency, amplitude	D. wavelength, period

The correct answer is "wavelength, frequency".

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

The amplitude of light can be used to describe the light's _____.

A. color	C. wavelength
B. intensity	D. temperature

The amplitude of light can be used to describe the light's [blank].

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Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

The amplitude of light can be used to describe the light's _____.

A. color	C. wavelength
B. intensity	D. temperature

The correct answer is "B.intensity"

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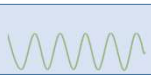
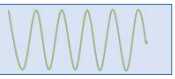
Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

Which of the following has the greatest light intensity?

A.	C.
B. 	D. 

Which of the following has the greatest light intensity?

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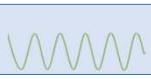
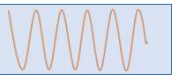
Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

Which of the following has the greatest light intensity?

A.	C.
B. 	D. 

The correct answer is "D".

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Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

The wavelength of visible light is 400 nm -750 nm. What is the color of light having the wavelength of 560 nm -590 nm?

A. Orange	C. Yellow
B. Green	D. Blue

The wavelength of visible light is 400 nm -750 nm. What is the color of light having the wavelength of 560 nm - 590 nm?

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Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

The wavelength of visible light is 400 nm -750 nm. What is the color of light having the wavelength of 560 nm -590 nm?

A. Orange	C. Yellow
B. Green	D. Blue

The correct answer is "C. Yellow"

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Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

What happens to the wavelength and frequency of light as it goes from red to violet?

A. The wavelength increases while the frequency decreases.

B. The wavelength decreases while the frequency increases.

C. Both the wavelength and frequency increases.

D. Both the wavelength and frequency decreases.

What happens to the wavelength and frequency of light as it goes from red to violet?

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Science 7 | S7LT-IIIf-10

Relating Characteristics of Light such as Color and Intensity to Frequency and Wavelength

Multiple Choice

Select the correct answer.

What happens to the wavelength and frequency of light as it goes from red to violet?

A. The wavelength increases while the frequency decreases.

B. The wavelength decreases while the frequency increases.

C. Both the wavelength and frequency increases.

D. Both the wavelength and frequency decreases.

The correct answer is "The wavelength decreases while the frequency increases".

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Explaining That Red Is the Least Bent and Violet the Most Bent According to Their Wavelengths or Frequencies

Hi! Our topic for today is explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies. Let's begin.

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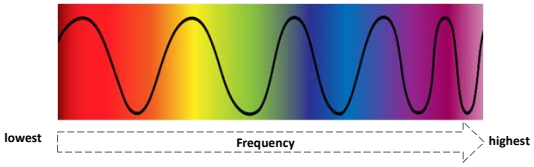
Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Hierarchy of Colors

Each color of light corresponds to different frequencies.



In the previous lesson, we discussed that each color of light corresponds to different frequencies.

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

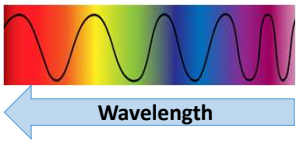
Hierarchy of Colors

The different colors of light corresponds to different **wavelengths**.

Wavelength

$$\lambda = \frac{v}{f}$$

- v: speed of light
- f: frequency



Also, the different colors of light also corresponds to different wavelengths. It is equal to the speed of light divided by the frequency. Hence, the higher the frequency, the lower the wavelength.

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Science 8 | S8FE-If-28

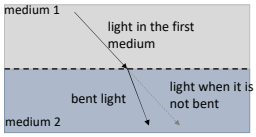
Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Bending of Light

One of the properties of light is **refraction**.

Refraction

Refraction is the bending of light when it passes through a medium to another.



One of the properties of light is refraction. It is the bending of light when it passes through a medium to another at different speed.

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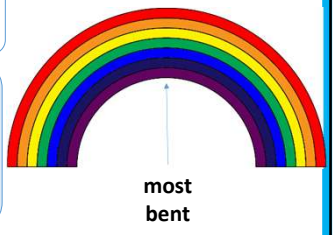
Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Bending of Light

Violet is the **most bent** color in the visible spectrum.

- Violet has the **shortest wavelength and highest frequency.**
- It travels **more slowly** when it enters another medium such as a prism.



A rainbow is a good example of how bending of light works. Notice that in a rainbow, red is always at the top of the arc while violet is at the bottom of the arc. Let us look at how this phenomenon happens. Firstly, violet is the color in the visible spectrum with the shortest wavelength and highest frequency, thus, it is the most bent. This is because it travels more slowly when it enters another medium such as prism.

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Bending of Light

Blue Sky

- Colors having the **higher frequencies** are **more scattered** in the atmosphere.
- The sun sends more blue light than violet to the Earth's atmosphere.
- Our eyes are more sensitive to blue.

Colors having the higher frequencies are more scattered in the atmosphere; however, the sun sends more blue light than violet to the Earth's atmosphere. Furthermore, our eyes are more sensitive to blue, therefore, causing the blue appearance of the sky during daytime.

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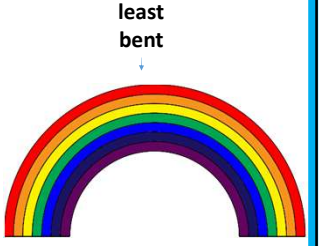
Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Bending of Light

Red is the **least bent** color in the visible spectrum.

- Red has the **longest wavelength and lowest frequency.**
- It travels **less slowly** when it enters another medium such as a prism.



On the other hand, red is the color with the longest wavelength and lowest frequency in the visible light spectrum. It travels less slowly when it enters another medium such as prism. Thus, it is the color that is least bent.

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Bending of Light

Red Sunset

- Red is the **least scattered** in the atmosphere.
- At sunset, the path through the atmosphere is longer.
- Only the colors having the **longer wavelengths reaches the ground.**

Red is also the least scattered color in the atmosphere. At sunset, the path through the atmosphere is longer so only the colors having the longer wavelengths reaches the ground. Colors with the shorter frequency are already scattered before they reach the ground, thus, producing a reddish sunset.

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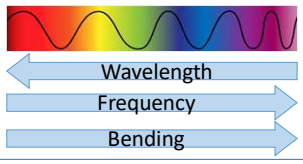
Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

SUMMARY

Red is the color of light having the **longest wavelength and lowest frequency** so it is the **least bent**. On the other hand, violet is the color having the **shortest wavelength and highest wavelength** so it is the **most bent.**



Red is the color of light having the longest wavelength and lowest frequency so it is the least bent. On the other hand, violet is the color having the shortest wavelength and highest frequency so it is the most bent.

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

EXERCISES

Explaining That Red Is the Least Bent and Violet the Most Bent According to Their Wavelengths or Frequencies

Now, let's answer some exercises. Are you ready?

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Multiple Choice

Select the correct answer.

How is the bending of color related to its frequency?

A. The higher the frequency, the more bent the color is.

B. The higher the frequency, the less bent the color is.

C. The lower the frequency, the more bent the color is.

D. The frequency of color does not affect the bending of color.

How is the bending of color related to its frequency?

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Multiple Choice

Select the correct answer.

How is the bending of color related to its frequency?

A. The higher the frequency, the more bent the color is.

B. The higher the frequency, the less bent the color is.

C. The lower the frequency, the more bent the color is.

D. The frequency of color does not affect the bending of color.

The correct answer is: A. The higher the frequency, the more bent the color is.

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Multiple Choice

Select the correct answer.

How is the bending of color related to its wavelength?

A. The longer the wavelength, the more bent the color is.

B. The longer the wavelength, the less bent the color is.

C. The shorter the wavelength, the less bent the color is.

D. The wavelength of color does not affect the bending of color.

How is the bending of color related to its wavelength?

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Multiple Choice

Select the correct answer.

How is the bending of color related to its wavelength?

A. The longer the wavelength, the more bent the color is.

B. The longer the wavelength, the less bent the color is.

C. The shorter the wavelength, the less bent the color is.

D. The wavelength of color does not affect the bending of color.

The correct answer is: B. The longer the wavelength, the less bent the color is.

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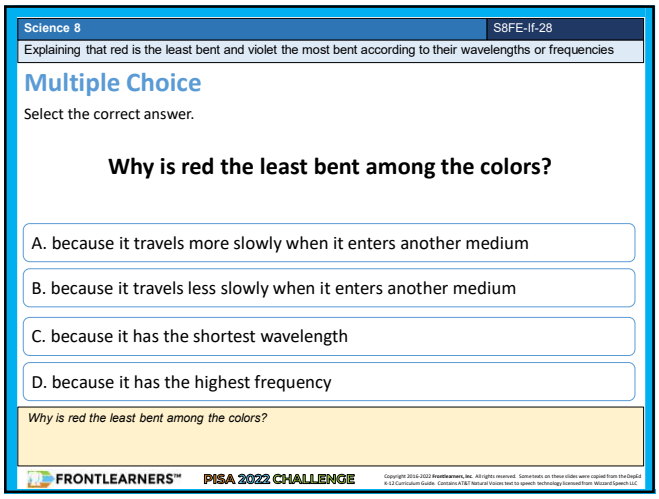

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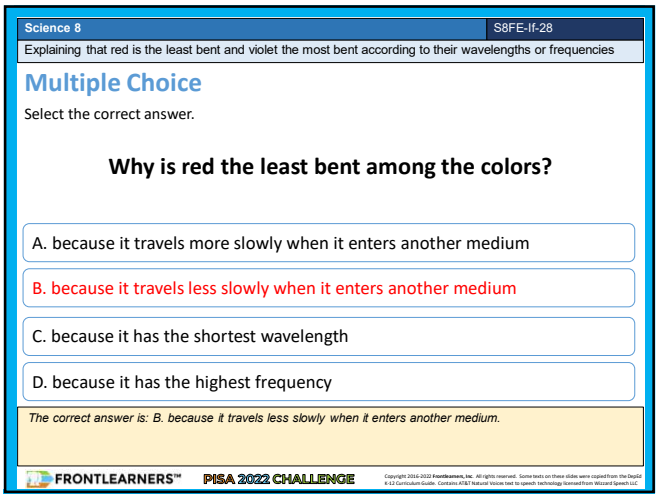

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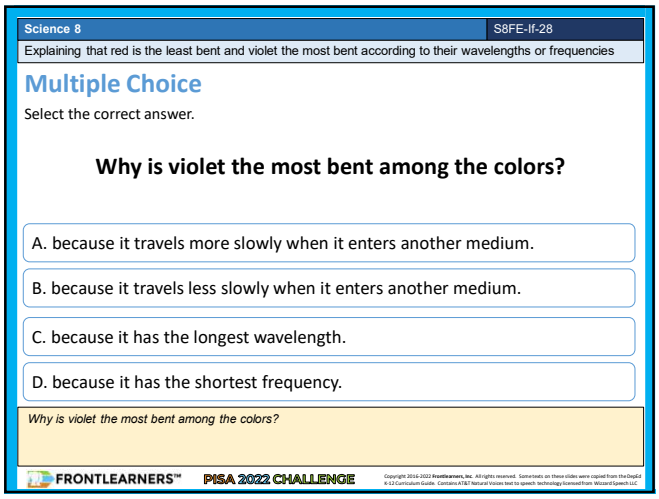

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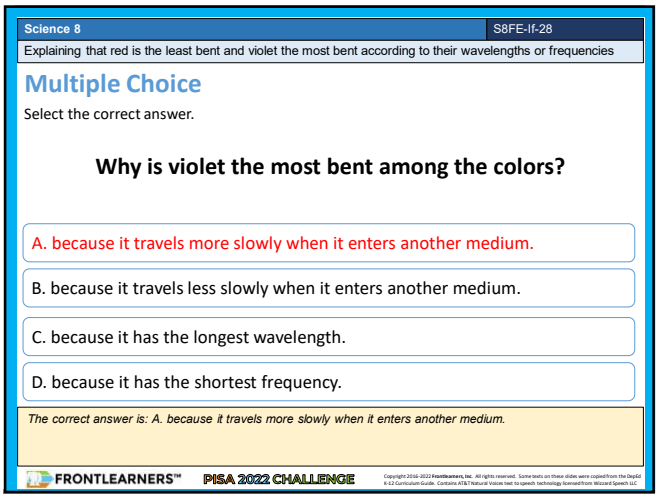

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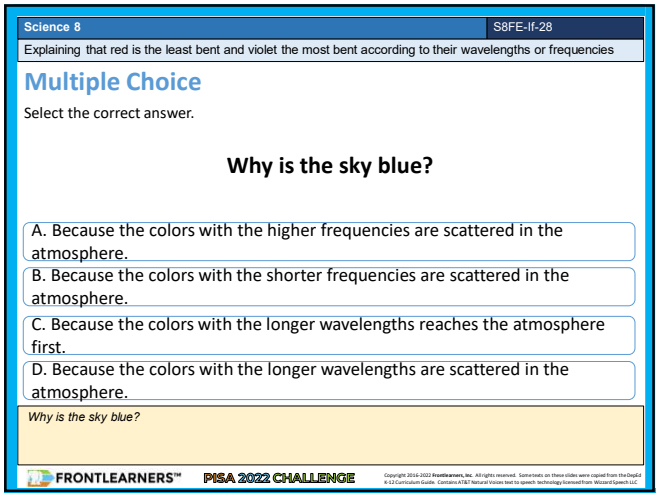

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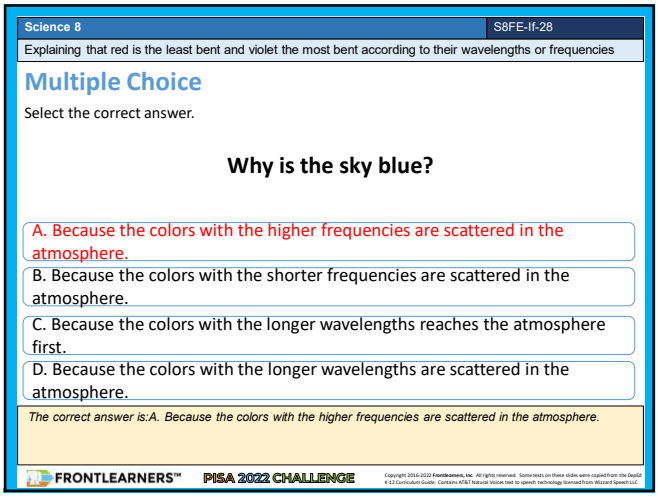

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Science 8 | S8FE-If-28

Explaining that red is the least bent and violet the most bent according to their wavelengths or frequencies

Citation

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Hi! Our topic is about predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors . Let's begin.

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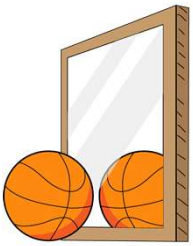
Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Mirror

A **mirror** is any **surface** (usually glass covered with metal film) that can **reflect light without any diffusion** to **form an image** of the **object** in front of it.



Types of Mirror

1. Plane Mirror
2. Curve Mirror
   - Concave
   - Convex

A mirror is any surface that can reflect light without any diffusion to form an image of the object in front of it. Mirrors can either be plane or curve. The images produced by these mirrors have distinct characteristics.

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Science 10 | S10FE-IIg-50

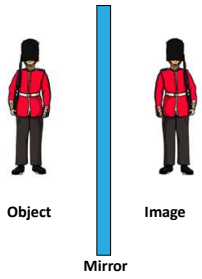
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Plane Mirror

A **plane mirror** is a mirror with **flat reflective surface**.

Characteristics of image formed

1. **Same size**
2. **Left-right reversed**
3. **Upright**



A plane mirror is a mirror with a flat reflective surface. It forms an image same size of the object. From the illustration, the image of the soldier formed is the same size as the object. A plane mirror also forms left-right reversed images, thus, as you can see, the image of the soldier formed has the gun on a different position. Moreover, plane mirror produces an upright image. The soldier and his image are both standing with their feet.

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Science 10 | S10FE-IIg-50

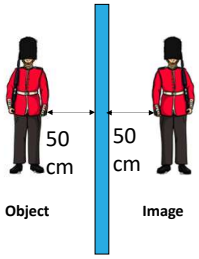
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Plane Mirror

A **plane mirror** is a mirror with **flat reflective surface**.

Characteristics of image formed

4. **Virtual image**
5. **Same distance from the mirror as the object's distance**



Another characteristic of plane mirror is that it produces a virtual image. Virtual image is an image formed behind the mirror where light cannot actually reach. Furthermore, the location of the image formed in a plane mirror is the same as the distance of the object. If the soldier is 50 cm from the mirror, then is image is also 50 cm away.

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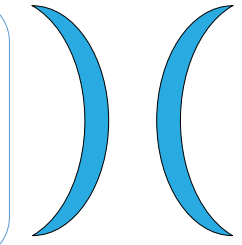
Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirrors

A **curve mirror** is a mirror with **curve reflective surface**. A **concave mirror** has a **surface** that is **bulging inward** while a **convex mirror** has a **surface** that is **bulging outward**.



A curve mirror is a mirror with curve reflective surface. A concave mirror has a surface that is bulging inward while a convex mirror has a surface that is bulging outward.

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Science 10 | S10FE-IIg-50

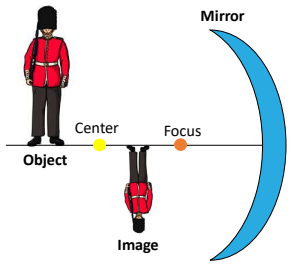
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Concave

Characteristics of image formed:

Case 1: Object beyond the center

1. Reduced in size
2. Inverted
3. Real image



Let us first discuss the image formed by concave mirrors. The image formed by a concave mirrors is dependent on the object's location. Let us first consider an object beyond the center of the mirror. The image formed is reduced in size, inverted and real. Real image is an image formed at the same side of the object.

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Science 10 | S10FE-IIg-50

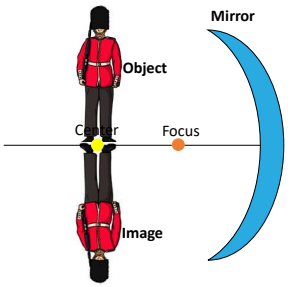
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Concave

Characteristics of image formed:

Case 2: Object located at the center

1. Same size
2. Inverted
3. Real image



If the object is located at the center, the image formed has the same size of the object, inverted and real.

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Science 10 | S10FE-IIg-50

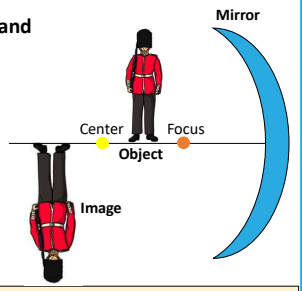
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Concave

Characteristics of image formed:

Case 3: Object between the center and the focus

1. Magnified
2. Inverted
3. Real image



Now, if the object is between the center and the focus, the image formed is magnified, inverted and real.

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Science 10 | S10FE-IIg-50

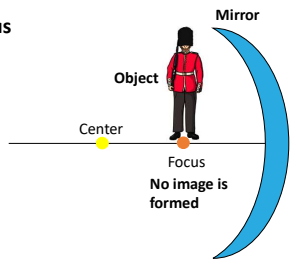
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Concave

Characteristics of image formed:

Case 4: Object is located at the focus

No image will be formed.



When the object is located at the focus, no image will be formed.

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Science 10 | S10FE-IIg-50

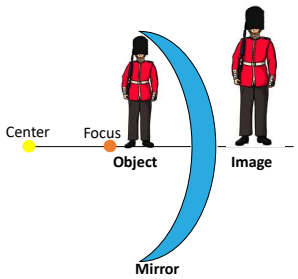
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Concave

Characteristics of image formed:

Case 5: Object is front of the focus

1. Magnified
2. Upright
3. Virtual image



If the object is in front of the focus, the image will be magnifies, upright and virtual. Recall that virtual image is an image formed at the other side of the mirror.

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Science 10 | S10FE-IIg-50

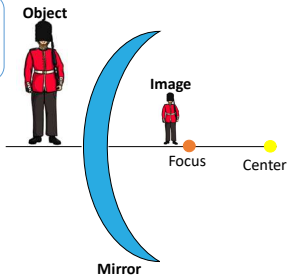
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Convex

The **image formed** in a **convex mirror** is **independent** on the **object's position.**

Characteristics of image formed

1. Reduced in size
2. Upright
3. Virtual image



Now, let us discuss image formation in a convex mirror. Unlike concave mirrors, the image formed in a convex mirror is independent on the object's position. The image formed is always reduced in size, upright and virtual.

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Science 10 | S10FE-IIg-50

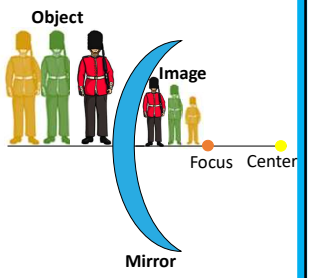
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Curve Mirror: Convex

The **image formed** in a **convex mirror** is **independent** on the **object's position.**

Characteristics of image formed

As the object gets closer to the mirror, the image on the virtual side gets closer to the mirror. The size also increases.



Moreover, in a convex mirror, as the object gets closer to the mirror, the image on the virtual side gets closer to the mirror. The size also increases.

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Science 10 | S10FE-IIg-50

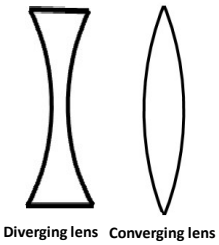
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Lenses

A **lens** is a **transparent material** that **refracts light** to **produce image.**

Types of Lenses

1. **Diverging lens**
2. **Converging lens**



Now, let us discuss lenses. A lens is a transparent material that refracts light to produce an image. A lens can either be diverging or converging.

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Science 10 | S10FE-IIg-50

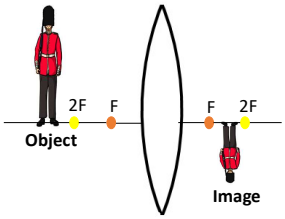
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Converging Lenses

Characteristics of image formed:

Case 1: The object is beyond 2F

1. **Reduced in size**
2. **Inverted**
3. **Real image**
4. **Image is between F and 2F of the other side of the lens**



Let us first discuss the image formed by a converging lens. The characteristics of the image formed is dependent on the position of the object. If the object is somewhere beyond 2F, then the image is formed somewhere between F and 2F of the other side of the lens. Moreover, it is reduced in size, inverted and real. The image is real if light will converge after refraction.

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Science 10 | S10FE-IIg-50

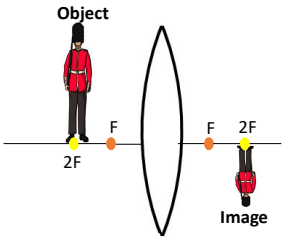
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Converging Lenses

Characteristics of image formed:

Case 2: The object is located at 2F

1. **Reduced in size**
2. **Inverted**
3. **Real image**
4. **Image is at 2F of the other side of the lens**



If the object is located at 2F, then the image is formed at 2F of the other side of the lens. Moreover, it is reduced in size, inverted and real..

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Science 10 | S10FE-IIg-50

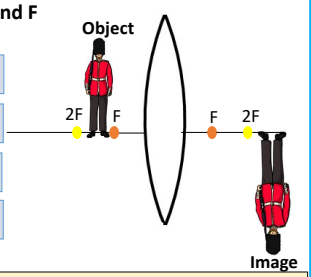
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Converging Lenses

Characteristics of image formed:

Case 3: The object is between 2F and F

1. **Magnified**
2. **Inverted**
3. **Real image**
4. **Image is beyond 2F of the other side of the lens**



Now if the object is between 2F and F, then the image is formed beyond 2F of the other side of the lens. Moreover, the image formed is magnified, inverted, and real.

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Science 10 | S10FE-IIg-50

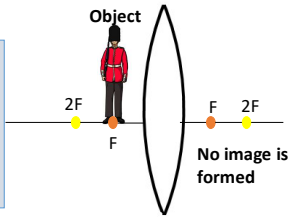
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Converging Lenses

Characteristics of image formed:

Case 4: The object is at F

No image will be formed.



When the object is located at F, no image will be formed..

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Science 10 | S10FE-IIg-50

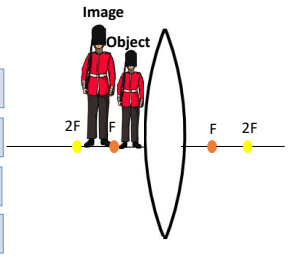
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Converging Lenses

Characteristics of image formed:

Case 5: The object is in front of F

1. **Magnified**
2. **Upright**
3. **Virtual image**
4. **Image is between F and 2F of the same side of the lens**



If the object is in front of F, then the image is formed between F and 2F of the same side of the lens. The image formed is magnified, upright and virtual. An image is virtual if light diverges after refraction.

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Science 10 | S10FE-IIg-50

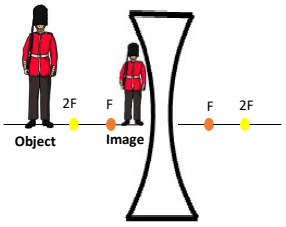
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Diverging Lenses

The **image formed** by a **diverging lens** has the **same characteristics regardless** of the **object's location**.

Characteristics of image formed

1. **Reduced in size**
2. **Upright**
3. **Virtual image**
4. **Image is at object's side of the lens**



In case of diverging lenses, the image formed has the same characteristics regardless of the object's location. The image formed is always reduced in size, upright, and virtual. The object is always formed at the side where the object is located.

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Science 10 | S10FE-IIg-50

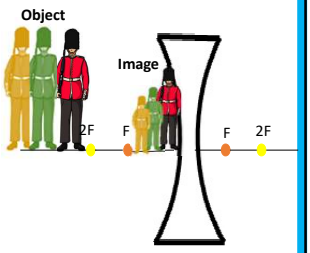
Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Diverging Lenses

The **image formed** by a **diverging lens** has the **same characteristics regardless** of the **object's location**.

Characteristics of image formed

As the object gets closer to the mirror, the image on the virtual side gets closer to the mirror as well. The size also increases.



Moreover, as the object gets closer to the mirror, the image on the virtual side gets closer to the mirror as well; its size also increases at the same time.

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

SUMMARY

Mirror		Type	Orientation	Magnification
Plane Mirror		Virtual	Upright but Left-right reversed	Same size
Curve Mirror — **Concave Mirror**	Object beyond the center	Real	Inverted	Reduced
	Object at the center	Real	Inverted	Same size
	Object between the center and the focus	Real	Inverted	Magnified
	Object at the focus	No image is formed		
	Object beyond the focus	Virtual	Upright	Reduced
	Convex Mirror	Virtual	Upright	Reduced

The table above summarizes the characteristics of images formed by plane and curved mirrors.

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

SUMMARY

Lenses		Type	Orientation	Magnification
Converging lens	Object beyond the 2F	Real	Inverted	Reduced
	Object at the 2F	Real	Inverted	Reduced
	Object between 2F and F	Real	Inverted	Magnified
	Object at F	No image is formed		
	Object beyond F	Virtual	Upright	Magnified
Diverging lens		Virtual	Upright	Reduced

The table above summarizes the characteristics of images formed by converging and diverging lenses.

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

EXERCISES

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors

Now, let's answer some exercises. Are you ready?

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

You stand in front of a plane mirror, your image that will be formed is _____.

A. Virtual, reduced, inverted	C. Virtual, same size, upright
B. Real, same size, inverted	D. Real, larger, upright

You stand in front of a plane mirror, your image that will be formed is [blank].

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

You stand in front of a plane mirror, your image that will be formed is _____.

A. Virtual, reduced, inverted	C. Virtual, same size, upright
B. Real, same size, inverted	D. Real, larger, upright

The correct answer is "C. Virtual, same size, upright"

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

Which of the following will be formed by a converging lens if the object is located at the focus?

A. Virtual, reduced, inverted	C. Virtual, smaller, upright
B. Real, same size, inverted	D. No image will be formed

Which of the following will be formed by a converging lens if the object is located at the focus?

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Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

Which of the following will be formed by a converging lens if the object is located at the focus?

A. Virtual, reduced, inverted	C. Virtual, smaller, upright
B. Real, same size, inverted	D. No image will be formed

The correct answer is "D. No image will be formed"

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

Which of the following will be formed by a diverging lens?

A. Virtual, reduced, inverted	C. Virtual, smaller, upright
B. Real, same size, inverted	D. No image will be formed

Which of the following will be formed by a diverging lens?

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

Which of the following will be formed by a diverging lens?

A. Virtual, reduced, inverted	C. Virtual, smaller, upright
B. Real, same size, inverted	D. No image will be formed

The correct answer is "C. Virtual, smaller, upright"

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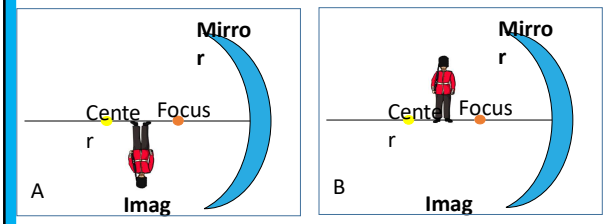
Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

If an object is located beyond the center of a curve, where will be the image formed?



Which of the following will be formed by a converging lens if the object is located at the focus?

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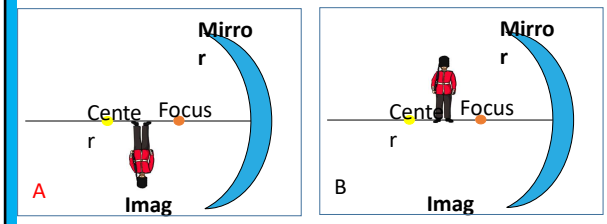
Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

If an object is located beyond the center of a curve, where will be the image formed?



The correct answer is "A"

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

Which of the following will happen to the image formed in a convex mirror if the distance of the object to the mirror decreases?

A. The distance of the image to the mirror will be half of the object's distance from the mirror.

B. The distance of the image to the mirror increases.

C. The distance of the image to the mirror decreases also.

D. The distance of the image to the mirror will not change regardless the position of the object.

Which of the following statements is true about horizontal motion of a projectile motion?

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Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

Multiple Choice

Select the correct answer.

Which of the following will happen to the image formed in a convex mirror if the distance of the object to the mirror decreases?

A. The distance of the image to the mirror will be half of the object's distance from the mirror.

B. The distance of the image to the mirror increases.

C. The distance of the image to the mirror decreases also.

D. The distance of the image to the mirror will not change regardless the position of the object.

The correct answer is "C. The distance of the image to the mirror decreases also."

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Science 10 | S10FE-IIg-50

Predicting the qualitative characteristics (orientation, type, and magnification) of images formed by plane and curved mirrors and lenses

[1] http://www.physicsclassroom.com/class/refln/Lesson-2/Image-Characteristics

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Science 10 | S10FE-IIg-51

Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

Hi! Our topic is about applying ray diagramming techniques in describing the characteristics and positions of images formed by lenses . Let's begin.

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Characteristics and positions of images formed by lenses

RECALL

	Lenses	Type	Orientation	Magnification	Position of the image
Converging lens	Object beyond the 2F	Real	Inverted	Reduced	Between F and 2F (other side of the lens)
	Object at the 2F	Real	Inverted	Reduced	At 2F
	Object between 2F and F	Real	Inverted	Magnified	Beyond 2F
	Object at F	No image is formed			
	Object beyond F	Virtual	Upright	Magnified	Between F and 2F (same side of the lens)
	Diverging lens	Virtual	Upright	Reduced	Same side of the lens.

Previously, we have discussed, the characteristics and positions of images formed by converging and diverging lenses. Now, let's discuss a technique to describe the image characteristics.

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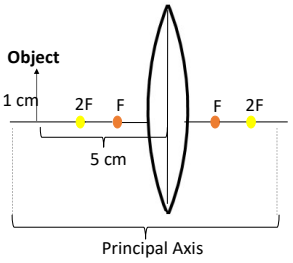
Ray diagramming technique
Converging Lens

Steps

1. **Locate the object**. Use the given distance and size of the object.

NOTE

Focus (F) is **half** the **distance** of the **object** from the **center**



Let's begin making the ray diagram. First, locate the object. Use the given distance and size of the object. In this example, the object

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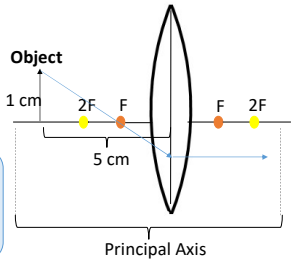
Ray diagramming technique
Converging Lens

Steps

2. From the top of the object, draw **one ray passing through the focal point**.

NOTE

Any **incident ray** traveling through the **focal point** on the way to the **lens will refract through the lens** and **travel parallel to the principal axis.**



Then, from the top of the object, draw one ray passing through the focal point. Take note that from the rules of refraction on converging, any incident ray traveling through the focal point on the way to the lens will refract through the lens and travel parallel to the principal axis.

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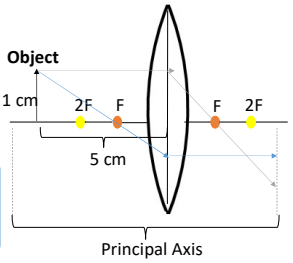
Ray diagramming technique
Converging Lens

Steps

3. **Draw another ray** from the top of the object **travelling parallel** to the **principal axis**.

NOTE

Any incident ray traveling **parallel to the principal axis** of a **converging lens** will **refract** through the **lens** and travel **through the focal point** on the **opposite side of the lens**.



Draw another ray from the top of the object travelling to the principal axis . This ray will refract through the lens and travel through the focal point on the opposite side of the lens.

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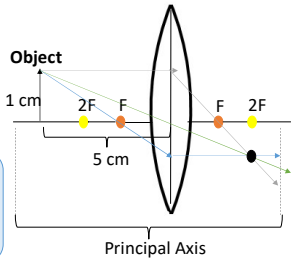
Ray diagramming technique
Converging Lens

Steps

4. **Draw** another **ray passing** through the **center of the lens**.

NOTE

An **incident ray** that passes through the **center** of the lens will **continue** travelling in the **same direction** towards the opposite side.



Draw another ray from the top of the object, but this time the ray passes through the center. This ray will continue travelling in the same direction towards the opposite side.

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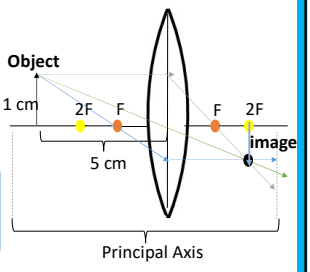
Ray diagramming technique
Converging Lens

Steps

5. **Mark** the **intersection** of the **three rays**. This is where the image is formed.

NOTE

The **ray** should be **drawn from the principal axis** going to the **intersection point**.



Now, mark the intersection of the three rays. This is where the image is formed. Take note that the ray should be drawn from the principal axis.

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Science 10 | S10FE-IIg-51

Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

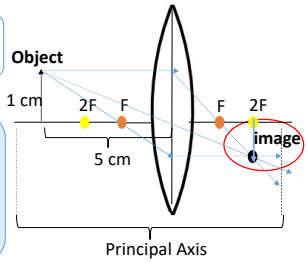
Ray diagramming technique
Converging Lens

The image formed is **smaller**, **inverted** and **real**.

$$\frac{1}{f} = \frac{1}{d_i} + \frac{1}{d_o}$$

$$M = \frac{-d_i}{d_o} = \frac{h_i}{h_o}$$

- **M**: Magnification; **f**: focus
- d_i: image's distance; d_o: object's distance
- h_i: image's height; h_o: object's height



From the diagram, we can see that the image formed is smaller, inverted and real. We can verify this by measuring the image formed or using the equations above.

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Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

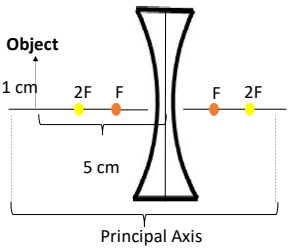
Ray diagramming technique
Diverging Lens

Steps

1. **Locate the object**. Use the given distance and size of the object.

NOTE

Focus (F) is **half** the **distance** of the **object** from the **center**



Now, let's proceed in making ray diagram of a diverging lens. Like the first step earlier, locate the object. Use the given distance and size of the object.

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Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

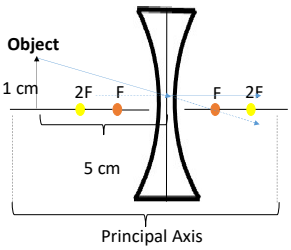
Ray diagramming technique
Diverging Lens

Steps

2. From the top of the object, draw **one ray towards** the **focal point** on the **opposite side** of the **lens**.

NOTE

Any **incident ray** traveling **towards** the **focal point** on the way to the lens will **refract** through the **lens** and travel **parallel** to the **principal axis**.



From the top of the object, draw one ray towards the focal point on the opposite side of the lens. Any incident ray traveling towards the focal point on the way to the lens will refract through the lens and travel parallel to the principal axis.

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Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

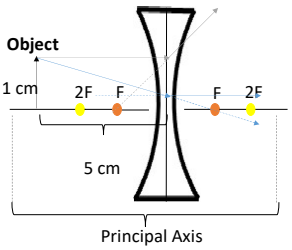
Ray diagramming technique
Diverging Lens

Steps

3. **Draw another ray** from the top of the object **travelling parallel** to the **principal axis**.

NOTE

Any **incident ray** traveling **parallel** to the **principal axis** of a **diverging lens** will **refract** through the **lens** and **travel in line** with the **focal point.**



Draw another ray from the top of the object travelling to the principal axis. This ray will refract through the lens and travel inline with the focal point.

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Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

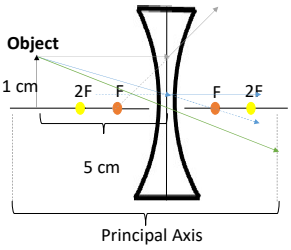
Ray diagramming technique
Diverging Lens

Steps

4. **Draw** another **ray passing** through the **center of the lens**.

NOTE

An **incident ray** that passes through the **center** of the lens will **continue** travelling in the **same direction** towards the opposite side.



Draw another ray from the top of the object travelling to the principal axis. This ray will continue travelling in the same direction towards the opposite side.

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Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

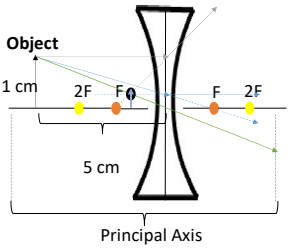
Ray diagramming technique
Diverging Lens

Steps

5. **Mark** the **intersection** of the **three rays**. This is where the image is formed.

NOTE

The **ray** should be **drawn from the principal axis** going to the **intersection point**.



Now, mark the intersection of the three rays. This is where the image is formed. Take note that the ray should be drawn from the principal axis.

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Ray diagramming technique

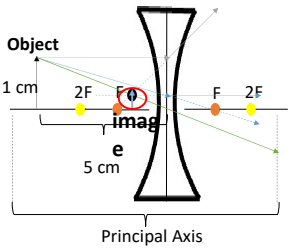
Diverging Lens

The image formed is **smaller**, **upright** and **virtual**.

$$\frac{1}{f}=\frac{1}{d_i}+\frac{1}{d_o}$$

$$M=\frac{-d_i}{d_o}=\frac{h_i}{h_o}$$

- **M**: Magnification; **f**: focus
- d_i: image's distance; d_o: object's distance
- h_i: image's height; h_o: object's height



The image formed is smaller, upright and virtual. This can be verified using by measuring the ray representing the image or by calculations.

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SUMMARY

Converging Lens	Diverging Lens
1. **Locate the object**. Use the given distance and size of the object.	1. **Locate the object**. Use the given distance and size of the object.
2. From the top of the object draw: a) **one ray passing through the focal point**. b) **one ray travelling parallel** to the **principal axis**. c) **one ray passing** through the **center of the lens**	2. From the top of the object draw: a) **one ray towards the focal point on the opposite side of the lens** b) **one ray travelling parallel** to the **principal axis**. c) **one ray passing** through the **center of the lens**
3. **Mark** the **intersection** of the **three rays**.	3. **Mark** the **intersection** of the **three rays**.

In summary, we have learned the steps in making ray diagram to describe the characteristics and positions of images formed by lenses.

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SUMMARY

Converging Lens	Diverging Lens
Any incident ray travelling to:	Any incident ray travelling to:
1. **through the focal point** on the way to the **lens will refract through the lens** and **travel parallel to the principal axis.** 2. **parallel to the principal axis** will **refract** through the **lens** and travel **through the focal point** on the **opposite side of the lens**. 3. **center** of the lens will **continue** travelling in the **same direction.**	1. **towards** the **focal point** on the way to the lens will **refract** through the **lens** and travel **parallel** to the **principal axis**. 2. **parallel** to the **principal axis** will **refract** through the **lens** and **travel in line** with the **focal point.** 3. **center** of the lens will **continue** travelling in the **same direction.**

We also learned the rules of refraction in converging and diverging lenses.

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ACTIVITY

Applying Ray Diagramming Techniques in Describing the Characteristics and Positions of Images Formed by Lenses

Now, let's do an activity. Are you ready?

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ACTIVITY

1. Use a ray tracing diagram to describe the characteristics of image formed by a diverging lens. The focal point is located 9 cm away from the center of the lens. The object is 10 cm tall and placed 15 cm from the center of the lens.

2. Use a ray tracing diagram to describe the characteristics of image formed by a converging lens with a focal length of 9 cm. The focal point is located 9 cm away from the center of the lens. The object is 10 cm tall and placed 15 cm from the center of the lens.

Here is the activity for this lesson.

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Hi! Our topic is about identifying ways in which the properties of mirrors and lenses determine their use in optical instruments. Let's begin.

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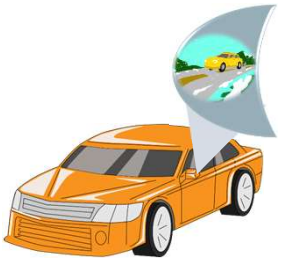
Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses
Rear view mirrors in vehicles

Convex mirror forms an image that is **smaller**, **virtual** and **upright** regardless of the position of the object.

Convex mirror allows the driver to see what are coming behind them.



Rear view mirror in vehicles is one application of convex mirrors. Convex mirror, forms an image that is smaller, virtual and upright regardless of the position of the object. Because of these, convex mirror allows the driver to see what are coming behind them.

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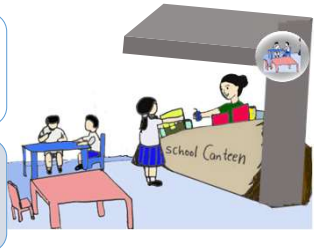
Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses
Security systems

Convex mirror forms an image that is **smaller**, **virtual** and **upright** regardless of the position of the object.

Convenient store uses **convex mirrors** to **monitor** the **security** of different parts of the store.



With the same principle, convex mirrors are also integrated in security systems. For example, convenient store uses convex mirrors to monitor what is happening in different parts of the store.

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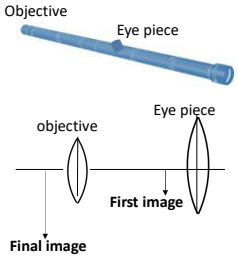
Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses
Refracting Telescope

A **telescope** is an **optical instrument use to see distant objects**. A **refracting telescope** has an **objective lens** and **eye piece**.

The **first image** formed is **real, inverted and smaller.** It is **formed by** the **objective lens.** The **eyepiece produces** the **final image** which is **larger, inverted and virtual.**



One example that uses converging lenses is refracting telescope. Telescope is an optical instrument use to see distant objects. A refracting telescope has an objective lens and eye piece. The first image formed is real, inverted and smaller. It is formed by the objective lens. The eyepiece produces the final image which is larger, inverted and virtual.

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses
Camera

A **camera** is an optical instrument used to **produce a permanent image**.

It has a **biconvex lens** producing **real, inverted and smaller image**.

Another application of lenses is camera. A camera is an optical instrument used to produce a permanent image. It has a biconvex lens producing real, inverted and smaller image.

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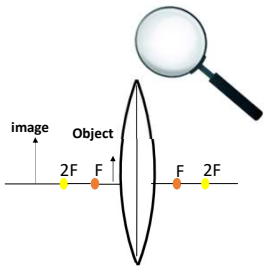
Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses
Magnifying glass

A **magnifying glass** is a **converging lens** where the **object** if placed near the **focus**.

The image formed by a converging lens when the object is placed near the focus is virtual, upright and magnified.



Now let us consider a magnifying glass. A magnifying glass is a converging lens where the object is placed near the focus. Recall that the image formed by a converging lens is virtual, upright and magnified, thus, objects appeared to be larger when viewed using a magnifying glass.

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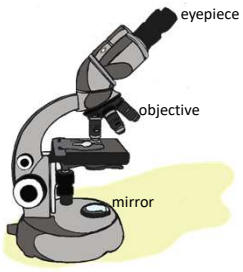
Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses
Compound microscope

Compound microscope uses both **mirrors and lenses**. Microscopes are used to examine microscopic objects.

Two converging lenses are used (**objective and eyepiece**) to achieve **greater magnification**.



There are also applications where both mirrors and lenses are used, one example is a compound microscope. Microscopes are used to examine microscopic objects. Two converging lenses are used to achieve greater magnification.

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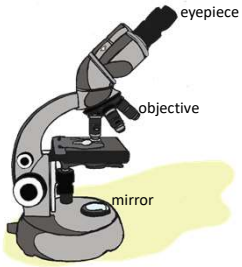
Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Applications of mirrors and lenses

Compound microscope

The **objective** produces a **real**, **inverted** and **larger** image which now becomes the object of the **eye piece**. The **final image** is **virtual, larger and upright**.

The **mirror** is used to **collect light.**



The objective produces a real, inverted and larger image which now becomes the object of the eye piece. The final image is virtual, larger and upright. On the other hand, the mirror is used to collect light

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

SUMMARY

Mirrors	Both	Lenses
• Rear view mirrors is vehicles • Security systems	Compound Microscope	• Refracting telescope • Camera • Magnifying glass

In summary, we have learned some applications of mirrors and lenses. The type of mirror or lens to be used depends on the desired image.

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

EXERCISES

Identifying ways in which the properties of mirrors and lenses determine their use in optical instruments

Now, let's answer some exercises. Are you ready?

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

What type of mirror are used as rear view mirror of vehicles?

A. Plane Mirror	C. Convex Mirror
B. Concave Mirror	D. Converging Mirror

What type of mirror are used as rear view mirror of vehicles?

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

What type of mirror are used as rear view mirror of vehicles?

A. Plane Mirror	C. Convex Mirror
B. Concave Mirror	D. Converging Mirror

The correct answer is "C. Convex Mirror"

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Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

The final image formed in a camera is _____.

A. real, inverted, smaller	C. virtual, inverted, smaller
B. real, upright, smaller	D. virtual, inverted, smaller

The final image formed in a camera is [blank].

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

The final image formed in a camera is _____.

A. real, inverted, smaller	C. virtual, inverted, smaller
B. real, upright, smaller	D. virtual, inverted, smaller

The correct answer is "A. real, inverted, smaller"

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

Which of the following has a larger, inverted and virtual final image?

A. Magnifying glass	C. Telescope
B. Microscope	D. Camera

Which of the following has a larger, inverted and virtual final image?

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

Which of the following has a larger, inverted and virtual final image?

A. Magnifying glass	C. Telescope
B. Microscope	D. Camera

The correct answer is "C. Telescope."

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

If you are to make an optical instrument that can reflect light and can produce a smaller, upright and virtual image regardless of the position of the object, what will you use?

A. Concave Mirror	C. Converging lens
B. Convex Mirror	D. Diverging lens

If you are to make an optical instrument that can reflect light and can produce a smaller, upright and virtual image regardless of the position of the object, what will you use?

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

If you are to make an optical instrument that can reflect light and can produce a smaller, upright and virtual image regardless of the position of the object, what will you use?

A. Concave Mirror	C. Converging lens
B. Convex Mirror	D. Diverging lens

The correct answer is "B. Convex Mirror"

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

Why does compound microscope have two converging lenses?

- A. to reduce the size of the image
- B. to make the image real
- C. to achieve greater magnification
- D. to make the image inverted

Why does compound microscope have two converging lenses?

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Science 10 | S10FE-IIh-52

Identifying Ways in Which the Properties of Mirrors and Lenses Determine their Use in Optical Instruments

Multiple Choice

Select the correct answer.

Why does compound microscope have two converging lenses?

A. to reduce the size of the image

B. to make the image real

C. to achieve greater magnification

D. to make the image inverted

The correct answer is "C. to achieve greater magnification"

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EM WAVES

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Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Hi! Our topic is about comparing the relative wavelengths of different forms of electromagnetic waves and its practical applications . Let's begin.

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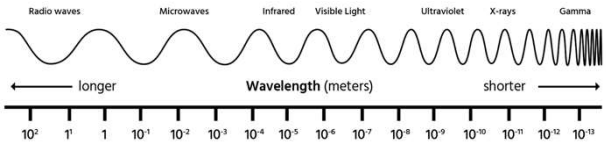
Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Electromagnetic Spectrum

The **electromagnetic spectrum** comprises all the **range of wavelengths** of the **electromagnetic waves**.



The electromagnetic spectrum comprises all the range of wavelengths of the electromagnetic waves.

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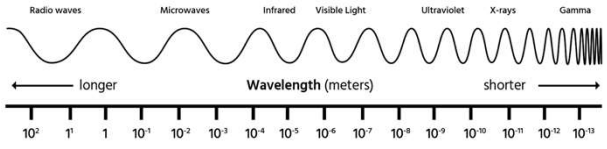
Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Electromagnetic Spectrum

The **electromagnetic spectrum** is divided into regions namely **radio**, **microwave**, **infrared**, **visible**, **ultraviolet**, **x-ray** and **gamma ray**.



Electromagnetic spectrum is divided into regions namely radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray.

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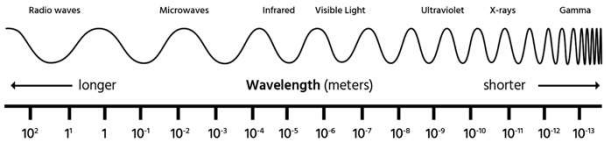
Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Electromagnetic Spectrum

Each region has a specific range of **wavelength** and **frequency**. As the **wavelength** of the wave **increases**, the **frequency decreases**.



Each region has a specific range of wavelength and frequency. We can see that as the wavelength of the wave decreases, its frequency increases.

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Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Electromagnetic Spectrum
Wavelength

Radio wave has the **longest wavelength** while **gamma ray** has the **shortest wavelength**.

EM Wave	Wavelength (m)
Radio wave	> 0.3
Microwave	0.001 – 0.3
Infrared	$7.6 \times 10^{-7} - 0.001$
Visible light	$3.8 \times 10^{-7} - 7.6 \times 10^{-7}$
Ultraviolet rays	$8.0 \times 10^{-9} - 3.8 \times 10^{-7}$
X-rays	$6.0 \times 10^{-12} - 8.0 \times 10^{-9}$
Gamma rays	$< 6.0 \times 10^{-12}$

Here are the wavelengths of each region of the electromagnetic spectrum. Radio wave has the longest wavelength while gamma ray has the shortest wavelength.

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Electromagnetic Spectrum
Wavelength

EM Wave	Wavelength (m)	Size Scale
Radio wave	> 0.3	Human, building mountain
Microwave	0.001 – 0.3	Houseflies, baseball
Infrared	$7.6 \times 10^{-7} - 0.001$	pin point
Visible light	$3.8 \times 10^{-7} - 7.6 \times 10^{-7}$	Bacteria
Ultraviolet rays	$8.0 \times 10^{-9} - 3.8 \times 10^{-7}$	Viruses
X-rays	$6.0 \times 10^{-12} - 8.0 \times 10^{-9}$	Atoms
Gamma rays	$< 6.0 \times 10^{-1}$	Nuclei

To visualize the size of each wave, the table shows estimated real-life size scale for each.

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Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Electromagnetic Spectrum
Frequency

Gamma ray has the **greatest frequency** while **radio wave** has the **least frequency**.

EM Wave	Frequency (Hz)
Radio wave	$< 10^9$
Microwave	$10^9 - 3.0 \times 10^{11}$
Infrared	$3.0 \times 10^{11} - 3.9 \times 10^{14}$
Visible light	$3.9 \times 10^{14} - 7.9 \times 10^{14}$
Ultraviolet rays	$7.9 \times 10^{14} - 3.4 \times 10^{16}$
X-rays	$3.4 \times 10^{16} - 5.0 \times 10^{19}$
Gamma rays	$> 5.0 \times 10^{19}$

Now, here are the frequencies of different electromagnetic waves measured in hertz. Gamma ray has the greatest frequency while radio wave has the least frequency.

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Science 10 | S10FE-IIa-b-47

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

SUMMARY

EM Wave	Wavelength (m)	Frequency (Hz)
Radio wave	> 0.3	$< 10^9$
Microwave	0.001 – 0.3	$10^9 - 3.0 \times 10^{11}$
Infrared	$7.6 \times 10^{-7} - 0.001$	$3.0 \times 10^{11} - 3.9 \times 10^{14}$
Visible light	$3.8 \times 10^{-7} - 7.6 \times 10^{-7}$	$3.9 \times 10^{14} - 7.9 \times 10^{14}$
Ultraviolet rays	$8.0 \times 10^{-9} - 3.8 \times 10^{-7}$	$7.9 \times 10^{14} - 3.4 \times 10^{16}$
X-rays	$6.0 \times 10^{-12} - 8.0 \times 10^{-9}$	$3.4 \times 10^{16} - 5.0 \times 10^{19}$
Gamma rays	$< 6.0 \times 10^{-12}$	$> 5.0 \times 10^{19}$

In summary, we have learned that the electromagnetic spectrum is composed of different regions with different wavelengths and frequencies. As the wavelength decreases, the frequency increases.

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

EXERCISES

Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Now, let's answer some exercises. Are you ready?

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following is not an electromagnetic wave?

A. Gamma ray
C. Infrared
B. Radio waves
D. Sound waves

Which of the following is not an electromagnetic wave?

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following is not an electromagnetic wave?

A. Gamma ray	C. Infrared
B. Radio waves	D. Sound waves

The correct answer is "D. Sound Waves"

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following has the shortest wavelength?

A. Gamma ray	C. Visible light
B. Ultraviolet	D. Infrared

Which of the following has the shortest wavelength?

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following has the shortest wavelength?

A. Gamma ray	C. Visible light
B. Ultraviolet	D. Infrared

The correct answer is "A. Gamma ray"

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following has the longest wavelength?

A. Gamma ray	C. Infrared
B. Radio waves	D. Microwaves

Which of the following has the longest wavelength?

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Comparing the Relative Wavelengths of Different Forms of Electromagnetic Waves

Multiple Choice

Select the correct answer.

Which of the following has the longest wavelength?

A. Gamma ray	C. Infrared
B. Radio waves	D. Microwaves

The correct answer is "B. Radio waves"

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Comparing the relative wavelengths of different forms of electromagnetic waves

Multiple Choice

Select the correct answer.

Which of the following has the greatest frequency?

A. Visible light	C. Infrared
B. X-rays	D. Ultraviolet

Which of the following has the greatest frequency?

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Comparing the relative wavelengths of different forms of electromagnetic waves

Multiple Choice

Select the correct answer.

Which of the following has the greatest frequency?

A. Visible light	C. Infrared
B. X-rays	D. Ultraviolet

The correct answer is "B. X-rays"

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Comparing the relative wavelengths of different forms of electromagnetic waves

Multiple Choice

Select the correct answer.

Which of the following statements is true?

A. As the frequency of a wave increases, its wavelength increases as well.

B. As the frequency of a wave decreases, its wavelength increases.

C. As the frequency of a wave decreases, its wavelength decreases as well.

D. The frequency and wavelength of a wave is always the same.

Which of the following statements is true?

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Science 10 | S10FE-IIa-b-47

Comparing the relative wavelengths of different forms of electromagnetic waves

Multiple Choice

Select the correct answer.

Which of the following statements is true?

A. As the frequency of a wave increases, its wavelength increases as well.

B. As the frequency of a wave decreases, its wavelength increases.

C. As the frequency of a wave decreases, its wavelength decreases as well.

D. The frequency and wavelength of a wave is always the same.

The correct answer is "B. As the frequency of a wave decreases, its wavelength increases".

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Hi! Our topic is about comparing the relative wavelengths of different forms of electromagnetic waves and its practical applications . Let's begin.

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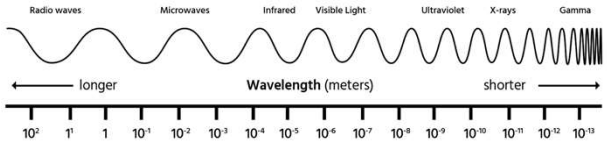
Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum

The **electromagnetic spectrum** is divided into regions namely, **radio waves**, **micro waves**, **infrared**, **visible light**, **ultraviolet**, **x-rays** and **gamma rays**, each having practical applications.



The electromagnetic spectrum is divided into regions namely, radio waves, micro waves, infrared, visible light, ultraviolet, x-rays and gamma rays, each having practical applications.

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
Radio Waves

Radio waves are used to **transmit information**. Some uses of radio waves are:

- **Television and radio**
- **Telephones and cellphones**
- **Wireless networks**
- **Radar** and **other navigation systems** (radars are important in military operations and imaging)

Let us first discuss the applications of radio waves. Radio waves are widely used in communication since it is used to transmit information. Television, radio, telephones and cellphones, wireless networks, radars and other navigation systems use radio waves. Radars are important in military operations and imaging

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
Microwaves

Microwaves are used in the following **applications:**
- Extremely high frequency: **radio astronomy** and **remote sensing.**
- Super high frequency: **radar transmitters**, **microwave ovens, wireless networks, microwave radio and satellite communications**.
- Ultra high frequency: **broadcasting, cellphones and walkie-talkies**

Now, let's proceed to microwaves. Microwaves with extremely high frequency can be used to radio astronomy and remote sensing. On the other hand, those with super high frequency are used as radar transmitters, microwave ovens, wireless networks, microwave radio and satellite communications. Lastly, those with ultra high frequency are used in broadcasting, cellphones and walkie-talkies.

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
Infrared

Infrared are used in the following **applications:**
- **Remote control**
- **Night vision camera/high sensitive vision camera**
- **Heating**
- **Spectroscopy**
- **Astronomy**
- **Biological and medical science**
- **Analysis of Work of art**

Infrared on the other hand is used for remote control, night vision camera or high sensitive vision camera, heating, spectroscopy, astronomy, biological and medical science and analysis of Work of art

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
Visible light

Visible light are used in the following **applications:**
- **responsible for human vision**; it **allows** us to **see things around**.
- **contributes** in the **process** of **photosynthesis**.

Now let us go to visible light. Visible light is the only light we can see in the electromagnetic spectrum. Visible light is responsible for human vision; it allows us to see things around. Moreover, it contributes in the process of photosynthesis.

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
Ultraviolet light

Ultraviolet light are used in the following **applications:**
- **kills bacteria** and **viruses**
- **sterilizes medical instrument**
- **induces vitamin D**
- **regulates calcium metabolism, immunity and blood pressures, insulin secretion**
- **checks counterfeit money**

Ultraviolet light also has various applications. UV kills bacteria and viruses, sterilize medical instrument, induces vitamin D, regulates calcium metabolism, immunity and blood pressure, insulin secretion and checks counterfeit money.

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
X-ray

X-rays are used in the following **applications:**
- **Diagnose diseases** (lung disorders)
- **X-ray spectroscopy for chemic analysis**
- **X-ray crystallography**
- **Kills malignant cells**

X-rays also have various applications. It can diagnose diseases especially lung disorders.

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Electromagnetic Spectrum
Gamma rays

Gamma rays are used in the following **applications:**
- **Astronomy**: studying high energy objects
- **Medicine**: radiation cancer therapy and diagnostic for nuclear medicine
- Other uses: **irradiation of foods, seeds for sterilization, production of radioisotopes**.

Last is the gamma ray. Gamma rays are used in studying high energy objects in the field of astronomy. In the field of medicine, it is used for radiation cancer therapy and diagnostic for nuclear medicine. Other uses are, irradiation of foods, seeds for sterilization and production of radioisotopes.

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Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

SUMMARY

The **electromagnetic spectrum** is divided into regions namely, **radio waves**, **micro waves**, **infrared**, **visible light**, **ultraviolet**, **x-rays** and **gamma rays**, each having practical applications.

In summary, we have learned that the electromagnetic spectrum is divided into regions namely, radio waves, micro waves, infrared, visible light, ultraviolet, x-rays and gamma rays, each having practical applications.

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

EXERCISES

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Now, let's answer some exercises. Are you ready?

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is used for diagnosis of lung disorders?

A. Gamma ray	C. Infrared
B. Radio waves	D. X-rays

Which of the following is used for diagnosis of lung disorders?

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is used for diagnosis of lung disorders?

A. Gamma ray	C. Infrared
B. Radio waves	D. X-rays

The correct answer is "D. X-rays"

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is used for night vision cameras?

A. Sound waves	C. Microwaves
B. Infrared	D. X-rays

Which of the following is used for night vision cameras?

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is used for night vision cameras?

A. Sound waves	C. Microwaves
B. Infrared	D. X-rays

The correct answer is "B. Infrared".

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is dependent on visible light?

A. Radio broadcasting	C. Production of isotopes
B. Photosynthesis	D. Spectroscopy

Which of the following is dependent on visible light?

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is dependent on visible light?

A. Radio broadcasting	C. Production of isotopes
B. Photosynthesis	D. Spectroscopy

The correct answer is "B. Photosynthesis".

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is NOT an application of ultraviolet rays?

A. production of radioisotopes	C. Checks counterfeit money
B. Sterilize medical instruments	D. kills bacteria and viruses

Which of the following is NOT an application of ultraviolet rays?

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

Which of the following is NOT an application of ultraviolet rays?

A. production of radioisotopes	C. Checks counterfeit money
B. Sterilize medical instruments	D. kills bacteria and viruses

The correct answer is "A. Production of radioisotopes"

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

_____ microwaves is used in microwave ovens for heating or cooking food.

A. Extremely high frequency	C. Super high frequency
B. Ultra high frequency	D. Very high frequency

[Blank] microwaves is used in microwave ovens for heating or cooking food.

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Science 10 | S10FE-IIc-d-48

Citing Examples of Practical Applications of the Different Regions of EM Waves, Such as the Use of Radio Waves in Telecommunications

Multiple Choice

Select the correct answer.

_____ microwaves is used in microwave ovens for heating or cooking food.

A. Extremely high frequency	C. Super high frequency
B. Ultra high frequency	D. Very high frequency

The correct answer is "C. Super high frequency"

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Explaining the Effects of EM Radiation on Living things and the Environment

Hi! Our topic is about explaining the effects of EM radiation on living things and the environment. Let's begin.

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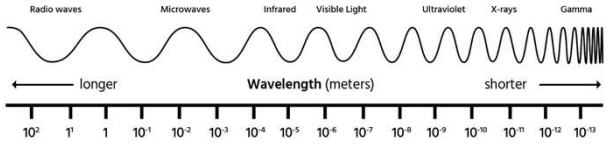
Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Electromagnetic radiation

RECALL



First, let us recall that electromagnetic spectrum is divided into regions namely radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray which can be transmitted to us by radiation. In this lesson, we will discuss the effects of EM radiation.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation
Radio waves

Radio waves may **warm up our tissues**.

Possibly carcinogenic (further researches are needed)

Radio waves may occur **naturally or artificially**. Radio waves may come from **lightning**, **cellphones**, **antennas** and **televisions**.

Radio waves may occur naturally or artificially. Radio waves may come from lightning, cellphones, antennas and televisions. The radio waves we get from these sources may warm up our tissues. Some says radio waves are possibly carcinogenic, however, further researches are still needed. Aside from these, radio waves pose no serious effects on the living things and the environment.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation
Microwaves

Long term exposure to **high levels** of **microwaves** may cause **cataracts**.

High-power microwave may cause **burning sensation on the skin**

Microwaves may come from **circuits, transmission towers, microwave ovens, sun atoms and molecules**.

Now let us discuss the effects of microwaves. Microwaves may come from circuits, transmission towers, microwave ovens, sun, atoms and molecules. Long-term exposure to high levels of microwaves may cause cataracts while high-power microwave may cause burning sensation on the skin.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation
Infrared

Changes in the lens of the eye.

Cataract

Skin aging

Infrared may come from any object with **temperature.** Any object can emit infrared at varying intensity. Detectable infrareds are emitted by **astronomical objects.**

On the other hand infrared may come from any object with temperature. Any object can emit infrared at varying intensity. Detectable infrareds are emitted by astronomical objects. Infrared emitted in welding operations can affect the eyes. It may change the lens of the eye or may cause cataracts. Too much infrared can also cause skin aging.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation
Visible light

Excessive exposure can cause **eye problems.**

Visible light can cause **breakdown** of object's (plastic) **molecular structure**.

Visible light can cause **photodegradation of pigments**

Visible light is a small portion in the electromagnetic spectrum. Any light we can see is visible light.

Visible light is a small portion in the electromagnetic spectrum that we can only see. Any light we are seeing right now is visible light. Some effects of visible light are the following: excessive exposure can cause eye problems; visible light can cause breakdown of object's molecular structure and it can also cause photodegradation of pigments.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation

Ultraviolet

UV-B can cause **cataracts**

UV from welding can **damage the cornea**

UV rays can cause **wrinkles, freckles, sunburn, melanoma and other skin problems**

Depletion of the ozone layer

Ultraviolet (UV) radiation may come from **sun, arc welding, mercury-vapor lamps and tanning lamps**.

Now let us discuss the effects of ultraviolet radiation. Ultraviolet radiation may come from sun, arc welding, mercury vapor-lamps and tanning lamps. This radiation particularly UV-B can cause cataracts. UV from welding can damage the cornea of our eyes. Moreover, UV rays can cause wrinkles, freckles, sunburn, melanoma and other skin problems. Ozone layer depletion can also be caused by too much UV radiation.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation

X-rays

Babies in the **mother's womb** exposed to **x-rays** have higher risks of having **cancers, tumors of the nervous system and leukemia**

Damage thyroid glands.

Bone marrow cancer

Genetic damages

X-rays can be emitted by either **electrons or ions with sufficient energy**.

X-rays are emitted by either electrons or ions with sufficient energy. Exposure to x-rays can damage our thyroid glands, and can cause bone marrow cancers. X-ray radiation can also pose serious genetic damages that can be passed to the next generations. Moreover, babies in their mother's womb who are exposed to x-rays have higher risks of having cancers, tumors of the nervous system and leukemia.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Effects of electromagnetic radiation

Gamma rays

Mild radiation poisoning affecting **skin, hair and gastrointestinal tract**. Symptoms of mild radiation poisoning include nausea and vomiting progressing to fatigue several weeks later.

Severe radiation can cause **bone marrow cancer, genetic mutations and death.**

Gamma radiations can be produced from the **decay of radionuclides, secondary radiation from atmospheric interaction with cosmic rays, nuclear fusion in stars** and other **astronomical processes.**

Last is the gamma radiation. Gamma radiations can be produced from the decay of radionuclides, secondary radiation from atmospheric interaction with cosmic rays, nuclear fusion in stars and other astronomical processes. Gamma rays can cause mild radiation affecting skin, hair and gastrointestinal tract. Severe radiation can cause bone marrow cancer, genetic mutations and death.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

SUMMARY

The **electromagnetic radiations** have **different effects on living things**. **Radiations** from EM waves of **higher frequency** have **greater effects**.

In summary, we have learned the different effects of electromagnetic radiation. Radiations from EM waves of higher frequency have greater effects.

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

EXERCISES

Explaining the Effects of EM Radiation on Living Things and the Environment

Now, let's answer some exercises. Are you ready?

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which of the following can cause photodegradation of pigments?

A. Ultraviolet rays

C. Visible light

B. Infrared

D. Microwave

Which of the following can cause photodegradation of pigments?

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which of the following can cause photodegradation of pigments?

A. Ultraviolet rays	C. Visible light
B. Infrared	D. Microwave

The correct answer is "C. Visible light"

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Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which of the following is the most penetrating and severe exposure to this can cause death?

A. Radio waves	C. Visible light
B. Microwave	D. Gamma ray

Which of the following is the most penetrating and severe exposure to this can cause death?

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Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which of the following is the most penetrating and severe exposure to this can cause death?

A. Radio waves	C. Visible light
B. Microwave	D. Gamma ray

The correct answer is "D. Gamma ray"

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which radiation coming from the sun may cause wrinkles, freckles, sunburn, melanoma and other skin problems?

A. Radio waves	C. Microwave
B. Ultraviolet rays	D. Gamma ray

Which radiation coming from the sun may cause wrinkles, freckles, sunburn, melanoma and other skin problems?

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which radiation coming from the sun may cause wrinkles, freckles, sunburn, melanoma and other skin problems?

A. Radio waves	C. Microwave
B. Ultraviolet rays	D. Gamma ray

The correct answer is "B. Ultraviolet rays"

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which radiation emitted by either electrons or ions with sufficient energy can damage thyroids?

A. Gamma rays	C. Microwave
B. Visible light	D. X-rays

Which radiation emitted by either electrons or ions with sufficient energy can damage thyroids?

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which radiation emitted by either electrons or ions with sufficient energy can damage thyroids?

A. Gamma rays	C. Microwave
B. Visible light	D. X-rays

The correct answer is "D. X-rays"

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which radiation coming from lightning, cellphones, antennas and televisions can warm up our tissues?

A. Gamma rays	C. Radio waves
B. X-rays	D. Sound waves

Which radiation coming from lightning, cellphones, antennas and televisions can warm up our tissues?

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Science 10 | S10FE-IIe-f-49

Explaining the Effects of EM Radiation on Living Things and the Environment

Multiple Choice

Select the correct answer.

Which radiation coming from lightning, cellphones, antennas and televisions can warm up our tissues?

A. Gamma rays	C. Radio waves
B. X-rays	D. Sound waves

The correct answer is "C. Radio waves"

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SEISMIC WAVE

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Hi! Our topic is about using models or illustrations and explaining how movements along faults generate earthquakes. Let's begin.

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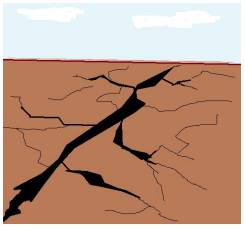
Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Earthquake

Earthquake is the shaking of the ground caused by the rocks slipping past one another.

Earthquakes occur within **faults**.



Earthquake is the shaking of the ground caused by the rocks slipping past one another. Earthquakes occur within faults.

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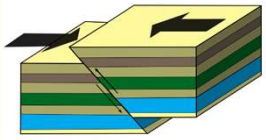
Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Fault

Fault is a thin rock fracture separating two sides of the Earth's crust.



A fault is a thin rock fracture separating two sides of the Earth's crust.

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Earthquake

How Earthquakes Occur?

Stress in the outer crusts push the sides of the fault together.

↓

The friction of the sides of the fault holds the rocks, so they wouldn't slide immediately to one another.

↓

When enough stress builds up, these rocks would slip suddenly; thus, creating energy waves that causes shaking.

Earthquake is produced when there is stress in the outer crusts pushing the sides of the fault together. The friction of the sides of the fault holds the rocks, so they wouldn't slide immediately to one another. When enough stress builds up, these rocks would slip suddenly; thus, creating energy waves that causes shaking.

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

SUMMARY

Stress in the outer crusts push the sides of the fault together.

↓

The friction of the sides of the fault holds the rocks, so they wouldn't slide immediately to one another.

↓

When enough stress builds up, these rocks would slip suddenly; thus, creating energy waves that causes shaking.

To summarize, earthquakes are generated when there is stress building up on the faults. The friction will hold the rocks for a moment, but a sudden slip would create energy waves that can cause shaking.

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

EXERCISES

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Now, let's answer some exercises. Are you ready?

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Multiple Choice

Select the correct answer.

What do you call the shaking of the ground that is caused by rocks slipping past one another?

A. fault	C. earthquake
B. stress	D. friction

What do you call the shaking of the ground caused by the rocks slipping past one another?

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Multiple Choice

Select the correct answer.

What do you call the shaking of the ground that is caused by rocks slipping past one another?

A. fault	C. earthquake
B. stress	D. friction

The correct answer is "C. earthquake".

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Modified True or False

Select "True" if the statement is true; otherwise select the correct word that would make the statement true.

When enough stress builds up, rocks would slip suddenly and creates magnetic waves that cause shaking.

A. True	C. shock waves
B. energy waves	D. oceanic waves

When enough stress builds up, rocks would slip suddenly and creates magnetic waves that cause shaking.

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Modified True or False

Select "True" if the statement is true; otherwise select the correct word that would make the statement true.

When enough stress builds up, rocks would slip suddenly and creates magnetic waves that cause shaking.

A. True	C. shock waves
B. energy waves	D. oceanic waves

The correct answer is B. energy waves

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Science 8 | S8ES-IIa-14

Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Modified True or False

Select "True" if the statement is true; otherwise select the correct word that would make the statement true.

Stress in the outer crusts push the sides of a fault together.

A. True	C. earthquake
B. shakes	D. friction

Stress in the outer crusts push the sides ofa fault together.

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Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Modified True or False

Select "True" if the statement is true; otherwise select the correct word that would make the statement true.

Stress in the outer crusts push the sides of a fault together.

A. True	C. earthquake
B. shakes	D. friction

Stress in the outer crusts push the sides ofa fault together.

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Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Multiple Choice

Select the correct answer.

Arrange the process in order:

I. Stress push the sides of the fault.
II. Rocks slip suddenly, creating energy waves causing the shaking.
III. Friction still hold the rocks so they wouldn't slide immediately to one another.

A. I,II, III
B. II, III, I
C. II, I, III
D. I, III, II

Arrange the process in order.

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Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Multiple Choice

Select the correct answer.

Arrange the process in order:

I. Stress push the sides of the fault.
II. Rocks slip suddenly, creating energy waves causing the shaking.
III. Friction still hold the rocks so they wouldn't slide immediately to one another.

A. I,II, III
B. II, III, I
C. II, I, III
D. I, III, II

The correct answer is "D. I, III, II".

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Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Multiple Choice

Select the correct answer.

What do you call the thin rock fracture separating two sides of the Earth's crust?

A. earthquake	C. stress
B. fault	D. friction

What do you call the thin rock fracture separating two sides of the Earth's crust?

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Using Models or Illustrations; Explaining How Movements Along Faults Generate Earthquakes

Multiple Choice

Select the correct answer.

What do you call the thin rock fracture separating two sides of the Earth's crust?

A. earthquake	C. stress
B. fault	D. friction

The correct answer is "B. Fault".

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Differentiating the Epicenter of an Earthquake from its Focus

Differentiating the Epicenter of an Earthquake from its Focus

Hi! Our topic is about differentiating the epicenter of an earthquake from its focus. Let's begin!

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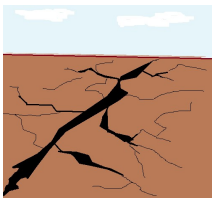
Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

Earthquake is the shaking of the ground caused by rocks slipping past one another.



Earthquake is the shaking of the ground caused by rocks slipping past one another.

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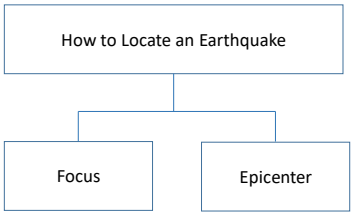
Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

How to Locate Earthquakes



There are two ways to determine the location of an earthquake. These are the focus and the epicenter of an earthquake. We will discuss each of them in the succeeding slides.

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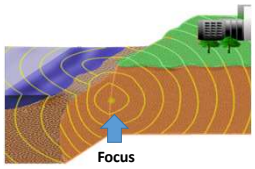
Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

Focus (Hypocenter)

Focus is the point of origin of an earthquake.

The focus of an earthquake is the weakest point of an earthquake located **inside the earth's crust** where seismic waves travel.



Focus which is also called as hypocenter is the point of origin of the earthquake. The focus of an earthquake is the weakest point of an earthquake located inside the earth's crust where seismic waves travel.

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Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

Focus (Hypocenter)

Types of Earthquake according to Depth of Focus	
Type of Earthquake	Focal Depth from the Earth's Surface
Shallow - focus	<70 km
Intermediate - focus	70 – 300 km
Deep focus	>300 km

There are different types of earthquakes based on their depth. These are shallow-focus, intermediate focus, and deep focus earthquakes. Shallow-focus earthquakes occur less than seventy kilometers from the surface, while intermediate-focus earthquakes occur from seventy to three hundred kilometers deep from the surface. Lastly, deep-focus earthquakes occur in more than three hundred kilometers deep from the surface.

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Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

Focus (Hypocenter)

NOTE

Since the seismic waves of shallow-focus earthquakes travel faster from the focus to the surface due to short distance between the focus and the surface, shallow-focus earthquakes can cause more damage than deep focus earthquakes.

Note! Since the seismic waves of shallow-focus earthquakes travel faster from the focus to the surface due to short distance between the focus and the surface, shallow-focus earthquakes can cause more damage than deep focus earthquakes.

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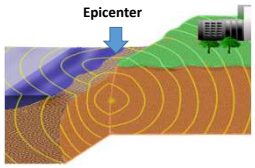
Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

Epicenter

Epicenter is the geographical point on the Earth's surface directly above the focus.

The epicenter is also described based on **its distance to the nearest community** in the area.



Now, let's learn about the epicenter of an earthquake. Epicenter is the geographical point on the Earth's surface directly above the focus. The epicenter is also described based on its distance to the nearest community in the area.

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Differentiating the Epicenter of an Earthquake from its Focus

Earthquake

Epicenter

NOTE

Assessing the damage of an earthquake to its epicenter provides an insight to the degree of damage it had caused.

Note! Assessing the damage of an earthquake to its epicenter provides an insight to the degree of damage it had caused.

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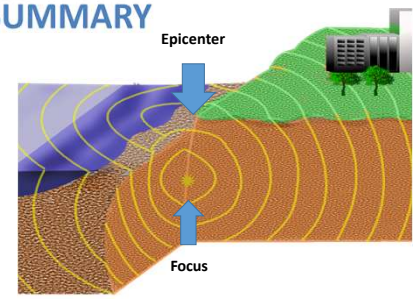
Differentiating the Epicenter of an Earthquake from its Focus

SUMMARY



In summary, the focus is the origin of the seismic waves and responsible for the occurrence of the earthquake, while the epicenter is the "visible" origin of the earthquake.

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Differentiating the Epicenter of an Earthquake from its Focus

EXERCISES

Differentiating the Epicenter of an Earthquake from its Focus

Now, let's answer some exercises. Are you ready?

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Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Where do seismic waves travel in the Earth's surface?

A. Focus	C. Crust
B. Epicenter	D. Earthquake

Where do seismic waves travel in the Earth's surface?

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Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Where do seismic waves travel in the Earth's surface?

A. Focus	C. Crust
B. Epicenter	D. Earthquake

The correct answer is "A. Focus".

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Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Which of the following is located in the ground surface?

A. Focus	C. Crust
B. Epicenter	D. Hypocenter

Which of the following is located at the ground surface?

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Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Which of the following is located in the ground surface?

A. Focus	C. Crust
B. Epicenter	D. Hypocenter

The correct answer is: B. Epicenter

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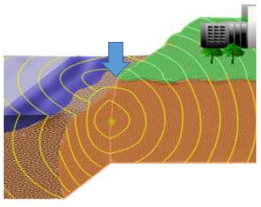
Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Identify the area that the arrow is pointing.



A. Hypocenter

B. Focus

C. Epicenter

D. Earthquake

Identify the area that the arrow is pointing.

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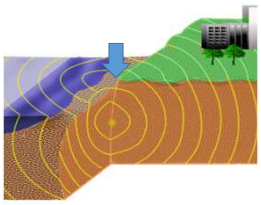
Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Identify the area that the arrow is pointing.



A. Hypocenter

B. Focus

C. Epicenter

D. Earthquake

The correct answer is "C. Epicenter".

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Differentiating the Epicenter of an Earthquake from its Focus

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Focus is the point of origin of an earthquake.

A. True

C. Earthquake

B. Epicenter

D. Seismic waves

Focus is the point of origin of an earthquake.

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Differentiating the Epicenter of an Earthquake from its Focus

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Focus is the point of origin of an earthquake.

A. True

C. Earthquake

B. Epicenter

D. Seismic waves

The correct answer is "A. True".

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Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Which of the following statements is correct?

I. Epicenter is above the focus.

II. The focus is located on the ground surface.

A. Statement I only

C. Both statements I and II are correct.

B. Statement II only

D. Both statements I and II are incorrect.

Which of the following statements is correct? Epicenter is above the focus. The focus is located on the ground surface.

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Differentiating the Epicenter of an Earthquake from its Focus

Multiple Choice

Select the correct answer.

Which of the following statements is correct?

I. Epicenter is above the focus.

II. The focus is located on the ground surface.

A. Statement I only

C. Both statements I and II are correct.

B. Statement II only

D. Both statements I and II are incorrect.

The correct answer is "A. Statement I only.

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Differentiating the Epicenter of an Earthquake from its Focus

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Differentiating the Intensity of an Earthquake from Its Magnitude

Differentiating the Intensity of an Earthquake from Its Magnitude

Hi! Our topic is about differentiating the intensity of an earthquake from its magnitude. Let's begin.

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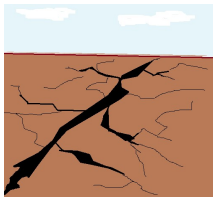
Differentiating the Intensity of an Earthquake from Its Magnitude

Earthquake

Earthquake is the shaking of the ground caused by rocks slipping past one another.



Earthquake is the shaking of the ground caused by rocks slipping past one another. Many houses are destroyed and many lives are killed during a big earthquake. We will learn how to measure the damage of an earthquake in the succeeding slides.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Earthquake

How to Locate Earthquakes

How to Measure the Strength of an Earthquake

- Magnitude
- Intensity

There are two ways to determine the strength of an earthquake. These are the magnitude and the intensity of an earthquake.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Magnitude

Magnitude measures the **amount of energy released** at the source or (epicenter) of an earthquake.

Richter Scale

↑

Measuring Magnitude

↓

Moment Magnitude Scale

Magnitude is the measure of the amount of energy released at the source or (epicenter) of an earthquake. Its degree is constant since the seismic energy waves. There are two ways to measure the magnitude of an earthquake.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Magnitude

Richter Scale & Moment Magnitude Scale

Richter scale is a mathematical formula using a logarithm of amplitude of waves as recorded by seismographs.

It was developed by **Charles F. Richter**

Moment Magnitude Scale includes the size of the seismic waves recorded by the seismographs and the area of the rupture and slippage among the fault.

Richter scale is a mathematical formula using a logarithm of amplitude of waves as recorded by seismographs. It was developed by Charles F. Richter. On the other hand, moment magnitude scale includes the size of the seismic waves recorded by the seismographs and the area of the rupture and slippage among the fault.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Intensity

Intensity is the measurement of the strength of an earthquake in a location and its damaging effects to the people and to the environment.

The degree of the intensity of an earthquake varies depending on the distance of an area to the epicenter.

Intensity is the measurement of the strength of an earthquake in a location, and its damaging effects to the people and to the environment. The degree of the intensity of an earthquake varies depending on the distance of an area to the epicenter.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Intensity

Modified Mercalli Intensity Scale

The Modified Mercalli Intensity Scale is a scale with 12 degrees with increasing level of intensity and damage.

It was developed by American seismologists Harry Wood and Frank Neuman.

The Modified Mercalli Intensity Scale is a scale with 12 degrees with increasing level of intensity and damage. It was developed by American seismologists Harry Wood and Frank Neuman.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Intensity

Modified Mercalli Intensity Scale

I. Not felt	Not felt except by a very few under especially favorable conditions.
II. Weak	Felt only by a few persons at rest, especially on upper floor of buildings.
III. Weak	Felt quite noticeably by persons indoors, especially on upper floors of buildings. Many people do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibrations similar to the passing of a truck. Duration estimated.

US Geological Survey, 2013

Here is a table representing the Modified Mercalli Intensity Scale. Intensity level one to three are considerable weak as few people can only feel the shaking of the land.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Intensity

Modified Mercalli Intensity Scale

IV. Light	Felt indoors by many, outdoors by few during the day. At night, some awakened. Dishes, windows, doors, disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.
V. Moderate	Felt by nearly everyone; many awakened. Some dishes, windows broken. Unstable objects overturned. Pendulum clocks may stop.
VI. Strong	Felt by all, many frightened. Some heavy furniture moved; a few instances of fallen plaster. Damage slight.

US Geological Survey, 2013

Intensity level four to six represents an earthquake which does not cause damage but can cause fear to people.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Intensity

Modified Mercalli Intensity Scale

VII. Very Strong	Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built or badly designed structures; some chimneys broken.
VIII. Severe	Damage slight in specially designed structures; considerable damage in ordinary substantial buildings with partial collapse. Damage great in poorly built structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned

US Geological Survey, 2013

Level seven and level eight can cause damage to poorly built structures.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Intensity

Modified Mercalli Intensity Scale

IX. Violent	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.
X. Extreme	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations. Rails bent.

US Geological Survey 2013

Levels nine and ten can cause damage even to well-designed frame structures.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Measuring Intensity

Modified Mercalli Intensity Scale

VII. Extreme	Few, if any (masonry) structures remain standing. Bridges destroyed. Rails bent greatly.
VIII. Extreme	Damage total. Lines of sight and level are distorted. Objects thrown into the air.

US Geological Survey, 2013

The last two levels of Modified Mercalli Intensity Scale cause great to total damage to an area.

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

SUMMARY

Magnitude

Magnitude measures the **amount of energy released** at the source or (epicenter) of an earthquake.

Intensity

Intensity is the measurement of the strength of an earthquake in a location and its damaging effects to the people and to the environment.

To summarize, the difference of magnitude and intensity is that Magnitude measures the amount of energy released at the source or (epicenter) of an earthquake while intensity is the measurement of the strength of an earthquake in a location and its damaging effects to the people and to the environment. .

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

EXERCISES

Differentiating the Intensity of an Earthquake from Its Magnitude

Now, let's answer some exercises. Are you ready?

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Multiple Choice

Select the correct answer.

Which of the following measures the strength of shaking caused by earthquakes?

A. Magnitude	C. Richter Scale
B. Intensity	D. Moment magnitude scale

Which of the following measures the strength of shaking caused by earthquakes?

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Multiple Choice

Select the correct answer.

Which of the following measures the strength of shaking caused by earthquakes?

A. Magnitude	C. Richter Scale
B. Intensity	D. Moment magnitude scale

The correct answer is "B. Intensity".

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Multiple Choice

Select the correct answer.

Which of the following is measured when talking about magnitude?

A. seismic energy waves	C. damage
B. Strength of shaking	D. epicenter

Which of the following is measured when talking about magnitude?

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Multiple Choice

Select the correct answer.

Which of the following is measured when talking about magnitude?

A. seismic energy waves	C. damage
B. strength of shaking	D. epicenter

The correct answer is "A. Seismic energy waves".

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Richter scale includes the size of the seismic waves recorded by the seismographs and the area of the rupture and slippage among the fault.

A. True

B. Magnitude

C. Moment magnitude scale

D. intensity

Richter scale includes the size of the seismic waves recorded by the seismographs and the area of the rupture and slippage among the fault.

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Richter scale includes the size of the seismic waves recorded by the seismographs and the area of the rupture and slippage among the fault.

A. True

B. Magnitude

C. Moment magnitude scale

D. intensity

The correct answer is "C. Moment magnitude scale".

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Differentiating the Intensity of an Earthquake from Its Magnitude

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Which of the following statements is correct?

I. The degree of magnitude varies.
II. The strength of shaking is constant for all locations affected by the earthquake.

A. Statement I only

B. Statement II only

C. Both statements I and II are correct.

D. Both statements I and II are incorrect.

Which of the following statements is correct?

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Science 8 | S8ES-IIa-15

Differentiating the Intensity of an Earthquake from Its Magnitude

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Which of the following statements is correct?

I. The degree of magnitude varies.
II. The strength of shaking is constant for all locations affected by the earthquake.

A. Statement I only

B. Statement II only

C. Both statements I and II are correct.

D. Both statements I and II are incorrect.

The correct answer is D. Both statements I and II are incorrect.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Intensity is focused on the size of the earthquake.

A. True

C. Moment magnitude scale

B. Magnitude

D. intensity

Intensity is focused on the size of the earthquake.

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Differentiating the Intensity of an Earthquake from Its Magnitude

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Intensity is focused on the size of the earthquake.

A. True

C. Moment magnitude scale

B. Magnitude

D. intensity

The correct answer is "B. Magnitude".

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Differentiating the Intensity of an Earthquake from Its Magnitude

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Science 8 | S8ES-IIa-15

Differentiating the Active and Inactive Faults

Differentiating Active and Inactive Faults

Hi! Our topic is about differentiating active and inactive faults. Let's begin.

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Science 8 | S8ES-IIa-15

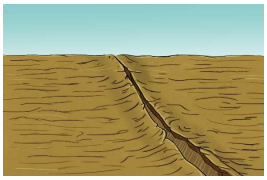
Differentiating the Active and Inactive Faults

Fault

Fault is a thin rock fracture separating two sides of the Earth's crust.

Classifications According to the Level of Activity

- Active Fault
- Inactive Fault



A fault is a thin rock fracture separating two sides of the Earth's crust. It can be classified according to the level of its activity. The two classifications are active fault and inactive fault.

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Differentiating the Active and Inactive Faults

Fault

Active Fault

Active faults are faults that generated earthquakes **within the last 10,000 years**.

- Active faults moved one or more times over a ten thousand year period.
- They are more likely to generate earthquakes in the future.
- Shallow earthquakes occur on active faults.

Active faults are faults generating earthquakes within the last 10,000 years. They moved one or more times over a ten thousand year period. They are more likely to generate earthquakes in the future. Shallow earthquakes occur on active faults.

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Differentiating the Active and Inactive Faults

Fault

Active Fault

Types of Active Faults

Holocene Active Fault
- Fault that has moved in the last 10,000 years

Late Quaternary Fault
- Fault that has moved in the last 130,000 years

Quaternary Fault
- Fault that has moved in the last 1,600,000 years

There are types of active faults based on the last time it generated earthquakes. Holocene active fault has moved in the last 10 000 years. Late quaternary fault has moved in the last 130, 000 years while quaternary fault has moved in the last 1, 600, 000 years.

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Differentiating the Active and Inactive Faults

Fault

Active Fault

There are active faults in the Philippines.

Active Faults in the Philippines
- Marikina Valley Fault
- West Philippine Fault
- Error Eastern Philippines
- Errors Southern Mindanao
- Central Philippine Fault

There are active faults located in the Philippines. Some of which are Marikina Valley Fault, West Philippines Fault, Error Eastern Philippines, Errors Southern Mindanao, and Central Philippine Fault.

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Science 8 | S8ES-IIa-15

Differentiating the Active and Inactive Faults

Fault

Inactive Fault

Inactive faults are faults that did not show any sign of generating earthquakes **within the last 10,000 years**.

- Inactive faults did not move for over ten thousand years.
- It can still generate earthquakes.

On the other hand, inactive faults are faults that did not show any sign of generating earthquakes within the last 10, 000 years; however, it is still possible for inactive faults to generate earthquakes.

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Differentiating the Active and Inactive Faults

SUMMARY

Active Faults	Inactive Faults
generated earthquakes **within the last 10,000 years**	did not show any sign of generating earthquakes **within the last 10,000 years**
more likely to generate earthquakes in the future.	no earthquake occurrences, but possible to have in the future

Active faults are faults that generated earthquakes within the last 10,000 years. They are more likely to generate earthquakes in the future. Inactive faults are faults that did not show any sign of generating earthquake within the last 10,000 years; however, it can still generate earthquakes in the future.

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Differentiating the Active and Inactive Faults

EXERCISES

Differentiating the Active and Inactive Faults

Now, let's answer some exercises. Are you ready?

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Differentiating the Active and Inactive Faults

Multiple Choice

Select the correct answer.

What occurs in an active fault?

A. Inactive fault	C. Massive earthquake
B. Shallow earthquake	D. Momentary ruptures

What occurs in an active fault?

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Differentiating the Active and Inactive Faults

Multiple Choice

Select the correct answer.

What occurs in an active fault?

A. Inactive fault	C. Massive earthquake
B. Shallow earthquake	D. Momentary ruptures

The correct answer is "B. shallow earthquake".

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Differentiating the Active and Inactive Faults

Multiple Choice

Select the correct answer.

What do you call the fault that has NO displacements?

A. Active fault	C. Shallow fault
B. Inactive fault	D. Deep fault

What do you call the fault that has NO displacements?

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Differentiating the Active and Inactive Faults

Multiple Choice

Select the correct answer.

What do you call the fault that has NO displacements?

A. Active fault	C. Shallow fault
B. Inactive fault	D. Deep fault

The correct answer is "B. Inactive fault".

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Differentiating the Active and Inactive Faults

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Holocene active faults moved one or more times over a <u>ten year</u> period.

A. True	C. Thousand
B. hundred	D. one

Holocene active faults moved one or more times over a ten year period.

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Differentiating the Active and Inactive Faults

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Quaternary faults are faults that have moved in the last <u>10,000 years</u>.

A. True	C. 1,600,000 years
B. 130,000 years	D. 160,000 years

Quaternary faults are faults that have moved in the last 10,000 years.

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Differentiating the Active and Inactive Faults

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Holocene active faults moved one or more times over a <u>ten year</u> period.

A. True	C. thousand
B. hundred	D. one

The correct answer is "C. thousand".

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Differentiating the Active and Inactive Faults

Multiple Choice

Select the correct answer.

Which of the following statements is correct?

I. Inactive faults are characterized by earthquakes.
II. Shallow earthquakes occur in inactive faults.

A. Statement I only	C. Both statements I and II are correct.
B. Statement II only	D. Both statements I and II are incorrect.

Which of the following statements is correct?

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Differentiating the Active and Inactive Faults

Multiple Choice

Select the correct answer.

Which of the following statements is correct?

I. Inactive faults are characterized by earthquakes.
II. Shallow earthquakes occur in inactive faults.

A. Statement I only	C. Both statements I and II are correct.
B. Statement II only	D. Both statements I and II are incorrect.

The correct answer is "D. Both statements are incorrect".

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Differentiating the Active and Inactive Faults

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Quaternary faults are faults that have moved in the last 10,000 years.

A. True	C. 1,600,000 years
B. 130,000 years	D. 160,000 years

The correct answer is "C. 1,600,000 years".

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Differentiating the Active and Inactive Faults

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Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Demonstrating How Underwater Earthquakes Generate Tsunamis

Hi! Our topic is about demonstrating how underwater earthquakes generate tsunamis. Let's begin.

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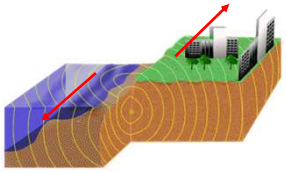
Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Earthquake

Earthquake is the shaking of the ground caused by the slipping of two plate boundaries



Earthquake is the shaking of the ground caused by the slipping of two plate boundaries.

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Science 8 | S8ES-IIb-16

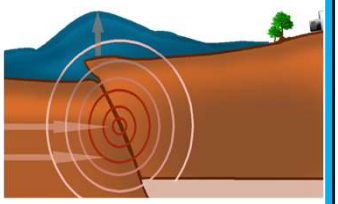
Demonstrating How Underwater Earthquakes Generate Tsunamis

Tsunami

Tsunami is a large ocean waves caused by an earthquake in the ocean floor.

It can also be caused by:

- volcanic eruption
- underwater landslide
- impact of a large meteorite



A tsunami is a large ocean wave usually caused by an earthquake in the ocean floor. It can be caused by volcanic eruption, underwater landslide, or large meteorite.

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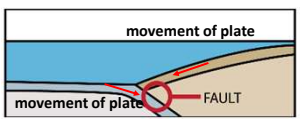
Demonstrating How Underwater Earthquakes Generate Tsunamis

Tsunami

How Tsunamis are Generated?

When plates slip past one another, it creates friction which causes earthquake on the sea floor.



When plates slip past one another, it creates friction which cauese earthquake on the sea floor.

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Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Tsunami

How Tsunamis are Generated?

Earthquakes are created in **subduction zones**.

NOTE **Subduction zones are converging plate boundaries where one is on top of the other**

Earthquakes are created in subduction zones. Subduction zones are converging plate boundaries where one is on top of the other.

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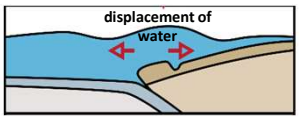
Demonstrating How Underwater Earthquakes Generate Tsunamis

Tsunami

How Tsunamis are Generated?

Water in the ocean is displaced away from the focus due to the earthquake.



When earthquake occurs, water in the ocean is displaced away from the focus of the earthquake.

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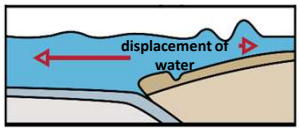
Demonstrating How Underwater Earthquakes Generate Tsunamis

Tsunami

How Tsunamis are Generated?

Some water travels across the **ocean basin**. Some water rushes landward that create flood.



The displacement of water in the ocean also disturbs the water on the surface. Some water travels across the ocean basin. Some water rushes landward which creates flood.

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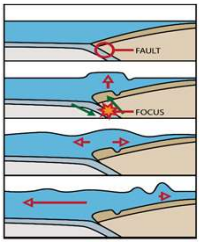
Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

SUMMARY

- Plates slip past one another
- Earthquakes are created in subduction zones
- Water in the ocean is displaced moving away from the focus
- Some water travels across the ocean basin. Some water rushes landward, creating flood.



Tsunamis occur when plates slip past one another; thus, creating a friction. Earthquakes are created in subduction zones. Water then, is displaced, moving away from the focus of the earthquake. Some water travels across the ocean basin. Some water also rushes toward the land, creating a flood.

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Demonstrating How Underwater Earthquakes Generate Tsunamis

EXERCISES

Demonstrating How Underwater Earthquakes Generate Tsunamis

Now, let's answer some exercises. Are you ready?

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Demonstrating How Underwater Earthquakes Generate Tsunamis

Multiple Choice

Select the correct answer.

What do you call the large ocean waves caused by the shaking of the ocean floor?

A. tsunami	C. hurricane
B. storm surge	D. ocean quake

What do you call the large ocean waves caused by the shaking of the ocean floor?

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Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Multiple Choice

Select the correct answer.

What do you call the large ocean waves caused by the shaking of the ocean floor?

A. tsunami	C. hurricane
B. storm surge	D. ocean quake

The correct answer is "A. tsunami".

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Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Multiple Choice

Select the correct answer.

A tsunami is usually caused by what natural disaster?

A. typhoon	C. hailstorm
B. earthquake	D. tornado

A tsunami is usually caused by what natural disaster?

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Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Multiple Choice

Select the correct answer.

A tsunami is usually caused by what natural disaster?

A. typhoon	C. hailstorm
B. earthquake	D. tornado

The correct answer is "B. earthquake".

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Demonstrating How Underwater Earthquakes Generate Tsunamis

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Conduction zones are converging plate boundaries where one is on top of the other.

A. True	C. Convection
B. Induction	D. Subduction

Conduction zones are converging plate boundaries where one is on top of the other.

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Demonstrating How Underwater Earthquakes Generate Tsunamis

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Conduction zones are converging plate boundaries where one is on top of the other.

A. True	C. Convection
B. Induction	D. Subduction

The correct answer is "D. Subduction".

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Demonstrating How Underwater Earthquakes Generate Tsunamis

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Water is displaced away the fault of the earthquake.

A. True	C. focus
B. subduction zone	D. epicenter

Water is displaced away the fault of the earthquake.

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Demonstrating How Underwater Earthquakes Generate Tsunamis

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Water is displaced away the fault of the earthquake.

A. True	C. focus
B. subduction zone	D. epicenter

The correct answer is "C. focus".

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Demonstrating How Underwater Earthquakes Generate Tsunamis

Multiple Choice

Select the correct answer.

Arrange the following as to how tsunami is created:

I. Earthquakes are created in the subduction zones
II. Water in the ocean is displaced moving away from the focus
III. Some water travels across the ocean basin. Some water rushes landward, creating great flood.
IV. Plates slip past one another

A. I, II, III, IV

B. II, III, I, IV

C. IV, I, II, III

D. IV, II, I, III

Arrange the following as to how tsunami is created:

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Science 8 | S8ES-IIb-16

Demonstrating How Underwater Earthquakes Generate Tsunamis

Multiple Choice

Select the correct answer.

Arrange the following as to how tsunami is created:

I. Earthquakes are created in the subduction zones
II. Water in the ocean is displaced moving away from the focus
III. Some water travels across the ocean basin. Some water rushes landward, creating great flood.
IV. Plates slip past one another

A. I, II, III, IV

B. II, III, I, IV

C. IV, I, II, III

D. IV, II, I, III

The correct answer is "C. IV, I, II, III".

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Demonstrating How Underwater Earthquakes Generate Tsunamis

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Science 8 | S8ES-IIc-17

Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Hi! Our topic is about explaining how earthquake waves provide information about the interior of the Earth. Let's begin.

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Science 8 | S8ES-IIc-17

Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Earthquake waves

Earthquake waves are **energy waves** travelling around the Earth which causes earthquakes.

Earthquake waves are also called **seismic waves**

There are two types of waves: **surface waves** and **body waves**.

Earthquake waves are energy waves travelling around the Earth which causes earthquakes. Earthquake waves are also called seismic waves. There are two types of waves. These are surface waves and body waves.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Earthquake waves

Surface waves are waves that travel in the surface of the Earth.

Body waves are waves that travel in the interior of the Earth.

Classifications of Body Waves

- **p-waves** – waves that travel through solid and liquid surfaces
- **s-waves**- waves that travel only though solid surfaces

Surface waves are waves that travel in the surface of the Earth. Body waves are waves that travel in the interior of the Earth. Body waves are further classified into two: p-waves and s-waves. We will only discuss body waves since they are the waves travelling in the interior of the Earth.

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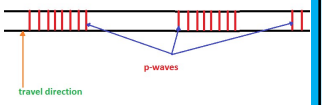
Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Body Waves

Characteristics of P-waves

P-waves traverse through solids and liquids along its direction of travel.

P-waves are faster than s-waves.



P-waves traverse through solids and liquids along its direction of travel. P-waves are faster than s-waves.

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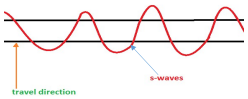
Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Body Waves

Characteristics of S-waves

S-waves traverse along the right angle direction of its travel.

P-waves travel through solids only.



S-waves traverse along the right angle direction of its travel. They travel through solids only.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Earthquake Waves

Seismic Waves

NOTE

Most of the information gathered about the interior of the earth was collected from studying seismic waves.

The travel time of the waves was used to locate **changes in the interior of the Earth** as an increase of velocity or density of a wave increases with depth because of **pressure and temperature.**

Most of the information gathered about the interior of the earth was collected from studying seismic waves. The travel time of the waves was used to locate changes in the interior of the Earth as an increase of velocity or density of a wave increases with depth because of pressure and temperature.

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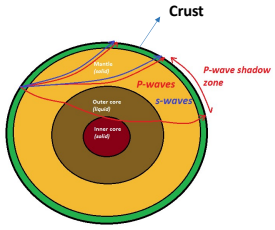
Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Interior of the Earth

Crust

The **outermost layer** of the Earth.

Both p-waves and s-waves pass through this layer.



The interior of the Earth is composed of three layers. Crust is the outermost layer of the Earth. Both p-waves and s-waves pass through this layer.

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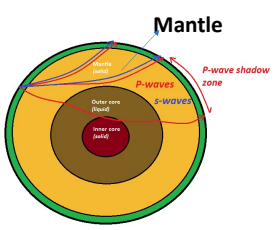
Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Interior of the Earth

Mantle

It consists of dense **silicate materials**.

Both p-waves and s-waves travel through it, showing that it is **solid**.



Mantle consists of dense silicate materials. Both p-waves and s-waves travel through it, showing that it is solid.

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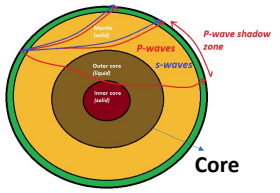
Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Interior of the Earth

Core

Outer core is liquid since **s-waves** do not traverse through it.

The core refracts **p-waves** creating a shadow zone*.



The core is divided into two: the inner core and outer core. Only p-waves can traverse the core since the outer core is liquid. Seismic activity cannot be detected after p-waves have passed through. The core refracts p-waves which then creates a shadow zone.

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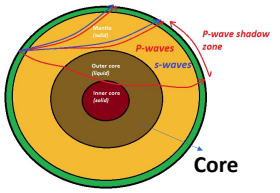
Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Interior of the Earth

Core

NOTE

***Shadow zone** - area in the Earth's surface where seismic activity cannot be detected after the p-waves have passed through. It is the evidence that the outer core is in liquid state.



Shadow zone is the area in the Earth's surface where seismic activity cannot be detected after the p-waves have passed through. It is the evidence that the outer core is in liquid state.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

SUMMARY

Seismic waves provide information about the **interior structure** of the Earth by means of their **travel time** while traversing in the interior structure of the Earth.

Velocity or density increases with depth since it is affected by temperature and pressure.

P-waves travel through the whole interior structure of the Earth; while **s-waves** travel only through the **crust and mantle**.

In summary, seismic waves provide information about the interior structure of the Earth by means of their travel time while traversing in the interior structure of the Earth. Velocity or density increases with depth since it is affected by temperature and pressure. Lastly, p-waves travel through the whole interior structure of the Earth while s-waves travel only through the crust and mantle.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

EXERCISES

Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Now, let's answer some exercises. Are you ready?

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Multiple Choice

Select the correct answer.

What kind of seismic waves pass through the outer core?

A. surface waves	C. s-waves
B. p-waves	D. body waves

What kind of seismic waves pass through the outer core?

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Multiple Choice

Select the correct answer.

What kind of seismic waves pass through the outer core?

A. surface waves	C. s-waves
B. p-waves	D. body waves

The correct answer is "B. p-waves".

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Multiple Choice

Select the correct answer.

What do you call the area in the Earth's surface where seismic activity cannot be detected after the p-waves have passed through?

A. shadow zone	C. dark zone
B. seismic zone	D. outer core zone

What do you call the area in the Earth's surface where seismic activity cannot be detected after the p-waves have passed through?

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Multiple Choice

Select the correct answer.

What do you call the area in the Earth's surface where seismic activity cannot be detected after the p-waves have passed through?

A. shadow zone	C. dark zone
B. seismic zone	D. outer core zone

The correct answer is "A. shadow zone"

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

S - waves pass through the <u>crust and inner core</u> only.

A. True	C. crust and outer core
B. crust and mantle	D. crust only

S - waves pass through the crust and inner core only.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

S - waves pass through the <u>crust and inner core</u> only.

A. True	C. crust and outer core
B. crust and mantle	D. crust only

The correct is "B. crust and mantle".

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

<u>Surface waves</u> travel only in the interior of the Earth.

A. True	C. Body waves
B. Seismic waves	D. Ocean waves

Surface waves travel only in the interior of the Earth.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

<u>Surface waves</u> travel only in the interior of the Earth.

A. True	C. Body waves
B. Seismic waves	D. Ocean waves

The correct answer is "C. Body waves".

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Modified True or False

Select "True" if the statement is true; otherwise, select the correct word that would make the statement true.

Seismic waves provide information about the interior of the Earth through the relation of their speed with the depth and composition of each of the Earth's layers.

A. True	C. composition
B. depth and velocity	D. depth

Seismic waves provide information about the interior of the Earth through the relation of their speed with the depth and composition of each of the Earth's layers.

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

Modified True or False

Select "True" if the statement is true, otherwise select the correct word that would make the statement true.

Seismic waves provide information about the interior of the Earth through the relation of their speed with the depth and composition of each of the Earth's layers.

A. True	C. composition
B. depth and velocity	D. depth

The correct answer is "A. True."

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Explaining How Earthquake Waves Provide Information about the Interior of the Earth

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Hi! Our topic is about describing the distribution of active volcanoes, earthquake epicenters, and major mountain belts.

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

FUN FACTS

- There are **29** mountain summits with prominence of 1,500 meters or greater, and **18** active volcanoes in the **Philippines**.
- There are **no** active volcanoes in **Australia.**
- **Indonesia** has the **most earthquakes** happening each year.

Have you ever wondered why there are many mountains and volcanoes in the Philippines? Or why there is no volcano in Australia? or why Indonesia has the most earthquakes?

Before we proceed to the discussion, here are some fun facts. Have you ever wondered why there are many mountains and volcanoes in the Philippines? Or why there is no volcano in Australia? or why Indonesia has the most earthquakes?

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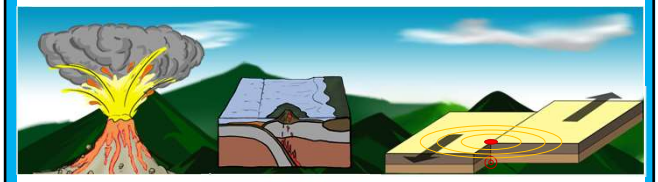
Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts



Distribution of **active volcanoes**, **earthquake epicenters**, and **major mountain belts** plays a vital **role in geological activity** of each country.

The distribution of active volcanoes, earthquake epicenters, and major mountain belts plays a vital role in geological activity of each country.

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Active Volcanoes

Let us discuss first the distribution of active volcanoes. Look at the map of global distribution of volcanoes. Volcanoes occur in long narrow bands.

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Active Volcanoes

As of today, there are more than 1500 active volcanoes on earth, 80 of them are under the oceans. They occur in belts in some areas and are absent from others.

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Active Volcanoes

Volcanoes can be found both on the land and in the sea. There is a line of volcanoes running down the middle of Atlantic Ocean.

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Active Volcanoes

As we can see, most of the volcanoes are located around the Pacific Ocean. This location is called Pacific Ring of Fire. The Philippines, Indonesia, the islands of Japan, the Alaskan and Cascade Range volcanoes are all part of the Pacific Ring of Fire.

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Science 10 | S10ES-Ia-j-36.1

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Active Volcanoes

There are also volcanoes in Southern Europe and down the east coast of Africa.

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Global Distribution of Volcanoes

Distribution of Active Volcanoes

There is also a chain of volcanoes in the islands of Hawaii which is located in the middle of Pacific Ocean.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Earthquake Epicenters

Now, let's proceed to the distribution of earthquake epicenters. Like the distribution of volcanoes, earthquake epicenters also occur in long narrow bands and linear clusters. Earthquakes occur on the land and in the sea.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Earthquake Epicenters

As we can observe on the map, heavy concentration of earthquakes runs around the edge of the Pacific Ocean, and Australia is unlikely to experience earthquake.

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Global Distribution of Volcanoes

Distribution of Earthquake Epicenters

There is also earthquake epicenters belt running down the center of the Atlantic Ocean.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Earthquake Epicenters

There is also a quite heavy distribution along the Caribbean archipelago, on the southern part of Europe, and on the eastern part of Africa.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Earthquake Epicenters

A lot of earthquake epicenters are found on the Philippine Island and Indonesian archipelagos.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes

Distribution of Major Mountain Belts

Now, here's the global distribution of major mountain belts. They also occur in narrow bands, and mostly are located near the area where volcanoes and earthquake epicenters are.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Volcanoes
Distribution of Major Mountain Belts

The location of the distribution of major mountain belts co-insides with the location of the distribution of active volcanoes and major earthquake epicenters. Why do you think this happens?

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

The distribution of active volcanoes, earthquake epicenters, and major mountain belts mark the boundaries of each lithospheric plate.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Global Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

These plates are slowly moving relative to each other which cause the geologic events to happen along their boundaries; hence, the explanation of the distribution.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

SUMMARY

Global Distribution

Active Volcanoes	Earthquake Epicenters	Major Mountain Belts
• occur in long, narrow bands • found both on the land and in the sea • most are located around the pacific ocean	• occur in long, narrow bands, and linear clusters • occur in land and sea • heavy concentration around the edge of pacific ocean	• occur in narrow bands • located near the area where volcanoes and epicenters are

Here's the summary of the global distribution of active volcanoes, earthquake epicenters, and major mountain belts.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

EXERCISES

Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Now, let's answer some exercises. Are you ready?

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Modified True or False

Identify which among the given statements are true and/or false.

1: There are lots of active volcanoes in Australia.
2: Indonesia has the most earthquakes happening each year.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Modified True or False

Identify which among the given statements are true and/or false.

1: There are lots of active volcanoes in Australia.
2: Indonesia has the most earthquakes happening each year.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The correct answer is B. Statement 1 is false; statement 2 is true.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Modified True or False

Identify which among the given statements are true and/or false.

1: Distribution of active volcanoes and earthquake epicenters occurs in long narrow bands.
2: Distribution of major mountain belts is far from the locations of active volcanoes and earthquake epicenters.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

Identify which among the given statements are true and/or false.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Modified True or False

Identify which among the given statements are true and/or false.

1: Distribution of active volcanoes and earthquake epicenters occurs in long narrow bands.
2: Distribution of major mountain belts is far from the locations of active volcanoes and earthquake epicenters.

A. Statement 1 is true; Statement 2 is false.

B. Statement 1 is false; Statement 2 is true.

C. Both Statements 1 and 2 are true.

D. Both Statements 1 and 2 are false.

The correct answer is A. Statement 1 is true; Statement 2 is false.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Multiple Choice

Select the correct answer.

What do you call the location around the Pacific Ocean where most of the volcanoes are located?

A. Islands of Volcanoes

C. Cascade Range Volcanoes

B. Pacific Ring of Fire

D. Volcanic Center of the Pacific

Select the correct answer.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Multiple Choice

Select the correct answer.

What do you call the location around the Pacific Ocean where most of the volcanoes are located?

A. Islands of Volcanoes

C. Cascade Range Volcanoes

B. Pacific Ring of Fire

D. Volcanic Center of the Pacific

The correct answer is B. Pacific Ring of Fire.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Multiple Choice

Select the correct answer.

Plates are _____ relative to each other which causes the geologic events to happen along their boundaries.

A. slowly moving

C. exploding

B. melting

D. not moving

Select the correct answer.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Multiple Choice

Select the correct answer.

Plates are _____ relative to each other which causes the geologic events to happen along their boundaries.

A. slowly moving	C. exploding
B. melting	D. not moving

The correct answer is A. slowly moving.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Modified True or False

Select "True" if the statement is true, otherwise select the correct word that would make the statement true.

The distribution of active volcanoes, earthquake epicenters, and major mountain belts mark the boundaries of each <u>atmospheric</u> plate.

A. True	C. lithospheric
B. strategic	D. pacific

Select "True" if the statement is true, otherwise select the correct word that would make the statement true.

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Describing the Distribution of Active Volcanoes, Earthquake Epicenters, and Major Mountain Belts

Modified True or False

Select "True" if the statement is true, otherwise select the correct word that would make the statement true.

The distribution of active volcanoes, earthquake epicenters, and major mountain belts mark the boundaries of each <u>atmospheric</u> plate.

A. True	C. lithospheric
B. strategic	D. pacific

The correct answer is C. lithospheric.

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Thank you!

This is the end of the presentation. Thank you.

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