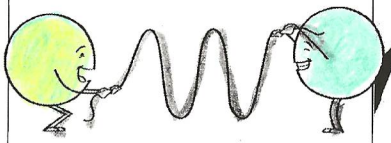
Name: Notes for Notebook Class: _____ Date: 3/12

Electromagnetic Waves

ESSENTIAL QUESTION: How do electromagnetic waves transfer energy through matter or space?

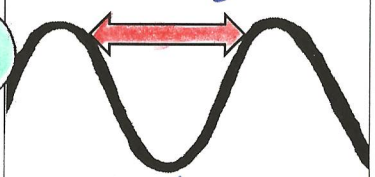
VOCAB

Wave



A disturbance that transmits energy through matter or empty space.

Wavelength



The distance from one crest of a wave to the next.

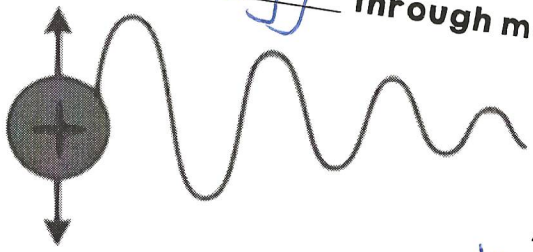
TOPIC QUESTIONS:

1

What is an electromagnetic wave?

ELECTROMAGNETIC WAVES

transmit energy through matter and/or empty space.



An electromagnetic wave begins when a charged particle vibrates, causing the electric field around it to vibrate as well.

The vibrating electric field creates a vibrating magnetic field.

ELECTRIC FIELD

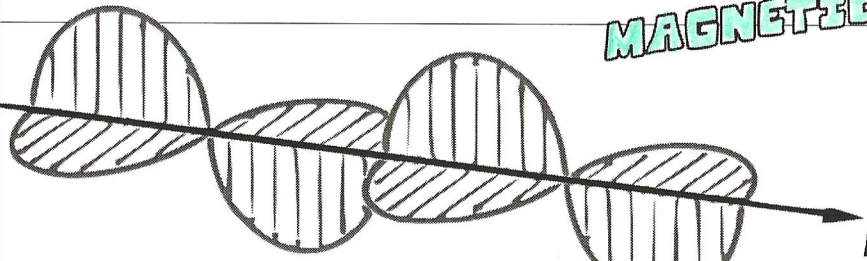
The two types of vibrating fields combine to create an electromagnetic wave.

MAGNETIC FIELD

WAVE DIRECTION

2

How does an electromagnetic wave travel?



An electromagnetic wave is a transverse wave because the electric and magnetic fields that make up the wave are perpendicular to each other.

All types of electromagnetic radiation travel at the same speed through space.

THE SPEED OF Light

8.3 min.

The Earth

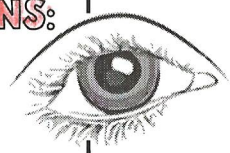
The Sun

The transfer of energy by electromagnetic waves is called electromagnetic radiation.

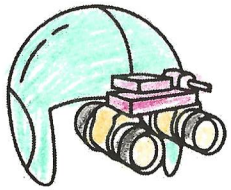
TOPIC QUESTIONS:

3

What are the types of electromagnetic radiation?



The light that our eyes can see is just a sliver of the total amount of light that surrounds us.



Night vision goggles help us to see wavelengths of light that are not normally accessible to our eyes.

THE ELECTROMAGNETIC SPECTRUM

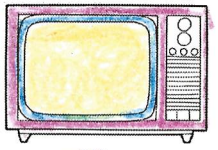
describes the _____ range of light that _____.

Low Frequency - Long Wavelengths

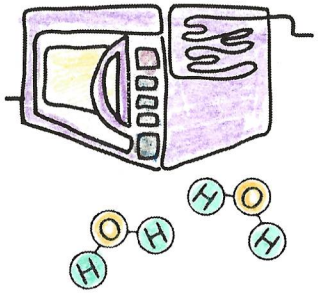
High Frequency - Shortest Wavelength

① Radio waves

Emitted at radio and TV stations. Radios and TVs convert these waves into sound and picture.

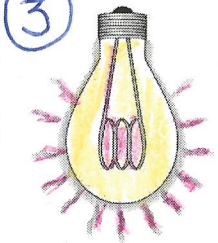


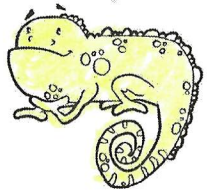
② Microwave



Emitted by power source in a microwave oven. Water molecules absorb microwaves and increase temperature of food.

③ Infrared radiation



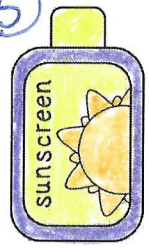


We sense this radiation as heat because it causes molecules to vibrate. Used in heat lamp for reptiles.

④ Visible light

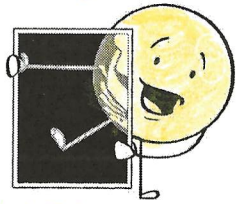
The only light that our eyes can see. Our eyes detect this light as colors. In a rainbow, the shortest wavelength of color (violet) is closest to Earth and the longest wavelength color (red) is at the top of the arc.

⑤ Ultraviolet radiation



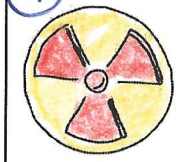
We need to wear sunscreen to protect our skin from this type of radiation from the sun. Bees can see UV light so many flowers have UV patterns on their petals to attract bees.

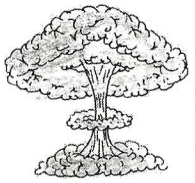
⑥ X-ray



Bone and teeth block X-rays, making it possible to take 'picture' of them.

⑦ Gamma rays



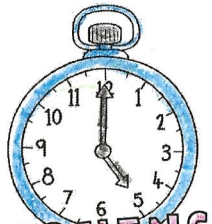


Extremely high frequency waves that are emitted during a nuclear explosion and by radioaction materials.

TOPIC QUESTIONS:

4

How do frequency and wavelength differ between the different types of electromagnetic radiation?

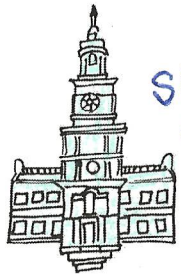


FREQUENCY?

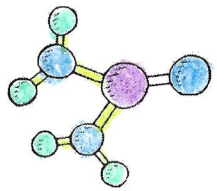
Study the diagram and imagine the wave's motion. What is meant by a wave's frequency?

Since we can't see almost all of the types of electromagnetic radiation, we can use examples to help us visualize the size of each wavelength as in the diagram below.

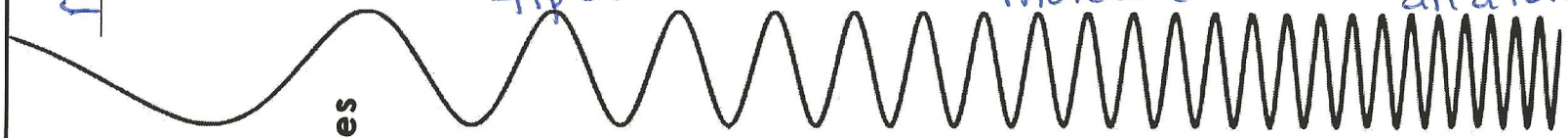
Longest **WAVELENGTH** ⟷ Shortest **WAVELENGTH**

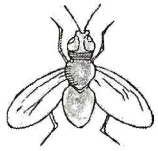
radio waves —  Size of a building

infrared —  Size of the tip of a needle

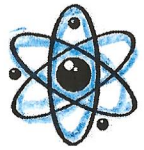
ultraviolet —  Size of a molecule

Gamma rays —  Size of a nucleus of an atom



microwaves —  Size of a fly

Visible light —  Size of a micro organism

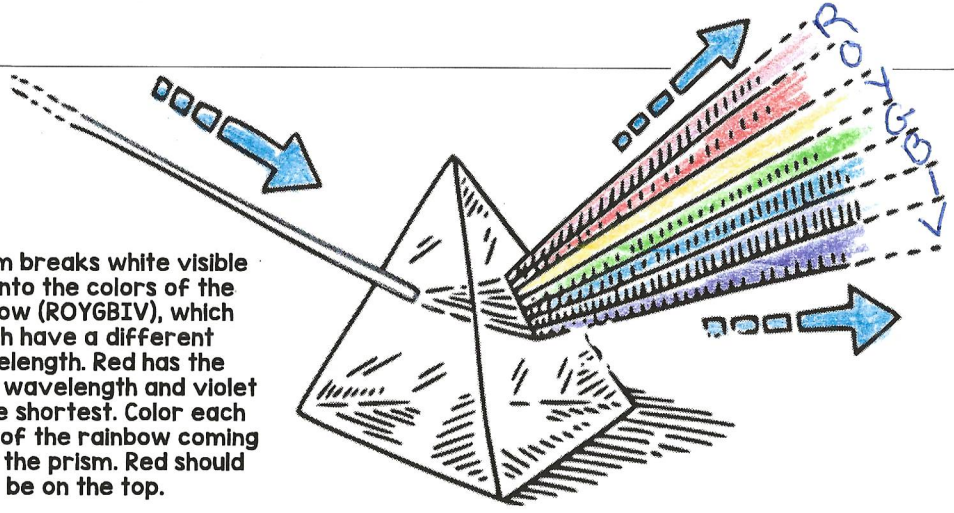
X-rays —  Size of an atom

Lowest **FREQUENCY** ⟷ Highest **FREQUENCY**

5

Do

How does white light break into the visible light spectrum?



A prism breaks white visible light into the colors of the rainbow (ROYGBIV), which each have a different wavelength. Red has the longest wavelength and violet has the shortest. Color each section of the rainbow coming out of the prism. Red should be on the top.

QUICK WATCH:

TEDed: Light Waves
https://tinyurl.com/y9a95k4a

Write a $2 summary of the video. Each word costs 10 cents.

THE ELECTROMAGNETIC SPECTRUM

Electromagnetic waves transfer ENERGY from one place to another.

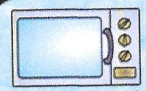
All EM waves, regardless of type, travel through space (or a vacuum) at the speed of light.

X-rays are used to make images of the body. X-rays pass easily through soft tissue, but not as easily through bone.

X-RAYS

Visible light is the wavelength that our eyes can see. red is the longest, violet is shortest.

VISIBLE LIGHT

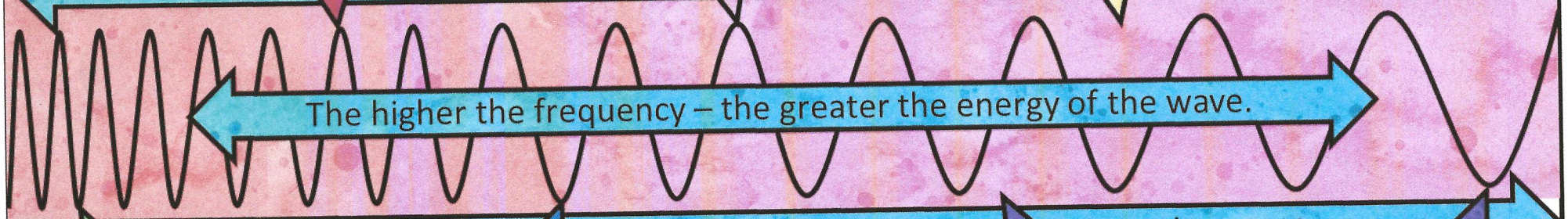


Used in many types of communication signals such as cell phones, wi-fi, and bluetooth and in microwave ovens.

MICROWAVES

EM waves are transverse. The vibrations are at right angles to the direction of travel.

FREQUENCY increases ← WAVELENGTH decreases →



The higher the frequency – the greater the energy of the wave.

FREQUENCY DECREASES ← WAVELENGTH increases →

GAMMA RAYS

Produced by radioactive elements. Cannot be seen or felt but can cause cancer. Also used to treat cancer.

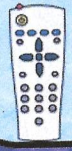
ULTRAVIOLET

Found naturally in sunlight. Causes sunburn and cancer.

Sunblock products protect against UV rays.

INFRARED

Infrared means "below red." As heat it is used in toasters and grills.



Used in electronics such as remote controls.

RADIO WAVES

The longest wavelength in the spectrum. Used to transmit radio and TV signals around the Earth.