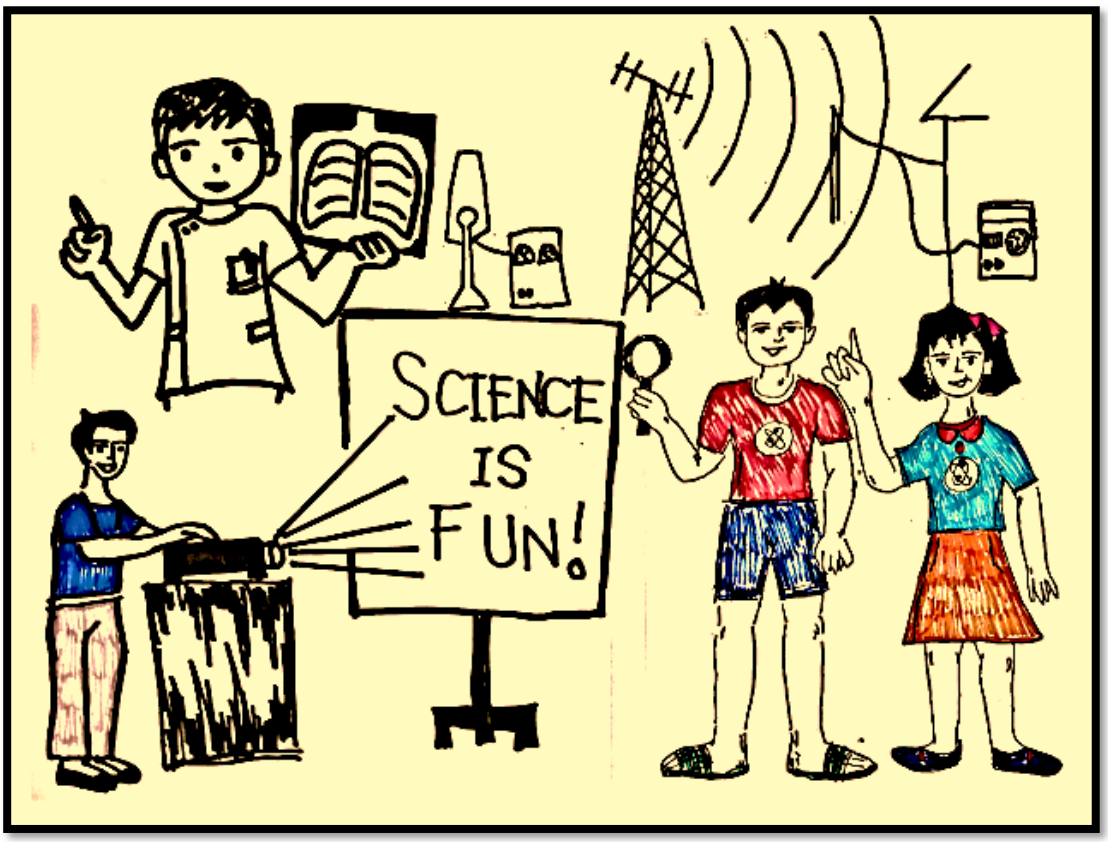
SELF- LEARNING KIT IN SCIENCE 10

REGIONS OF ELECTROMAGNETIC SPECTRUM AND APPLICATIONS



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SCIENCE 10
Self- Learning Kit
Quarter 2 Module 4: REGIONS OF ELECTROMAGNETIC SPECTRUM AND APPLICATIONS
First Edition, 2024

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FOREWORD

This Self-Learning Kit aims to guide Grade 10 students on citing diverse effects and uses of the different regions in the EM spectrum and explaining their important applications.

The electromagnetic spectrum is broadly classified into different named categories based on the wavelength and characteristics of the energy. The names like "microwave" or "infrared" were developed for convenience to describe electromagnetic radiation with similar characteristics, but there are no definitive dividing lines between one spectral region or the next. The only region in the electromagnetic spectrum that is relatively consistent in the wavelength definition is the visible spectrum, as it corresponds directly with to wavelengths that human eyes are sensitive to. The visible spectrum is a small window of the entire electromagnetic spectrum. Though the sciences generally classify EM waves into seven basic types, all are manifestations of the same phenomenon.

The different activities in this kit will enable students to explore the different applications of the regions of the electromagnetic spectrum. The activities provide students analytical thinking while doing their given tasks.

SCIENCE 10
PIONEERS OF ELECTROMAGNETIC THEORY

CONTENT STANDARD

The learners demonstrate an understanding of the different regions of the electromagnetic spectrum.

PERFORMANCE STANDARD

The learners should be able to perform differentiated activities on electromagnetic waves.

MOST ESSENTIAL LEARNING COMPETENCY

a. Cite examples of practical applications of the different regions of EM waves, such as the use of radio waves in telecommunications
Code: (S10FE-IIa-b-48)

b. Explain the effects of EM radiation on living things and the environment
Code: (S10FE-IIe-f-49)

SPECIFIC OBJECTIVES

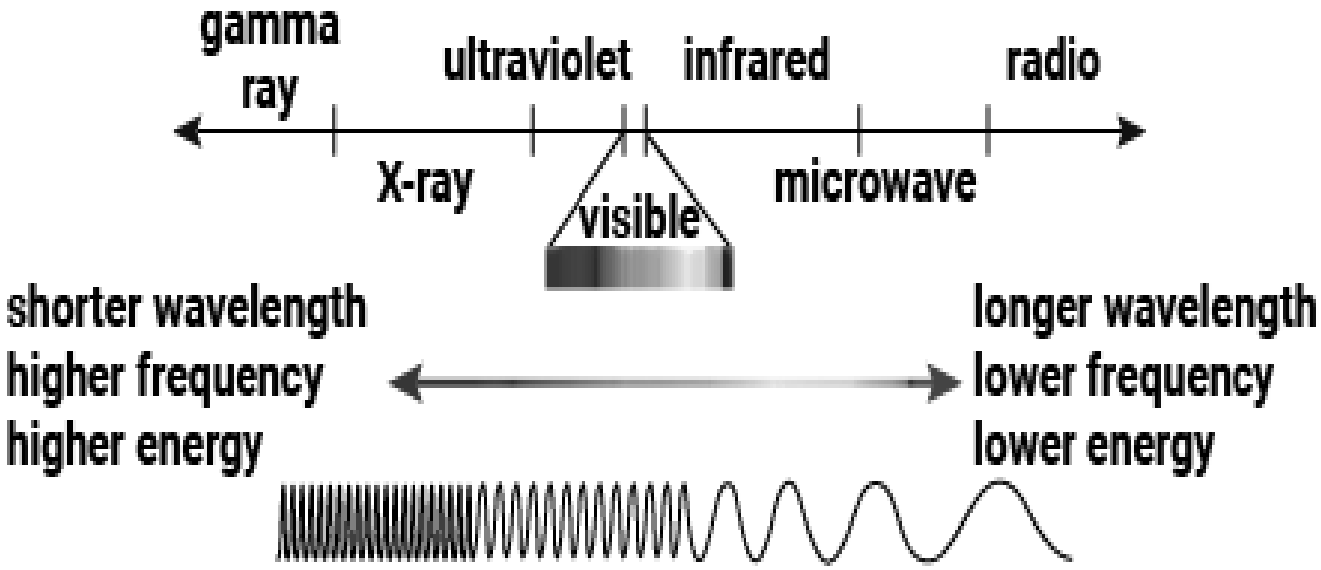
1. Cite diverse effects and uses of the different regions in the EM spectrum; and

2. Explain the important applications of the different regions of EM spectrum.

WHAT HAPPENED?

REVIEWING MY EM SPECTRUM CHARACTERISITICS

DIRECTIONS: Refer to the Electromagnetic Spectrum Chart below. Analyze the characteristics of each region. Write the letter of your choice on the space provided before the number.



Source: https://www.toppr.com/ask/question/the-diagram-shows-the-principal-regions-of-the-electromagnetic-spectrum/

____1. Which EM ray has the longest wavelength?
a. X-ray b. Radio wave c. Microwave d. Infrared

____2. Which EM ray has the shortest wavelength?
a. Gamma ray b. Visible light c. UV ray d. Radio wave

____3. Which EM ray has the strongest energy?
a. Gamma ray b. Visible light c. UV ray d. Radio wave

____4. Which EM ray is least energetic?
a. Radio wave b. Infrared c. X-ray d. Gamma ray

____5. Which EM ray has the largest size in terms of amplitude?
a. X-ray b. Radio wave c. Microwave d. Infrared

____6. Which EM ray has the smallest size in terms of frequency?
a. Gamma ray b. Visible light c. UV ray d. Radio wave

PRE- TEST

DIRECTIONS: Write the letter of your answer on the space provided before the number.

____1. All of the following are uses of visible light. Which one is NOT?
A. it enables us to see things
B. for thermal imaging
C. gives light to the screen of our devices
D. used in optical fibers

____2. Which of the following is a use of ultraviolet radiation?
A. diagnosing bone fracture
B. night vision goggle
C. identifying original from fake banknotes

D. optical fiber

____3. What imaging technique uses powerful magnets, computer and radio waves to make detailed pictures inside your body?
A. thermal imaging
B. infrared imaging
C. Magnetic Resonance Imaging (MRI)
D. X-ray image

____4. Which of the EM waves below are emitted by stars and some radioactive substances?
A. gamma rays B. radio waves C. microwave D. X-ray

____5. Among the following forms of the EM spectrum, which waves do NOT have enough energies to damage the body cells?
A. gamma ray and infrared
B. gamma ray and ultraviolet
C. radio wave and visible light
D. X-ray and ultraviolet

____6. Radio wave is useful in which of the following applications?
A. watching television C. sterilizing medical equipment
B. treating cancers D. sunbathing

____7. What form of wave makes your skin tan when exposed for a long period of time?
A. infrared rays B. microwaves
C. radio waves D. ultraviolet ray

____8. Which of the devices below can be used to detect aircrafts and ships?
A. RADAR B. MRI C. GPS D. Cell Site

____9. How many of the EM waves are visible?
A. none out of seven EM waves
B. all of the EM waves
C. most of it
D. only one out of seven EM waves

____10. Which pair of EM waves is commonly used for communication?
A. X-rays and infrared
B. radio waves and gamma rays
C. radio waves and microwaves
D. infrared and microwaves

WHAT TO LEARN?

REGIONS OF ELECTROMAGNETIC SPECTRUM

1. RADIO WAVE

Radio waves have the **longest wavelengths** in the electromagnetic spectrum with wavelengths ranging from approximately 1 mm to several hundred meters. It is being bounced of the ionosphere. Radio waves are used to transmit a variety of data. **Wireless networking, television and amateur radio** all use radio waves. The use of radio frequencies is usually regulated by governments. Your radio captures radio waves emitted by radio stations, bringing your favorite tunes. You can tune a radio to a specific wavelength—or frequency—and listen to your favorite music.

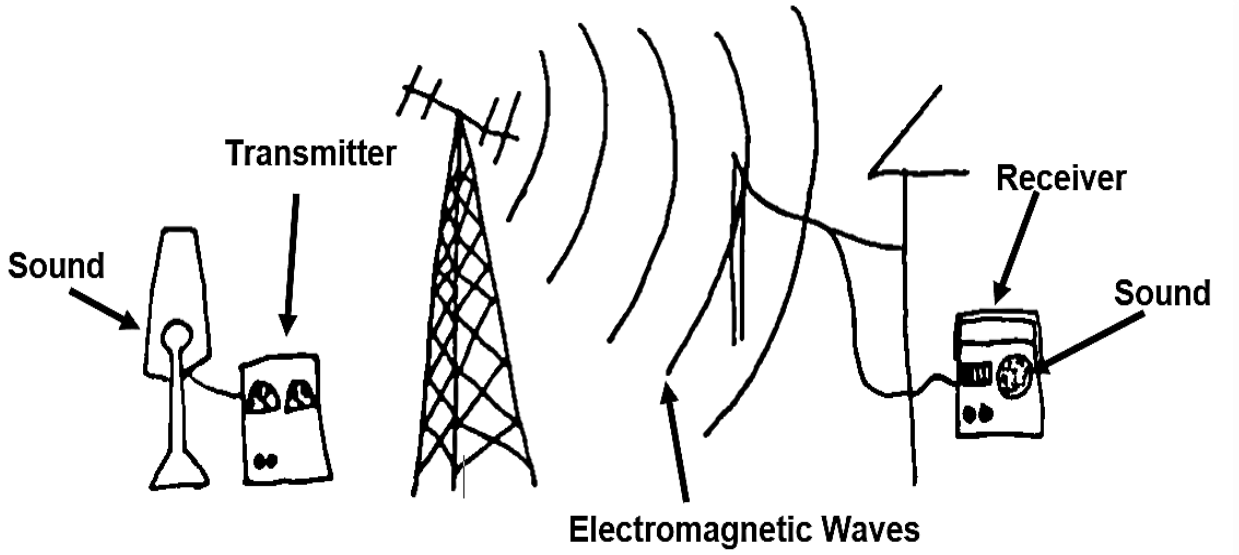


Figure 1: Radio Transmitter and Receiver

The radio "receives" these electromagnetic radio waves and converts them to mechanical vibrations in the speaker to create the sound waves you can hear. Radio waves are used for **communications** - that's why the thing in your car is called a radio. But they're not just for FM (uses short wavelength of radio waves) and AM (uses longer wavelength) radio. **They're also used to broadcast television signals, and they're how mobile phones work - your voice is sent through radio signals.** Radio is used primarily for communications including voice, data and entertainment media.

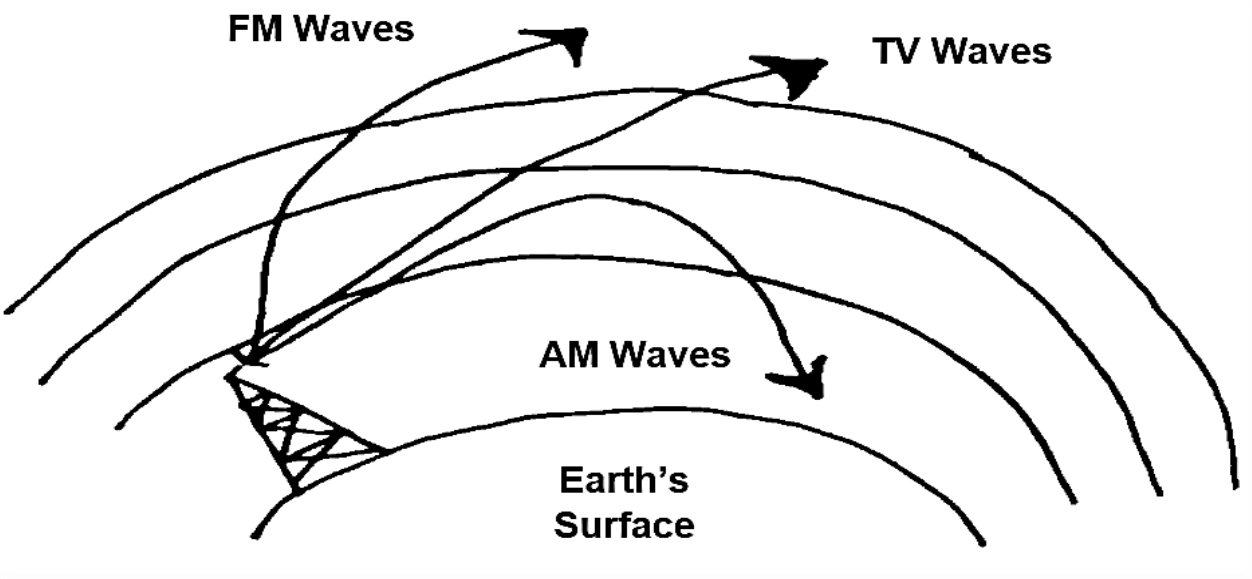


Figure 2: AM and FM Radio Waves in the Atmosphere

2. MICROWAVE

Microwaves fall in the range of the EM spectrum **between radio and infrared**. They have frequencies from about 3 GHz up to about 30 trillion hertz, or 30 terahertz (THz), and wavelengths of about 10 mm (0.4 inches) to 100 micrometers (μm), or 0.004 inches. Different wavelengths or bands of microwaves are used for different applications. Mid-wavelength microwaves can penetrate haze, light rain and snow, clouds, and smoke are beneficial for **satellite communication and studying the Earth from space**. It is also used by astronomers to **learn about the structure of nearby galaxies**. This wave can penetrate the ionosphere.

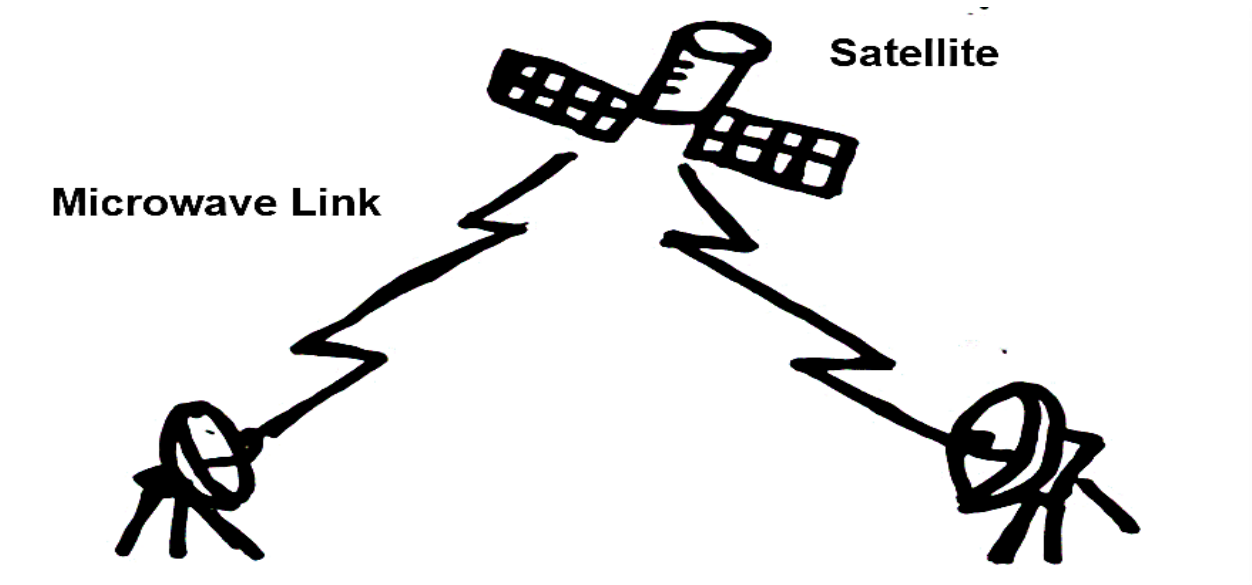


Figure 3: Satellite Communication Uses Microwave

Microwaves can be used to heat and cook your food, like the **microwave oven**. Microwaves cause water and fat molecules to vibrate, which makes the substances hot. So, we can use microwaves to cook many types of food.

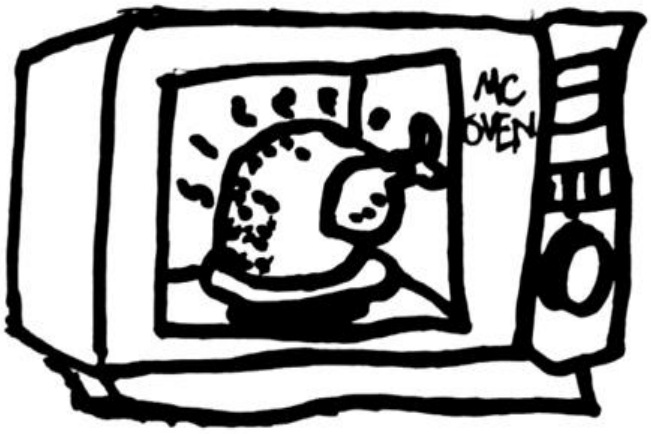


Figure 4: A Microwave Oven

Figure 5: A Mobile Phone

Microwaves are basically extremely high frequency radio waves and are made by various types of transmitter. In a **mobile phone**, they're made by a transmitter chip and an antenna. Mobile phones use microwaves, as they can be generated by a small antenna, which means that the phone doesn't need to be very big. **Wifi** also uses microwaves. Microwaves are also used by fixed **traffic speed cameras, and for radar, which is used by aircraft, ships and weather forecasters**.

The most common type of radar (short for **Radio Detecting and Ranging**) works by sending out bursts of microwaves, detecting the "echoes" coming back from the objects they hit, and using the time it takes for the echoes to come back to work out how far away the object is. **Radar technology** sends pulses of microwave energy and senses the energy reflected back.

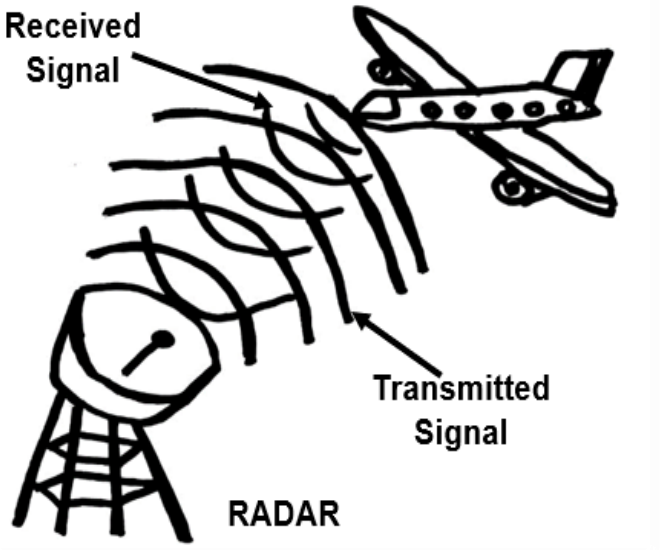


Figure 6: A RADAR Technology

3. INFRARED

Infrared is in the range of the EM spectrum between **microwaves and visible light**. Infrared has frequencies from about 30 THz up to about 400 THz and wavelengths of about 0.004 inches to 740 nanometers (nm), or 0.00003 inches. Infrared light is **invisible to human eyes**, but we can feel it as heat if the intensity is sufficient. Infrared radiation **lies beyond the red end of the visible light**. It is emitted by all objects. The amount and wavelength of radiation depend on temperature. Below 500^{o}C, an object emits only infrared radiation. Above 500^{o}C, an object glows and emits both infrared and some visible light.

Our bodies radiate infrared and under **infrared camera or a night vision goggle**, our images appear in variety of colors. The differences in color determine the differences in temperature. For example, shades of blue and green indicate regions of colder temperature; and red and yellow indicate warmer temperature. The following are some useful applications of infrared radiation:

1. **Infrared photographs** taken from a satellite with special films provide useful details of the vegetation on the Earth's surface (as shown on the photograph on the right). Objects reflect, transmit, and absorb the Sun's near-infrared and shortwave radiation in unique ways, and this can used to observe the health of vegetation, soil composition and moisture content. In space, infrared light helps us map the dust between stars.

https://files.nc.gov/ncdit/documents/files/Using-Color-Infrared-Imagery-20110810.pdf

Infrared Scanner
https://iopscience.iop.org/article/10.1088/1742-6596/655/1/012062/pdf

2. **Infrared scanners** are used to show the temperature variation of the body. This can be used for medical diagnosis.

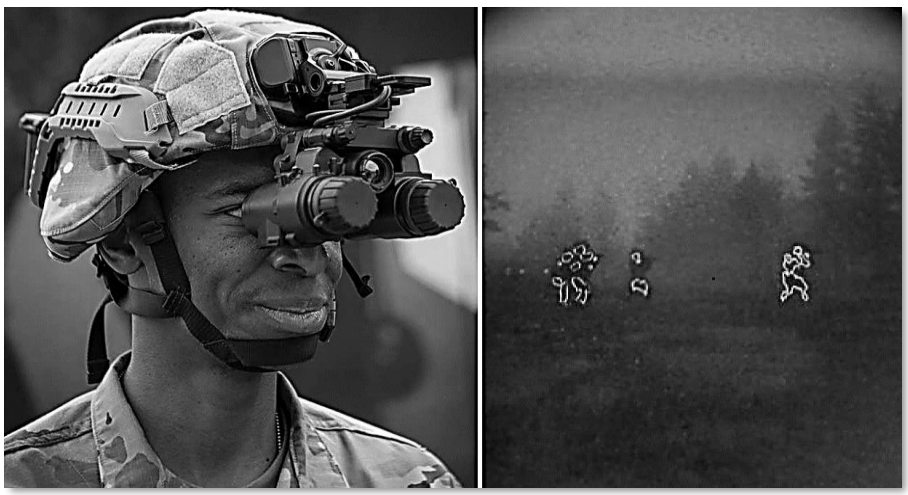
3. **Infrared radiation** is used extensively in remote sensing. Infrared remote controls are used in TVs, video, cassette recorders and other electronic appliances.

Remote Control
https://www.vectorstock.com/royalty-free-vector/hand-holding-tv-remote-control-vector-20998749

Autofocus Camera
https://ulirvision.en.made-in-china.com/product/CZDTvVaHrwWf/China-Autofocus-Function-Thermal-Imaging-Camera-Good-Infrared-Quality-Imager.html

4. Some **night-vision goggles** use infrared.

5. Some **autofocus cameras** have transmitter that sends out infrared pulses. The pulses are reflected by the object to be photographed back to the camera. The distance of the object is calculated by the time lag between the sending and receiving of pulses. The lens is then driven by a built-in motor to adjust to get the correct focus of the object.



Night Vision Google
https://www.armytimes.com/news/your-army/2019/04/26/newest-night-vision-goggle-is-finishes-testing-heres-when-army-units-will-get-it/

4. VISIBLE LIGHT

Visible light is found in the middle of the EM spectrum**, between infrared and ultraviolet**. It has frequencies of about 400 THz to 800 THz and wavelengths of about 740 nm (0.00003 inches) to 380 nm (.000015 inches). More generally, visible light is defined as the wavelengths that are **visible to most human eyes**. This is the only region in spectrum that human eyes are sensitive to.

The Sun emits the most radiation in the visible portion of the spectrum. Each individual wavelength within the spectrum of visible light wavelengths is representative of a particular color. Light at the lower end of the visible spectrum, having a longer wavelength, about 750 nm, is seen as red; light in the middle of the spectrum is seen as green; and light at the upper end of the spectrum, with a wavelength of about 380 nm, is seen as violet.

When all the wavelengths of the visible light spectrum strike your eye at the same time, the color white is perceived. The visible portion of the spectrum is used extensively in **remote sensing** and is the energy that is recorded using **photography**. **Fireflies**, **light bulbs, and stars** all emit visible light**.**

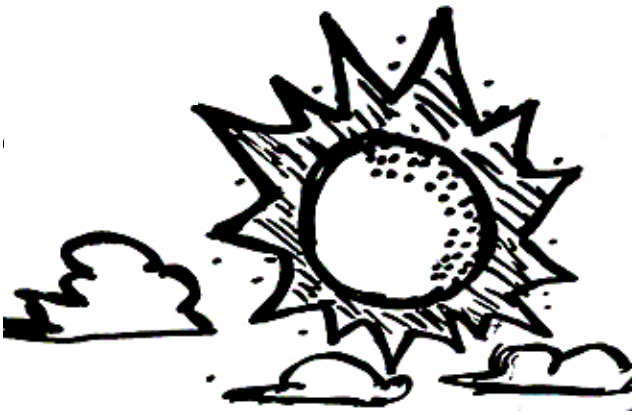


Figure 7. Sun

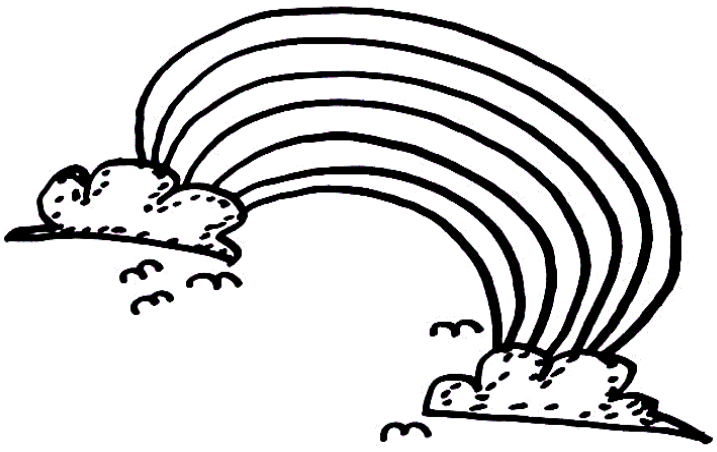


Figure 8. Rainbow

White light is actually made up of a whole range of colors, mixed together. We can see this if we pass white light through a **glass prism** - the violet light is bent ("refracted") more than the red, because it has a shorter wavelength and is slowed down more by the glass - and we see a **rainbow of colors** (ROYGBV). This is called **'dispersion'**, and allows us to work out what stars are made of by looking at the mixture of wavelengths in the light.

The vibrant colors of nature can never be observable without light. It is even the means by which earth receives the life-giving energy from the sun. The very basic process of food production by plants called **photosynthesis** (as shown in the right diagram) will not be possible if light cannot pass through earth's atmosphere. Thus, lie will not exist without the light from the sun.

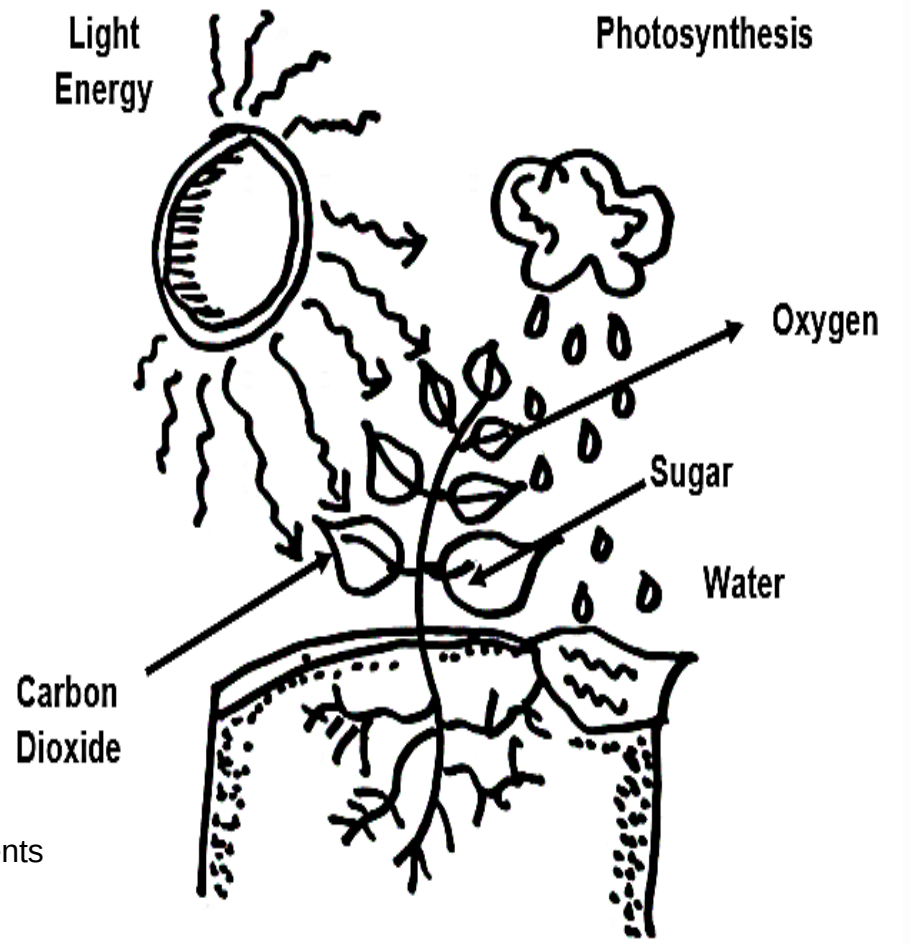


Figure 9. Major components of Photosynthesis

5. ULTRAVIOLET RAY

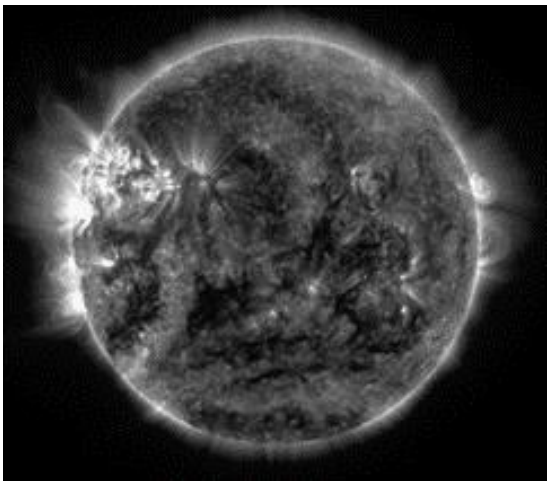


Image of the Sun
https://www.nasa.gov/image-feature/goddard/stereo/welcome-back-stereo-a

Ultraviolet light is in the range of the EM spectrum **between visible light and X-rays**. It has frequencies of about 8×10^{14} to 3×10^{16} Hz and wavelengths of about 380 nm (.000015 inches) to about 10 nm (0.0000004 inches). UV light is a component of sunlight; however, it is invisible to the human eye. It has numerous medical and industrial applications, but it can damage living tissue and can cause cancer in living organisms.

Uses for UV light include getting a **suntan and sunscreen lotions** serve as filters to protect the body from ultraviolet radiation, **detecting forged bank notes** in shops, and hardening some types of **dental filling**. Ultraviolet radiation in UV lamps are used by banks to check the signature on a passbook.

You also see UV lamps in clubs, where they make your **clothes glow**. This happens because substances in washing powder **"fluoresce"** when UV light strikes them - they absorb the UV and then re-radiate the energy at a longer wavelength.

UV Ray in Money Detector
https://www.lazada.com.ph/products/money-detector-ad-118ab-ultraviolet-detection-electronic-uv-light-money-detector-bill-currency-authenticity-electronic-uv-light-money-detector-checker-fake-money-detector-i378052029.html

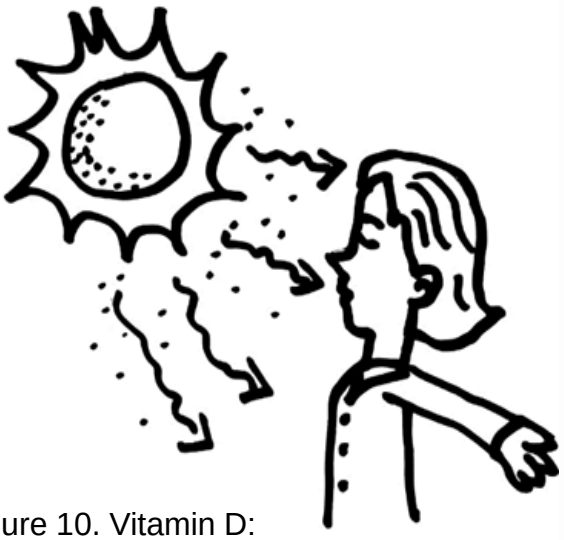
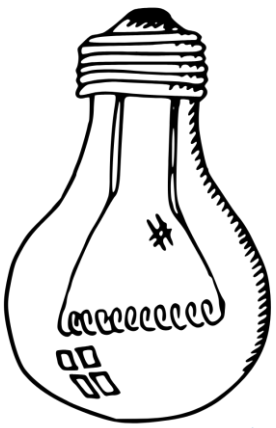


Figure 10. Vitamin D: "Sunshine Vitamin"



https://goodbtsk.live/product_details/26401380.html

Ultraviolet rays can be used to **kill microbes**. Hospitals use UV lamps to **sterilize surgical equipment** and the air in operating theatres. Food and drug companies also use UV lamps to sterilize their products. Ultraviolet radiation is also used in **sterilizing water from drinking fountains**.

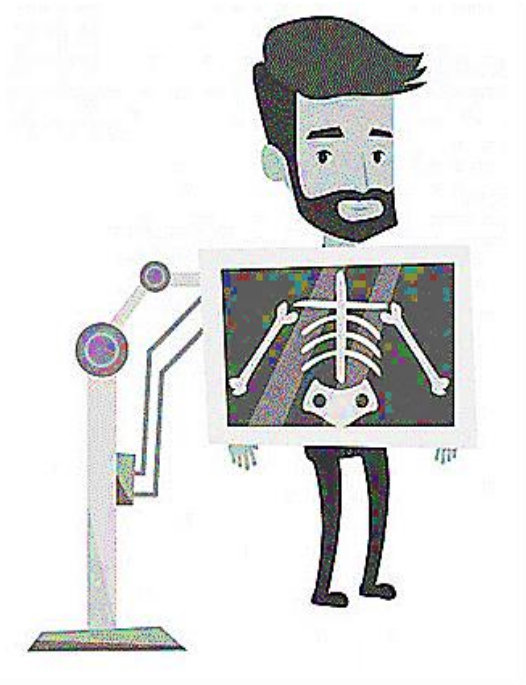
Suitable doses of Ultraviolet rays cause the body to produce **vitamin D**, and this is used by doctors to treat vitamin D deficiency and some skin disorders. A number of artificial sources have been devised for producing UV radiation. According to the Health Physics Society,

"Artificial sources include **tanning booths, black lights, curing lamps, germicidal lamps, mercury vapor lamps, halogen lights, high-intensity discharge lamps, fluorescent and incandescent sources, and some types of lasers**."

6. X- RAY

X-rays are roughly classified into two types: soft X-rays and hard X-rays. **Soft X-rays** comprise the range of the EM spectrum between UV and gamma rays. Soft X-rays have frequencies of about 3×10^{16} to about 10^{18} Hz and wavelengths of about 10 nm (4×10^{-7} inches) to about 100 picometers (pm), or 4×10^{-8} inches.

Hard X-rays occupy the same region of the EM spectrum as gamma rays. The only difference between them is their source: X-rays are produced by accelerating electrons, while gamma rays are produced by atomic nuclei. Natural sources of x-rays include enormously energetic cosmic phenomena such as pulsars, supernova and black holes.



Medical X-Ray
https://depositphotos.com/vector-images/x-ray-cartoon.html

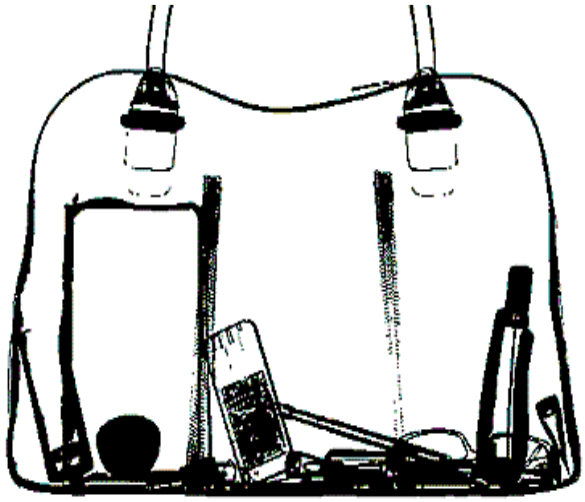
Beginning of X-Ray
https://www.dailymail.co.uk/news/article-6491287/Roentgens-human-X-ray-wifes-hand-1895.html

X-rays were first observed and documented in 1895 by **Wilhelm Conrad Roentgen**, a German scientist who found them quite by accident when experimenting with vacuum tubes. A week later, he took an X-ray photograph of his wife's hand which clearly revealed her **wedding ring and her bones**. Roentgen called it **"X"** to indicate it was an unknown type of radiation.

X-rays are commonly used in **imaging technology** to view bone structures within the body. The machines are managed by a trained x-ray technician. They pass easily through soft tissues, but not so easily through bones. Lower energy X-Rays don't pass through tissues as easily and can be used to scan soft areas such as the brain. **X-rays can cause cell damage and cancers**.

Long wavelength X-rays can penetrate the flesh but not the bones. They are used in **X-ray photography** to help doctors look inside the body. They are useful in **diagnosing bone fractures and tumors**.

Figure 11. X-Ray Photography



Airport Security Check
https://givt.com/en/blog/what-can-airport-baggage-scanners-see/

X-rays are also used in airport security checks, to see inside your luggage. They are also used by astronomers - many objects in the universe emit X-rays, which we can detect using suitable radio telescopes. Short wavelength X-rays can penetrate even through metals. They are used in industry to inspect welded joints for faults.

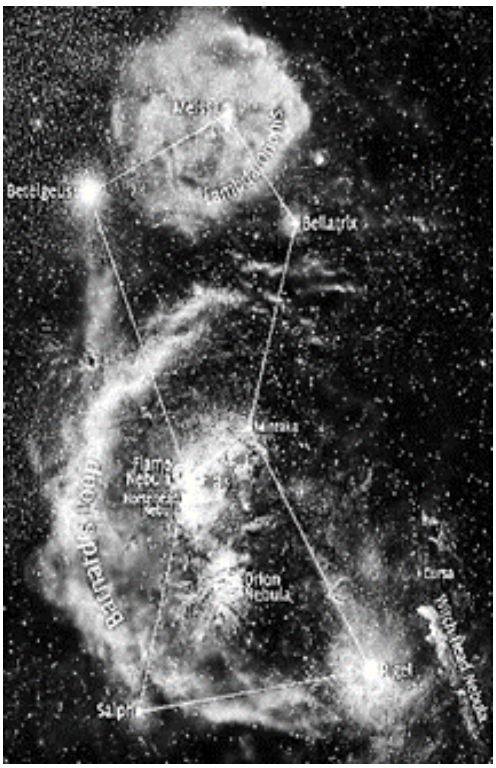
Full-body X-ray Scanner
https://www.kiwi.com/stories/new-zealand-airports-install-full-body-x-ray-scanners/

7. GAMMA RAY

Gamma-rays are in the range of the spectrum above soft X-rays. Gamma-rays have frequencies greater than about 10^{18} Hz and wavelengths of less than 100 pm (4×10^{-9} inches). Gamma radiation **causes damage to living tissue**, which makes it useful for **killing cancer cells** when applied in carefully measured doses to small regions. Uncontrolled exposure, though, is extremely dangerous to humans.

One disadvantage of gamma ray is an **atomic bomb explosion** or nuclear explosion as shown in the diagram at the right.

Figure 12. Mushroom Cloud Caused by Nuclear Explosion



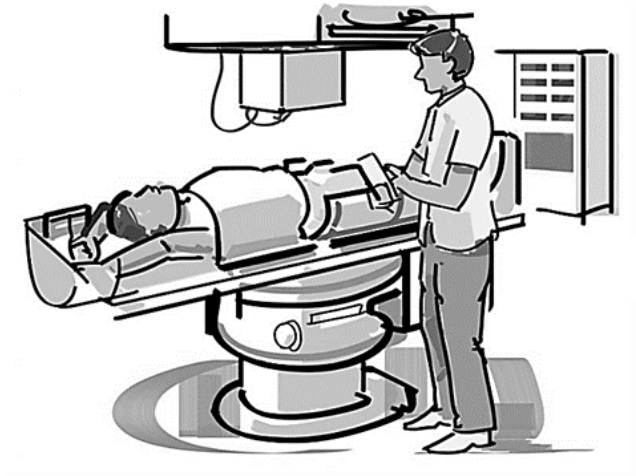
A Photo of Neutron Stars
https://www.pinterest.ph/pin/517773288408366677/

Gamma waves are the **highest-frequency EM waves** and are emitted by only the most energetic cosmic objects such **pulsars, neutron stars, supernova and black holes**. Terrestrial sources include lightning, nuclear explosions and radioactive decay. Gamma rays can destroy living cells; fortunately, the Earth's atmosphere absorbs any gamma rays that reach the planet.

Gamma rays are given off by stars, and by some radioactive substances. They are extremely high frequency waves and carry a large amount of energy. They pass through most materials and are quite difficult to stop - you need lead or concrete in order to block them out.

Because Gamma rays can kill living cells, they are used to kill cancer cells without having to resort to difficult surgery. This is called **"Radiotherapy".** There's also targeted radiotherapy, where a radioactive substance is used to kill cancer cells - but it's a substance that'll be taken up by a specific part of the body, so the rest of the body only gets a low dose.

An example would be using radioactive iodine to treat cancer in the thyroid gland. Doctors can put slightly radioactive substances into a patient's body, then scan the patient to detect the gamma rays and build up a picture of what's going on inside the patient. We call it as **medical tracers**.



Radiotherapy Machine
https://givt.com/en/blog/what-can-airport-baggage-scanners-see/https://medicalxpress.com/news/2017-05-cancer-radiotherapy-proton-therapy.html

Gamma rays are also used to **sterilize medical equipment**. In industry, radioactive "tracer" substances can be put into pipes and machinery, then we can detect where the substances go. This is basically the same use as in medicine. **Gamma rays kill microbes**, and are used to sterilize food so that it will keep fresh for longer. This is known as **"irradiated" food**.

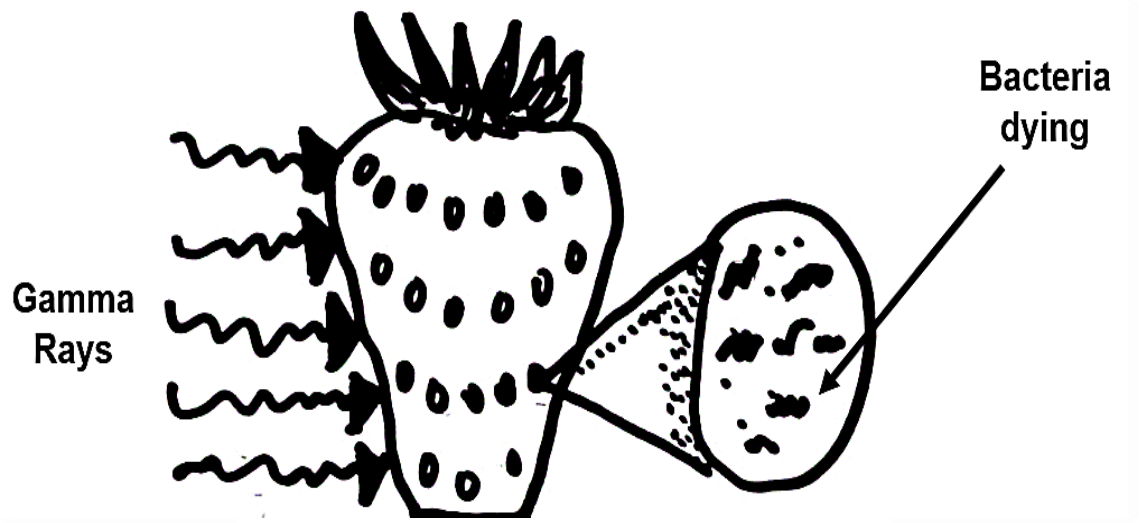


Figure 13. Irradiated Strawberry

WHAT HAVE YOU LEARNED?

ACTIVITY 1
MATCHING ELECTROMAGNETIC GAME

DIRECTIONS: Match the items on the right (COLUMN B) to the items on the left (COLUMN A) to assemble the waves in the correct order. Use an arrow for this task.

A	B
Used for mobile phones and radar	GAMMA RAY
The waves used for TV remote controls	INFRARED
These waves have the longest wavelength in the EM spectrum	X-RAY
You also see UV lamps in clubs, where they make your clothes glow	MICROWAVE
These waves are used to inspect luggage in airport security	VISIBLE LIGHT
Emitted by the laser in CD & DVD drives	RADIO WAVE
The highest frequency waves in the EM spectrum	ULTRA VIOLET

ACTIVITY 2
EM SPECTRUM HIDE AND SEEK

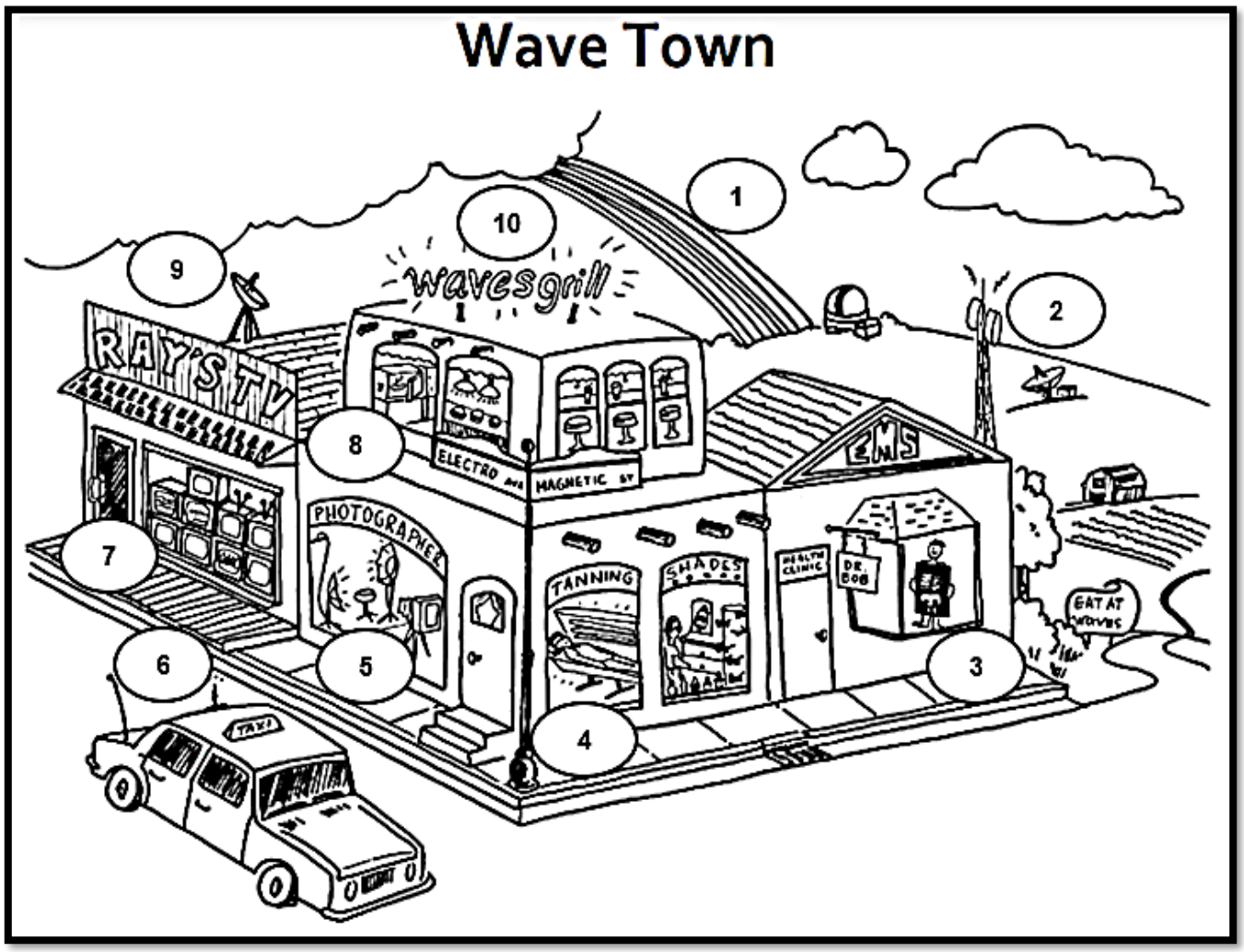
Directions: See if you can find the following mystery keywords in this word search about Electromagnetic Spectrum. Words are hidden 

I	O	N	O	S	P	H	E	R	E	A	B	B	S	T
R	I	A	B	C	D	E	F	G	I	J	K	A	L	E
A	M	R	O	P	Q	R	T	S	T	U	T	W	X	L
I	N	Y	R	Z	A	R	B	E	C	E	D	E	F	E
N	O	S	S	A	E	R	Q	P	L	O	N	M	N	V
B	P	T	U	N	D	V	M	L	U	O	B	L	E	I
O	Q	U	N	D	E	I	I	T	V	D	I	K	G	S
W	R	Y	T	C	F	T	A	T	W	X	C	V	T	I
V	C	A	A	B	E	L	N	T	A	Y	Z	J	N	O
S	S	R	N	A	G	K	O	S	E	M	A	I	E	N
W	T	X	Y	Z	I	J	P	Q	R	D	I	G	O	N
X	U	N	I	G	H	T	V	I	S	I	O	N	R	M
Y	R	A	D	I	O	T	H	E	R	A	P	Y	D	K
Z	S	I	S	E	H	T	N	Y	S	O	T	O	H	P
R	A	D	A	R	A	B	C	D	E	F	G	I	J	K

MY ANSWERS

ACTIVITY 3
WELCOME TO WAVE TOWN!

Directions: James invites you in his hometown named Wave Town. Since your topic in Science 10 is Applications of EM Waves, you are tasked to write the different EM Wave applications found in James' hometown on the given arrows below.



Adopted: https://slideplayer.com/slide/4894630/

MY ELECTROMAGNETIC SPECTRUM ANSWERS

1	6
2	7
3	8
4	9
5	10

ACTIVITY 4
SEMANTIC FEATURE ANALYSIS

Directions: Complete the table below about the information on different regions of Electromagnetic Spectrum. You can use other references such as books or online resources

Regions of EM Spectrum	FEATURES				
	Description	Frequency	Wave-length	Uses/ Application	Harmful Effects
1.					
2.					
3.					
4.					
5.					
6.					
7.					

POST- TEST

DIRECTIONS: Write the letter of your answer on the space provided before the number.

____1. All of the following are uses of visible light. Which one is NOT?
A. it enables us to see things
B. for thermal imaging
C. gives light to the screen of our devices
D. used in optical fibers

____2. Which of the following is a use of ultraviolet radiation?
A. diagnosing bone fracture
B. night vision goggle
C. identifying original from fake banknotes
D. optical fiber

____3. What imaging technique uses powerful magnets, computer and radio waves to make detailed pictures inside your body?
A. thermal imaging
B. infrared imaging
C. Magnetic Resonance Imaging (MRI)
D. X-ray image

____4. Which of the EM waves below are emitted by stars and some radioactive substances?
A. gamma rays B. radio waves C. microwave D. X-ray

____5. Among the following forms of the EM spectrum, which waves do NOT have enough energies to damage the body cells?
A. gamma ray and infrared
B. gamma ray and ultraviolet
C. radio wave and visible light
D. X-ray and ultraviolet

____6. Radio wave is useful in which of the following applications?
A. watching television C. sterilizing medical equipment
B. treating cancers D. sunbathing

____7. What form of wave makes your skin tan when exposed for a long period of time?
A. infrared rays B. microwaves
C. radio waves D. ultraviolet ray

____8. Which of the devices below can be used to detect aircrafts and ships?
A. RADAR B. MRI C. GPS D. Cell Site

____9. How many of the EM waves are visible?
A. none out of seven EM waves
B. all of the EM waves
C. most of it
D. only one out of seven EM waves

____10. Which pair of EM waves is commonly used for communication?
A. X-rays and infrared
B. radio waves and gamma rays
C. radio waves and microwaves
D. infrared and microwaves

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ANSWER KEY

What Happened?

1. b, 2. a, 3. a, 4. a, 5. a, 6. d
Pre-Test & Post- Test
1. b, 2. c, 3. c, 4. a, 5. c, 6. a, 7. d,
8. a, 9. d, 10. c

Activity 1
Microwave, Infrared, Radio Wave, Ultraviolet, X-Ray, Visible Light, Gamma

Activity 2

I	O	N	O	S	P	H	E	R	E	A	B	B	S	T
R	I	A	B	C	D	E	F	G	I	J	K	A	L	E
A	M	R	O	P	Q	R	T	S	T	U	T	W	X	L
I	N	Y	R	Z	A	R	B	E	C	E	D	E	F	E
N	O	S	S	A	E	R	Q	P	L	O	N	M	N	V
B	P	T	U	N	D	V	M	L	U	O	B	L	E	I
O	Q	U	N	D	E	I	I	T	V	D	I	K	G	S
W	R	Y	T	C	F	T	A	T	W	X	C	V	T	I
V	C	A	A	B	E	L	N	T	A	Y	Z	J	N	O
S	S	R	N	A	G	K	O	S	E	M	A	I	E	N
W	T	X	Y	Z	I	J	P	Q	R	D	I	G	O	N
X	U	N	I	G	H	T	V	I	S	I	O	N	R	M
Y	R	A	D	I	O	T	H	E	R	A	P	Y	D	K
Z	S	I	S	E	H	T	N	Y	S	O	T	O	H	P
R	A	D	A	R	A	B	C	D	E	F	G	I	J	K

Activity 3
1. Visible Light, 2. Microwave, 3. X-Ray, 4. UV Ray, 5. Visible Light, 6. Radio Wave, 7. Radio Wave, 8. Microwave, 9. Microwave, 10. UV Ray

Activity 4 (Answer May Vary)

SYNOPSIS

The electromagnetic spectrum is comprised of all frequencies of electromagnetic radiation that propagate energy and travel through space in the form of waves.

Electromagnetic energy travels in waves and spans a broad spectrum from very long radio waves to very short gamma rays. The human eye can only detect only a small portion of this spectrum called visible light. A radio detects a different portion of the spectrum, and an x-ray machine uses yet another portion.

NASA's scientific instruments use the full range of the electromagnetic spectrum to study the Earth, the solar system, and the universe beyond.

When you tune your radio, watch TV, send a text message, or pop popcorn in a microwave oven, you are using electromagnetic energy. You depend on this energy every hour of every day. Without it, the world you know could not exist.

ABOUT THE AUTHOR

MARIO JAMES S. DELA CRUZ, Master Teacher I, is an Advanced Physics and Science 10 teacher at Santiago City NHS. In 2020, he was awarded Most Outstanding Secondary Teacher in the Schools Division of Santiago City and a Finalist during the 2020 Regional STARS Awards.

In 2021, he received an international recognition as Luminary Excellence in Education and Research Award- Outstanding Educator in Science.

His work as Science teacher also appreciated in Region 02 and gave him the award Most Outstanding Secondary Teacher and Outstanding Employee Award.

He was awarded as the Grand National Champion in SIM Making at the National Science and Technology Fair in 2020. Recently, he was awarded Grand National Champion in SIM Making spearheaded by the Salindunong Review and Research Center.

He is a Regional Learning Activity Sheet writer and Content Editor. He is a Strategic Intervention Material (SIM) and Self- Learning Kit (SLK) writer.

He continues to contribute to Science Education as a Science Club adviser, academic coach, resource person, lecturer and evaluator at various seminars, conferences and Science fairs.