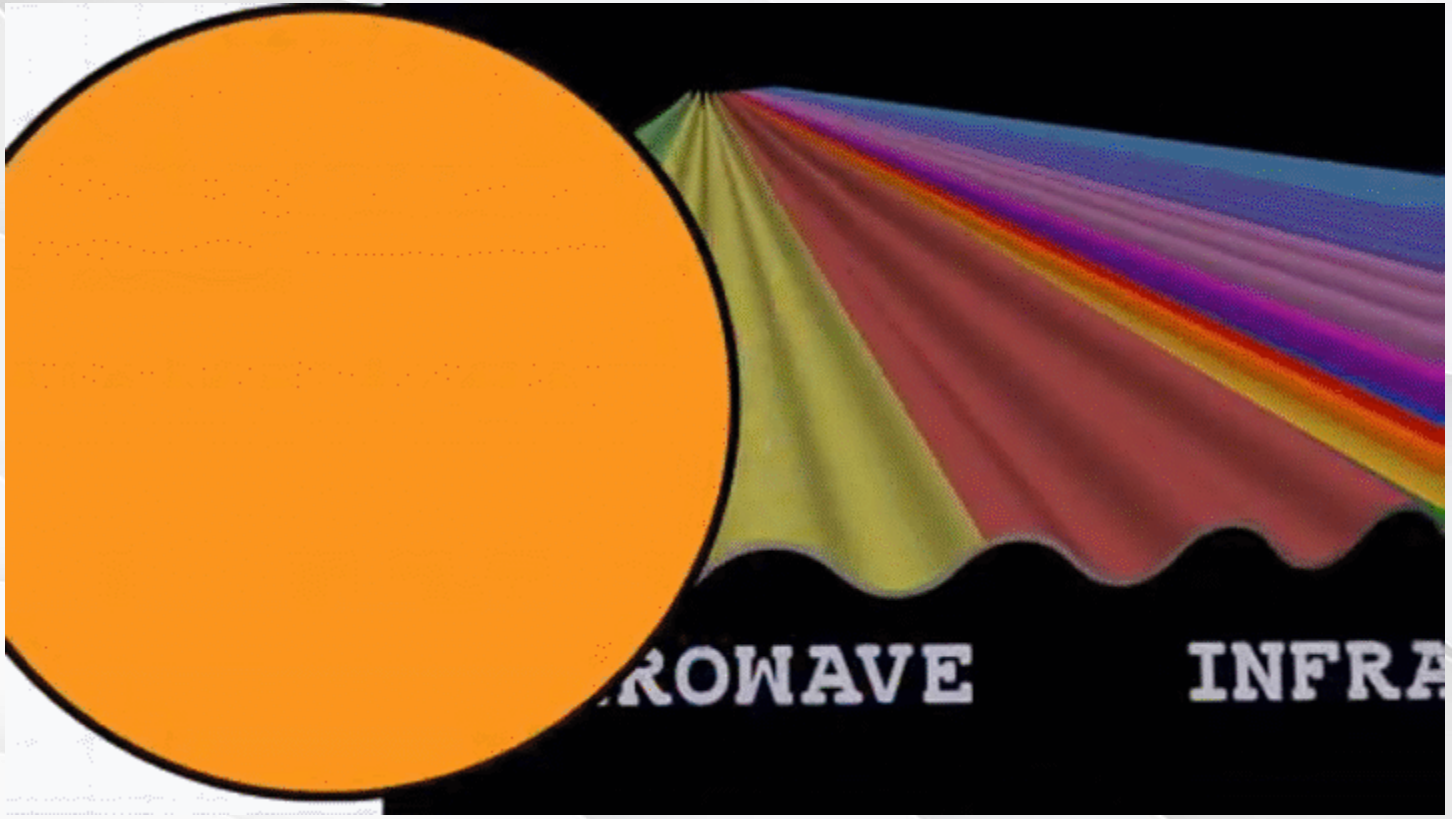
READY RESPECTFUL SAFE

Ready	Respectful	Safe
Enter the room quietly, calmly and on time;	Raise your hand, and wait for permission before speaking.	Follow the teacher's instructions.
Come prepared for the work with jotters and pen or pencil etc.	Allow people to get on with their work.	Follow the laboratory rules
Complete all homework and hand it in on time	No Put Downs	Do not touch equipment that is not part of your work
Pay attention	Not deface jotters, desks folders, etc.	
	Pay attention	
	At the end of a lesson, when told to do so, pack away quietly, place stools under the desk and leave in an orderly manner.	

A Physics topic on the Electromagnetic Spectrum

THE VISIBLE AND BEYOND!



A PHYSICS TOPIC ON THE ELECTROMAGNETIC SPECTRUM

BUT WE NEED SOME BACKGROUND FIRST

Lessons 8-11

ELECTROMAGNETIC SPECTRUM LEARNING INTENTIONS

There is a collection of waves that all travel at the speed of light and these form the electromagnetic spectrum.

The speed of light in air is 300 million metres per second,

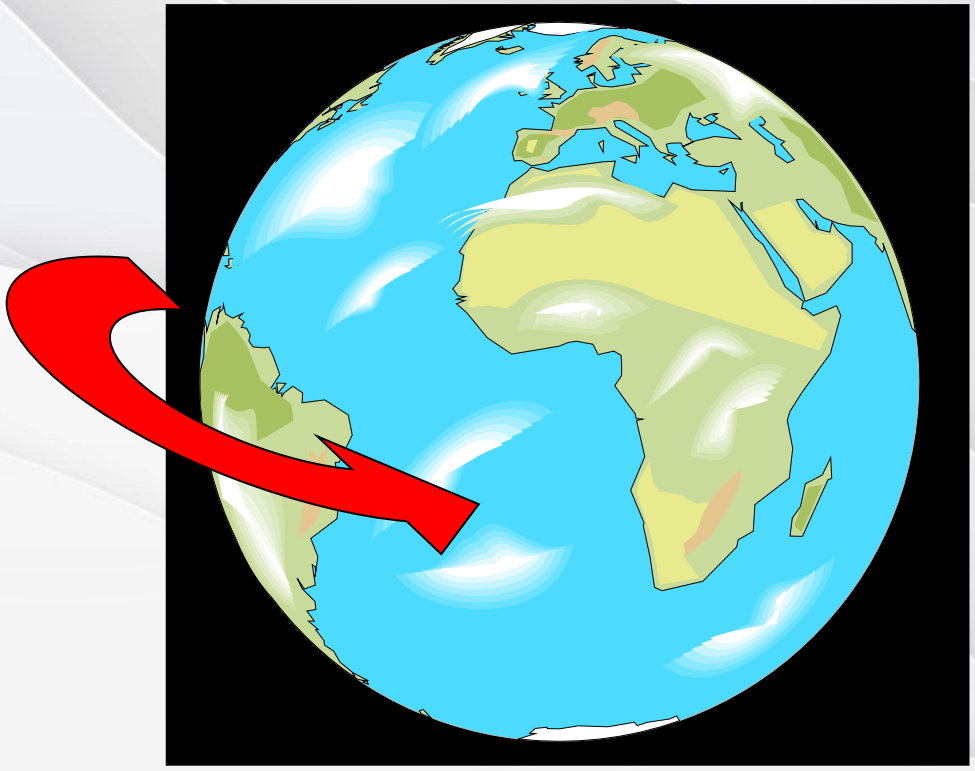
Written as 300 000 000 m/s

Each of the waves travel in the same way but have different properties, uses and methods of detection.

Find a source, detector, protector and use for each type of electromagnetic wave

- LIGHT IS AN ELECTROMAGNETIC WAVE
- ELECTROMAGNETIC WAVES TRAVEL VERY FAST – 300, 000, 000 M/S OR 300,000 KILOMETRES PER SECOND (THE SPEED OF LIGHT).

At this speed the waves can travel the equivalent of 7.5 times around the world in one second. (but light travels in straight lines)

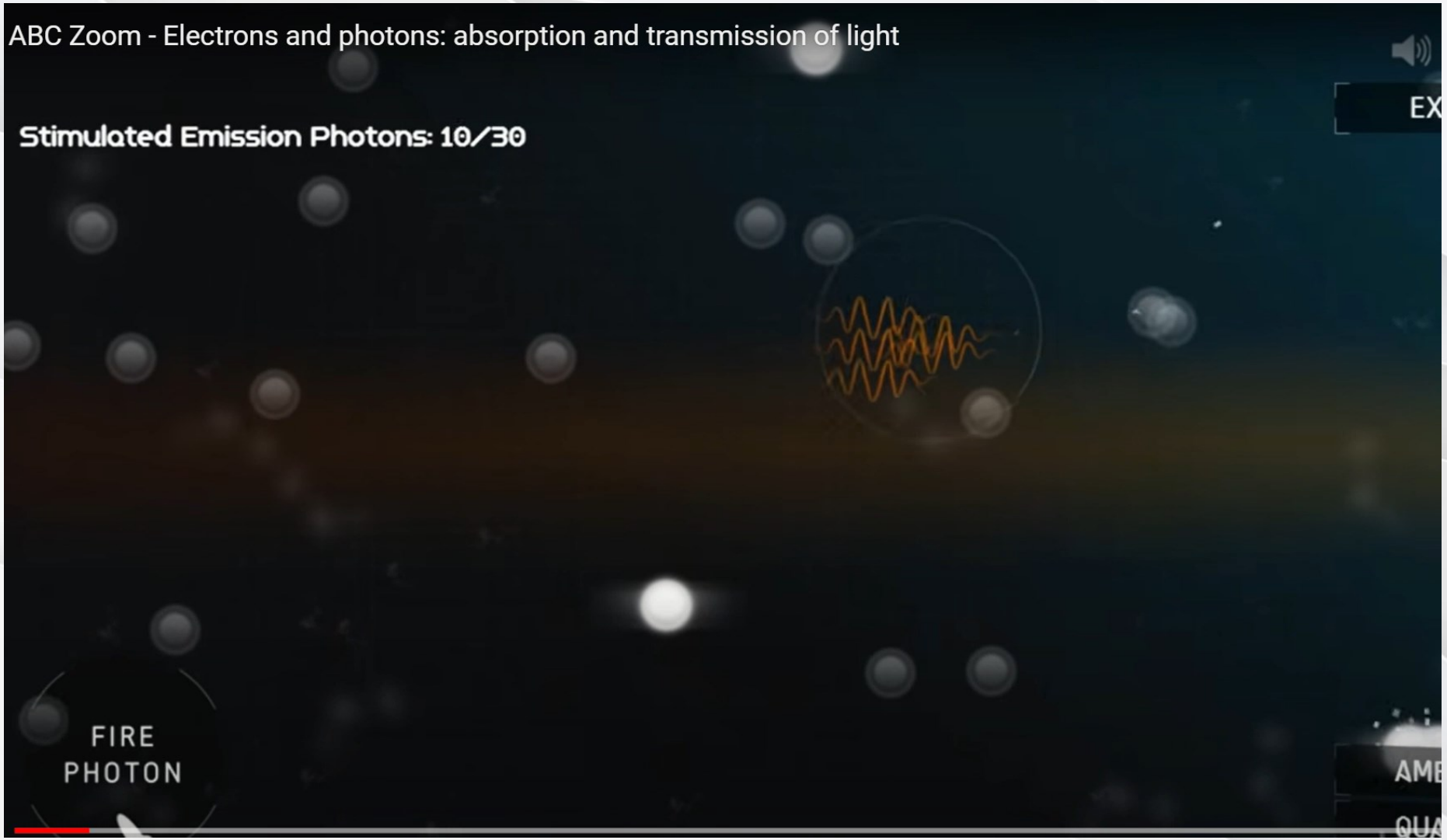


Extension

Here is a simple question with a difficult answer!

How is light made?

ONLY FOR THE MOST CURIOUS!

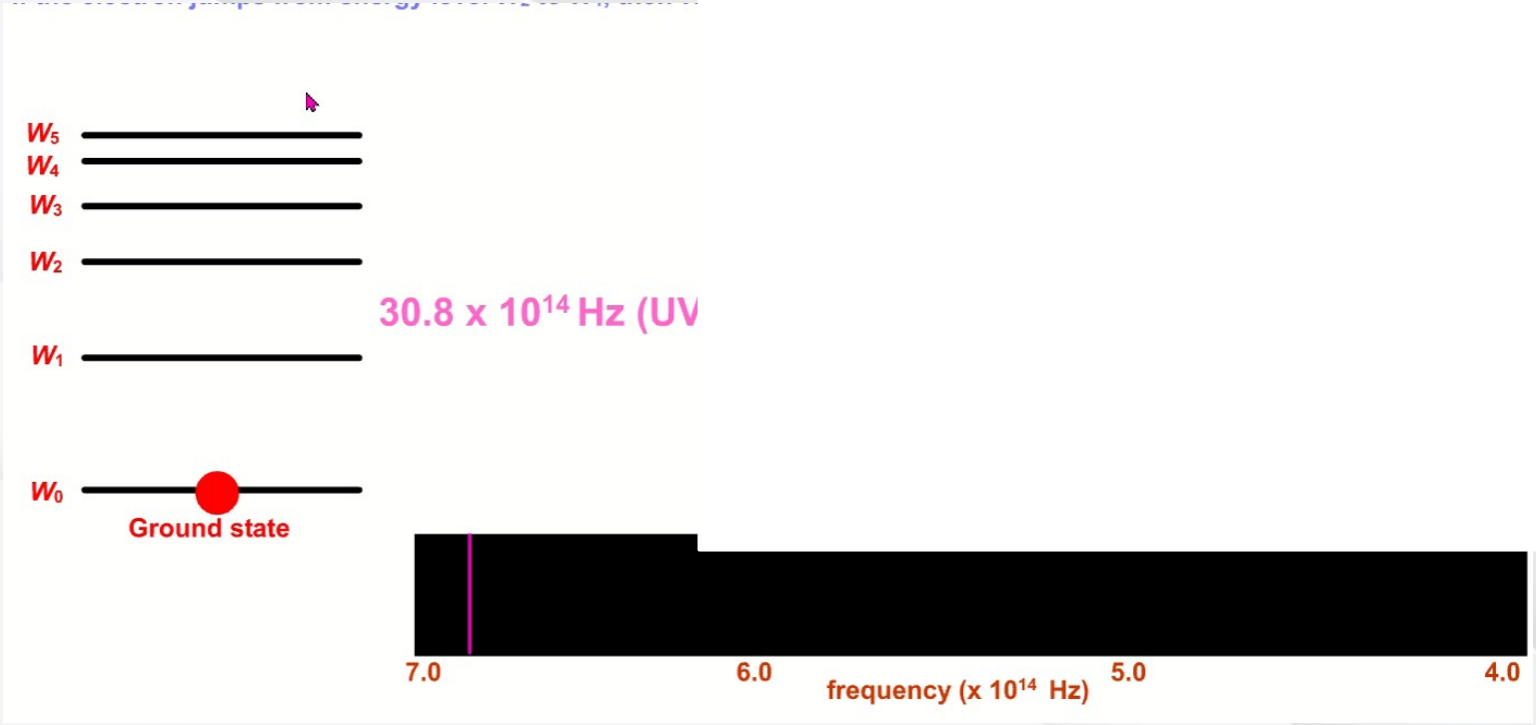


https://www.youtube.com/watch?v=N9nWdNadklE

YES THINGS THAT BURN OR GET HOT GIVE OFF LIGHT

Extension only

But how?



When electrons drop from different energy levels in atoms they give off energy as packets of light

LET'S START WITH A SONG TO SET THE SCENE!

https://www.youtube.com/watch?v=bjOGNVH3D4Y

Before we do work on the EM Spectrum we need to find out more about WAVES

8e

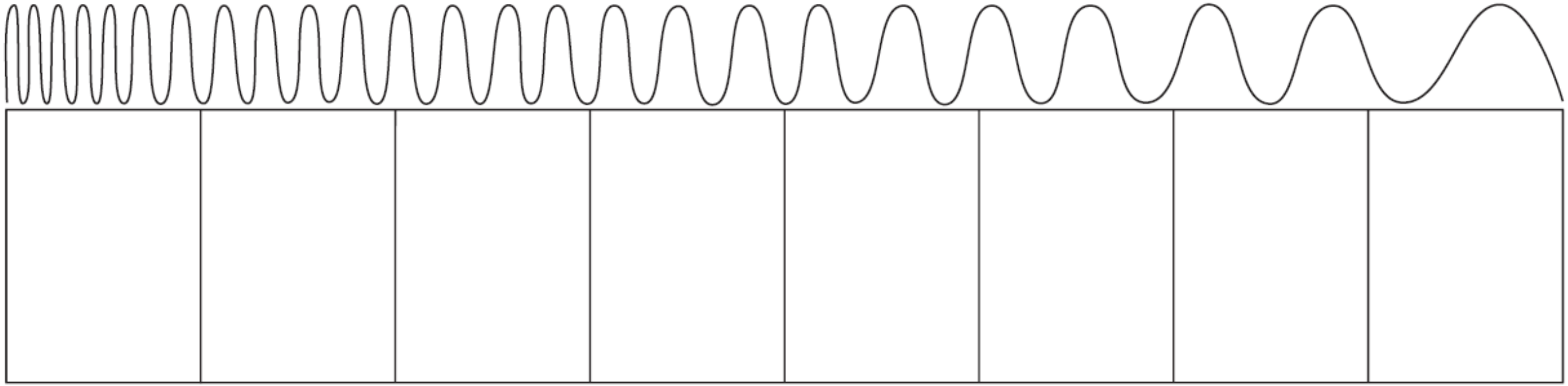
The electromagnetic spectrum

Extra Help

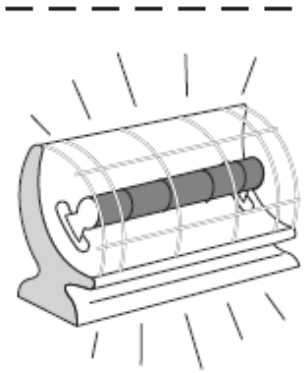
- Cut out the pictures at the bottom of the sheet. Stick them on to the correct part of the electromagnetic spectrum.

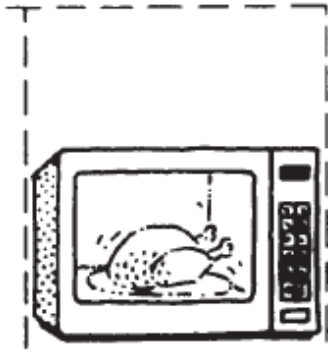
Short wavelength

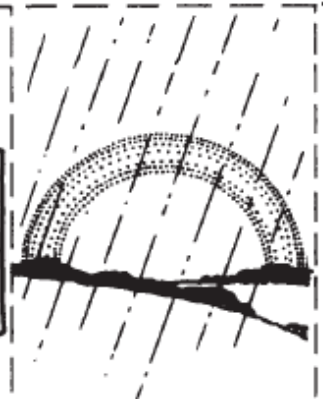
Long wavelength

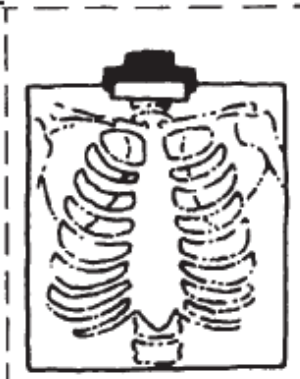


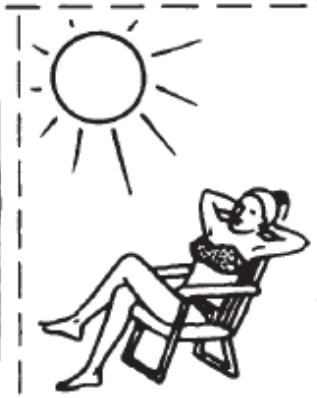
← gamma-rays → ← X-rays → ← ultra-violet → ← visible → ← infra-red → ← radio waves →











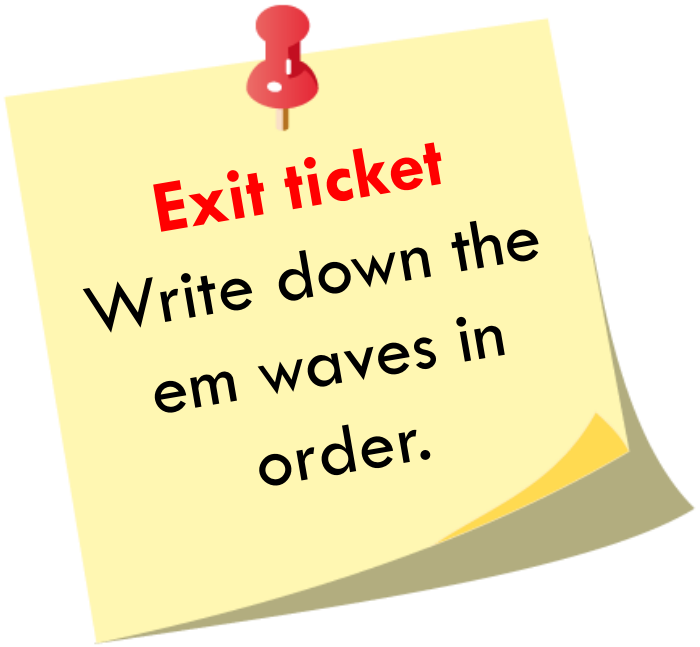
THE ELECTROMAGNETIC SPECTRUM

Copy the diagram over a double page in your jotter. Research using books and the internet to complete the table

Type of EM Waves	Use	Detector	Danger	Protector	Sources
Radio & TV					
Microwaves					
Infra Red					
Visible					
Ultra violet					
X-Ray					
Gamma Rays					

EXIT PASS
JOIN IN THE SONG

HTTPS://WWW.YOUTUBE.COM/WATCH?V=-H8HJXGTOXW



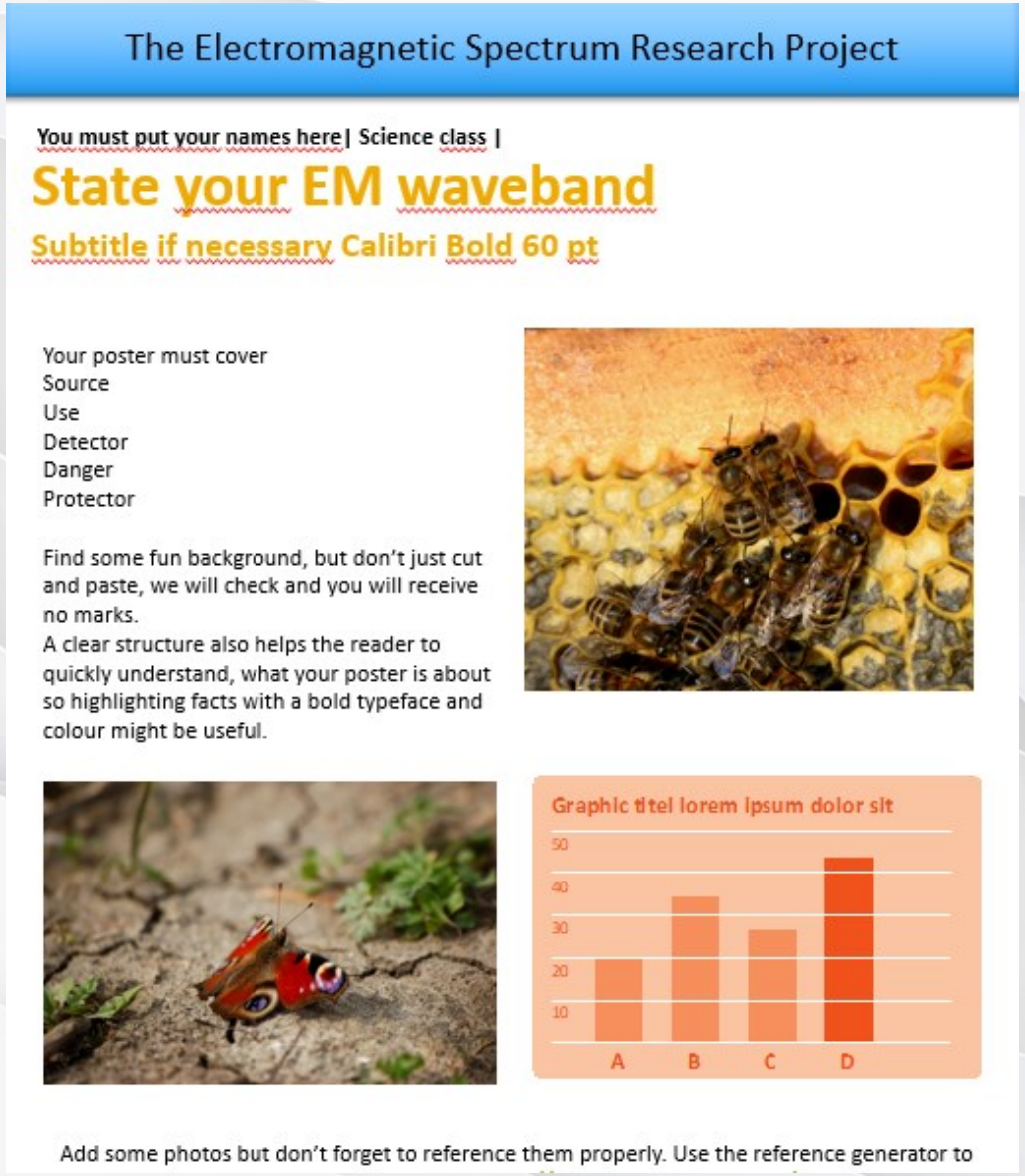
Electromagnetic Waves

Key Points

1. All electromagnetic waves travel at the same speed through space (the speed of light)
2. Gamma rays, X-rays, Ultra-violet waves, Light, Infra-red rays, Microwaves, and Radio waves are all electromagnetic waves with different wavelengths
3. Some substances absorb EM waves, some reflect them and others transmit them

EM SPECTRUM RESEARCH TASK

- IN PAIRS YOU ARE GOING TO USE THE TEMPLATE TO PRODUCE A SCIENTIFIC POSTER ON THE EM SPECTRUM. YOUR TEACHER WILL SHOW YOU AN EXAMPLE ON THE VISIBLE WAVEBAND.
- RESEARCH,
- COVER ALL AREAS
- MAKE IT CLEAR
- DON'T COPY
- REFERENCE PROPERLY



SUPERHERO HOMEWORK

- DESIGN A SUPERHERO WHO HAS SOME SUPERPOWERS RELATED TO THE ELECTROMAGNETIC SPECTRUM. THERE ARE WEBSITES THAT CAN HELP YOU IF YOU CAN'T DRAW.
- YOUR SUPERHERO SHOULD BE:

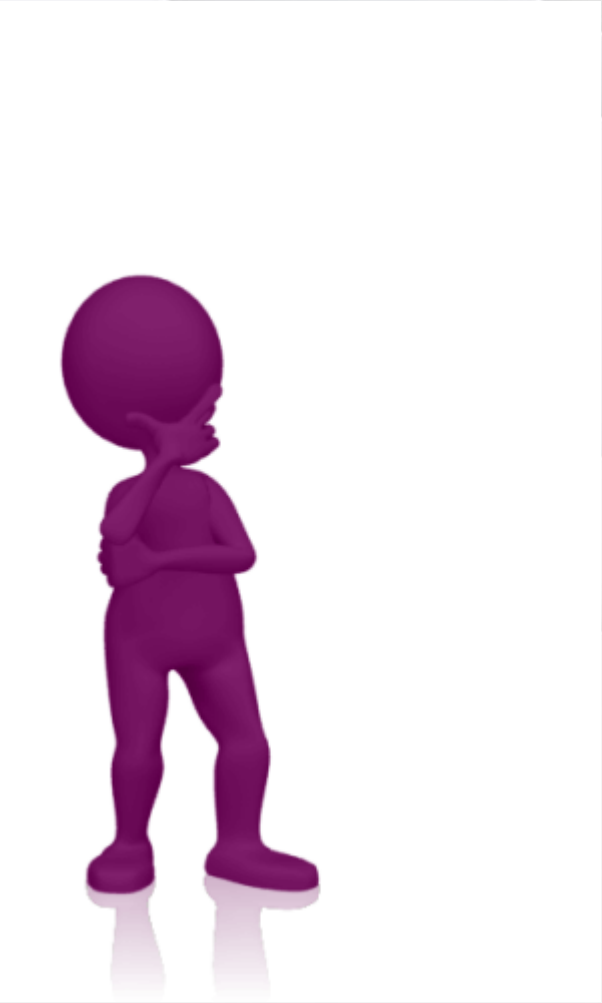
1. DRAWN
2. NAMED
3. SUPER POWERS EXPLAINED
4. ANY WEAKNESSES DISCUSSED
5. EXPLAIN HOW HE/SHE/THEY CAN SAVE THE WORD

Miss Violet
Can see in the UV, flies, travels at the speed of light, is stopped by some glass, cures some cancer, jaundice, and kills bacteria and viruses but causes skin cancer in enemies

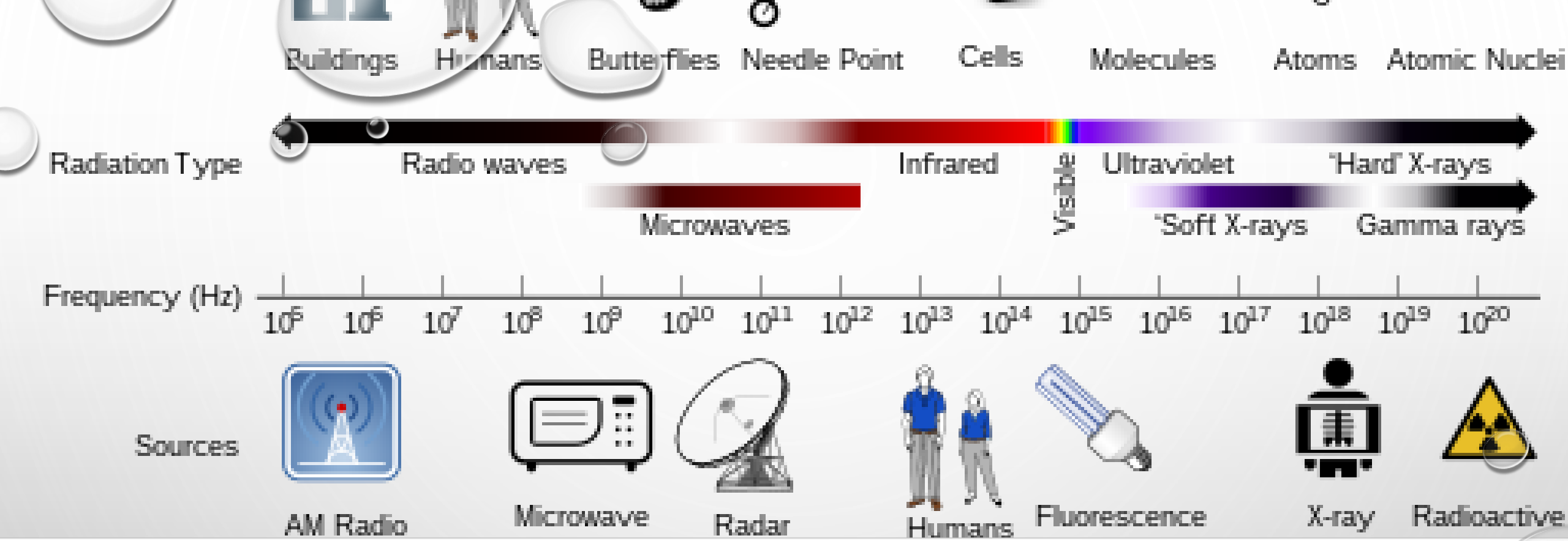
RADIO WOMAN

- CAN DETECT ALL RADIO WAVES AND CAN OVERRIDE WHAT IS ON THE RADIO.
- CAN BE IN MANY PLACES AT ONCE, BUT NOT VISIBLE TO EVERYONE
- LOOSES SUPERPOWERS IN A METAL TANK.
- CAN HAVE INFLUENCE ON PEOPLE VIA SOCIAL MEDIA AND CAN MAKE SOCIAL INFLUENCERS SAY WHATEVER SHE WANTS THEM TO.

STARTER THINKERS



- DRAW A DIAGRAM OF A TRANSVERSE WAVE AND LABEL AS MUCH AS YOU CAN
- STATE THE FUNCTION OF THE IRIS IN THE EYE
- STATE ONE FORM OF EYE DEFECT
- LIST THE COLOURS IN A RAINBOW!



ELECTROMAGNETIC SPECTRUM

PRACTICALS

https://upload.wikimedia.org/wikipedia/commons/6/60/Electromagnetic_spectrum_clothesUS.svg

RADIO


Radio waves- linked to electrical waves
Mrs Physics
SONY
BASS REFLEX BODY

MICROWAVES

- SPEED OF LIGHT WITH CHEESE SLICES
- REMOVE THE TURNTABLE FROM THE MICROWAVE
- PLACE THE CHEESE SLICES ON A CARDBOARD “TRAY”
- PUT ON THE MICROWAVE FOR 1-1.5 MINUTES
- MEASURE THE DISTANCE BETWEEN THE BURNT SPOTS (THIS SHOULD BE ½ A WAVELENGTH
- FIND THE FREQUENCY OF THE WAVES FROM THE BACK OF THE MICROWAVE (NOT THE 50HZ ELECTRICAL SUPPLY)
- USE SPEED = FREQUENCY X WAVELENGTH TO CALCULATE THE SPEED OF LIGHT/ EM WAVES

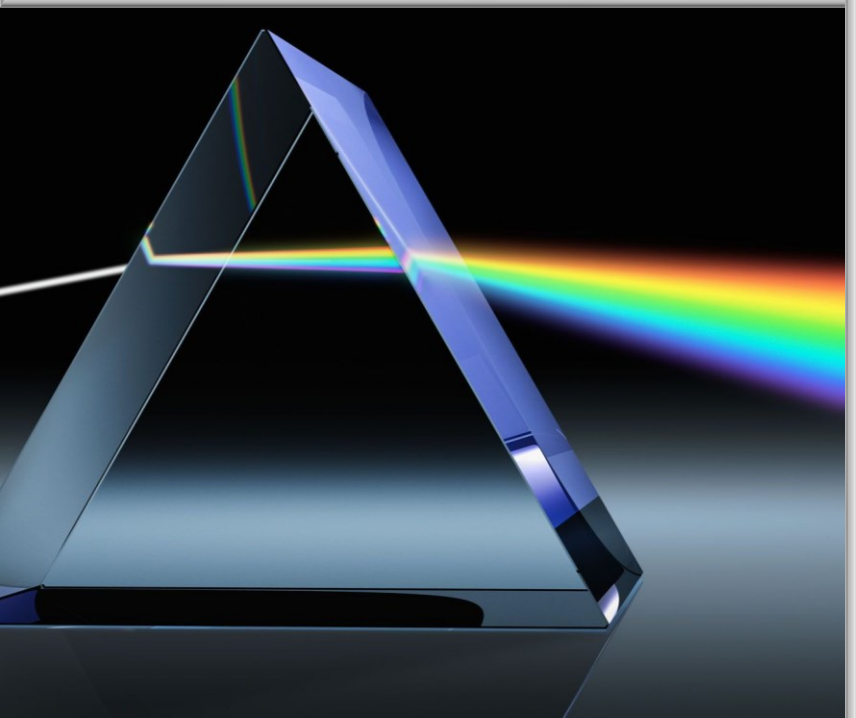
MICROWAVE 2

1. Use the microwave transmitter to send a signal to the receiver
2. Try receiving the signal after you have reflected it from a metal surface, how much signal do you lose?
3. What happens when you put a baking sheet or oven shelf between the transmitter and receiver and turn the shelf? This is polarisation!!

INFRA-RED/ HEAT

- USE THE IR CAMERA TO TAKE PHOTOS AROUND THE ROOM. **BE CAREFUL IT IS REALLY REALLY EXPENSIVE.**
- TAKE AN IMAGE OF SOMEONE IN THE CLASS
- TAKE ANOTHER PHOTO OF THE SAME PERSON HOLDING UP A BIN BAG IN FRONT OF THEIR FACE. WHAT DOES THIS SAY ABOUT BIN BAGS AND IR RADIATION

- HTTPS://VIMEO.COM/498104023



VISIBLE

- FIND THE PRIMARY, SECONDARY AND TERTIARY COLOURS OF LIGHT
- FIND OUT ABOUT OTHER ANIMALS AND WHAT THEY CAN SEE.
- SPLIT LIGHT WITH A PRISM

ULTRAVIOLET

- HTTPS://VIMEO.COM/498085647
- USE THE UV TORCH TO CHECK OUT DIFFERENT BANK NOTES
- SHINE THE TORCH ON THE UV BEADS. HOW LONG TO THEY TAKE TO CHANGE COLOUR?

X-RAYS

- CHECK OUT SOME OF THE X-RAYS THAT WE HAVE IN THE FACULTY. CAN YOU SPOT WHAT IS WRONG WITH SOME OF THE PATIENTS?
- CHECK OUT YOUTUBE VIDEOS ON THE THINGS FOUND ON X-RAYS

GAMMA RADIATION

Teacher demo only

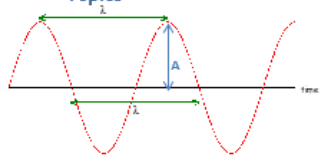
- ONLY SHOW GAMMA RADIATION
- CHECK THE BACKGROUND
- USE THE PERSPEX SCREEN

EXIT PASS
JOIN IN THE SONG

HTTPS://WWW.YOUTUBE.COM/WATCH?V=-H8HJXGTOXW

REVISION

Topics



Introduction to Waves
Light
EM Spectrum
Eye
Lenses

Introduction to waves

1. Amplitude is the midpoint to the crest of a wave
2. Wavelength is the distance between the same point on successive waves
3. Frequency is the number of waves per second and is measured in Hertz, Hz,
4. Period is the time taken for one wave to pass a point.
5. Waves carry energy, the amplitude is a measure of the energy of a wave.
6. Use the formulae
   a. wavelength = distance /no. of waves.
   b. Frequency =no. of waves/time,
   c. period =time /no. of waves.
7. Understand and correctly use the formulae $v = d/t$
8. Properties of waves, reflection, refraction, (diffraction- not covered),
9. Describe the two types of waves, longitudinal and transverse.
10. Sound and seismic p waves are examples of longitudinal waves and the EM waves are transverse waves.

Light

11. Light travels at 300 million (3×10^8) m/s in air and travels in straight lines. Light is a transverse wave.
12. Light can be refracted, reflected and diffracted.
13. Light is made up of a range of colours, red, orange, yellow, green, blue, indigo, and violet; where red light has a longer wavelength and lower frequency than blue light.
14. The primary light colours are red, green, and blue.
    a. Red and green mix to give yellow,
    b. blue and red make magenta and
    c. green and blue make cyan.
    d. If all of these three colours are mixed in the right ratio then white light is produced.
15. A prism can be used to split light into a spectrum.

Reflection

16. On a diagram I can label a mirror, the normal, the incident ray, the reflected ray, the angle of incidence, the angle of reflection
17. All angles are measured from the normal
18. The angle of incidence = the angle of reflection. This is the law of reflection
19. Light is reversible, if the direction of a light beam is reversed, it will follow the same path.

Refraction

20. Refraction occurs when light enters a material which is more optically dense the wave speed and wavelength reduce but frequency remains the same. Usually there is a change in direction of the wave.
21. If a ray of light enters a more dense material along the normal there will be no change in direction, although the wave speed and the wavelength will decrease.

Eye

22. Label a diagram of the eye and label the parts, cornea, iris, lens, retina and optic nerve.
23. Know that light enters our eye and lands on the retina where sense cells detect the signal and pass these through the optic nerve to the brain.
24. In short sight the lens is too strong or the eyeball is too long and light focuses in front of the retina, it can be corrected with a concave lens.
25. In long sight the lens is too weak or the eyeball is too short and light focuses behind the retina, it can be corrected with a convex lens
26. Explain that the size of the pupil changes due to the brightness of the surroundings.
27. State that the image formed on the retina of the eye is upside side-down and reversed.
28. Describe the position of the blind spot in the eye.

Lenses

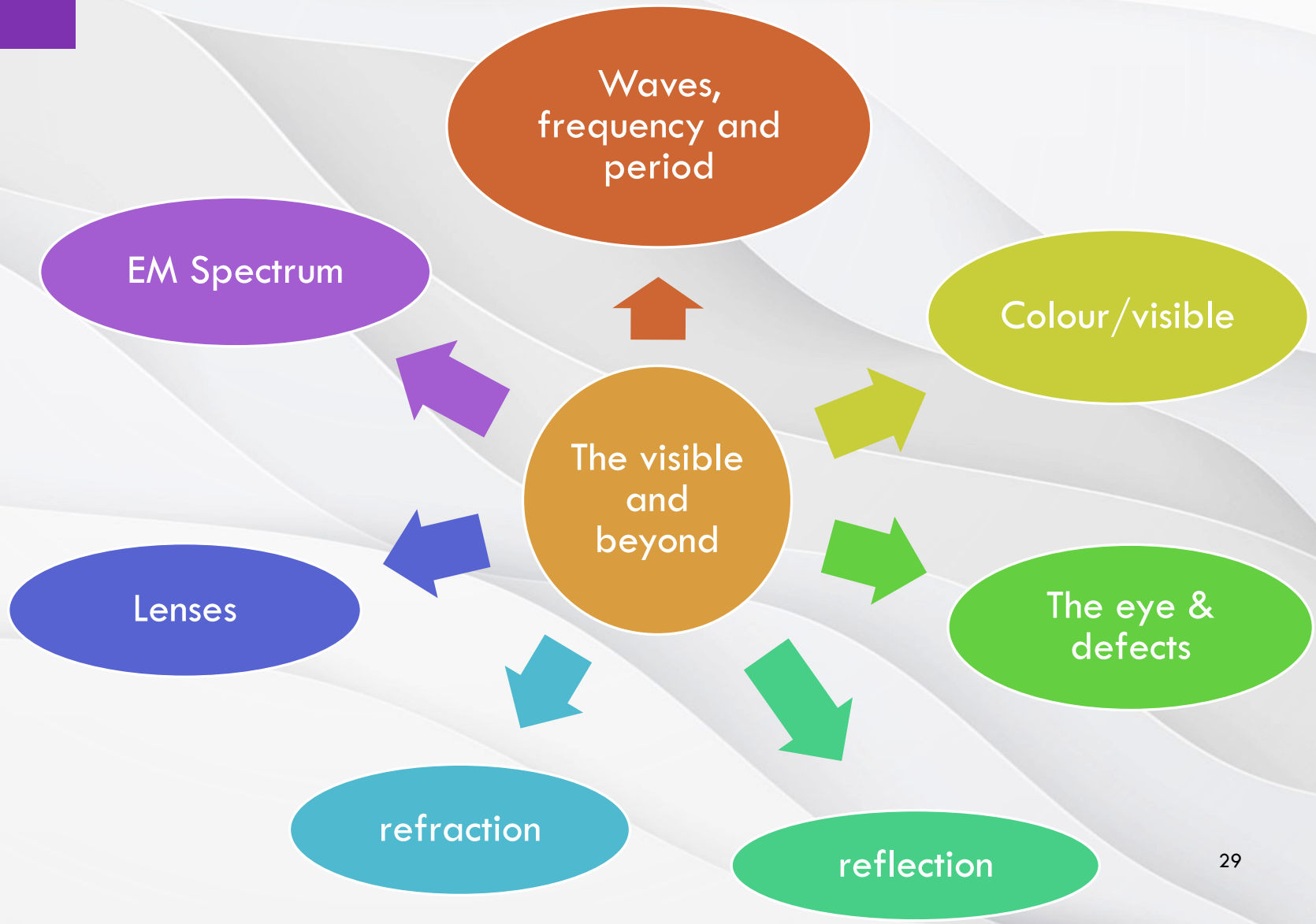
29. There are two types of lenses- convex or converging and concave or diverging. Draw these two lenses and show how light passes through them. Lenses refract the light.
30. Describe how concave and convex lenses focus a parallel beam of light.
31. Describe an experiment to measure the focal length of a convex lens.
32. Convex lenses correct long sight, concave lenses correct short sight.

EM Spectrum

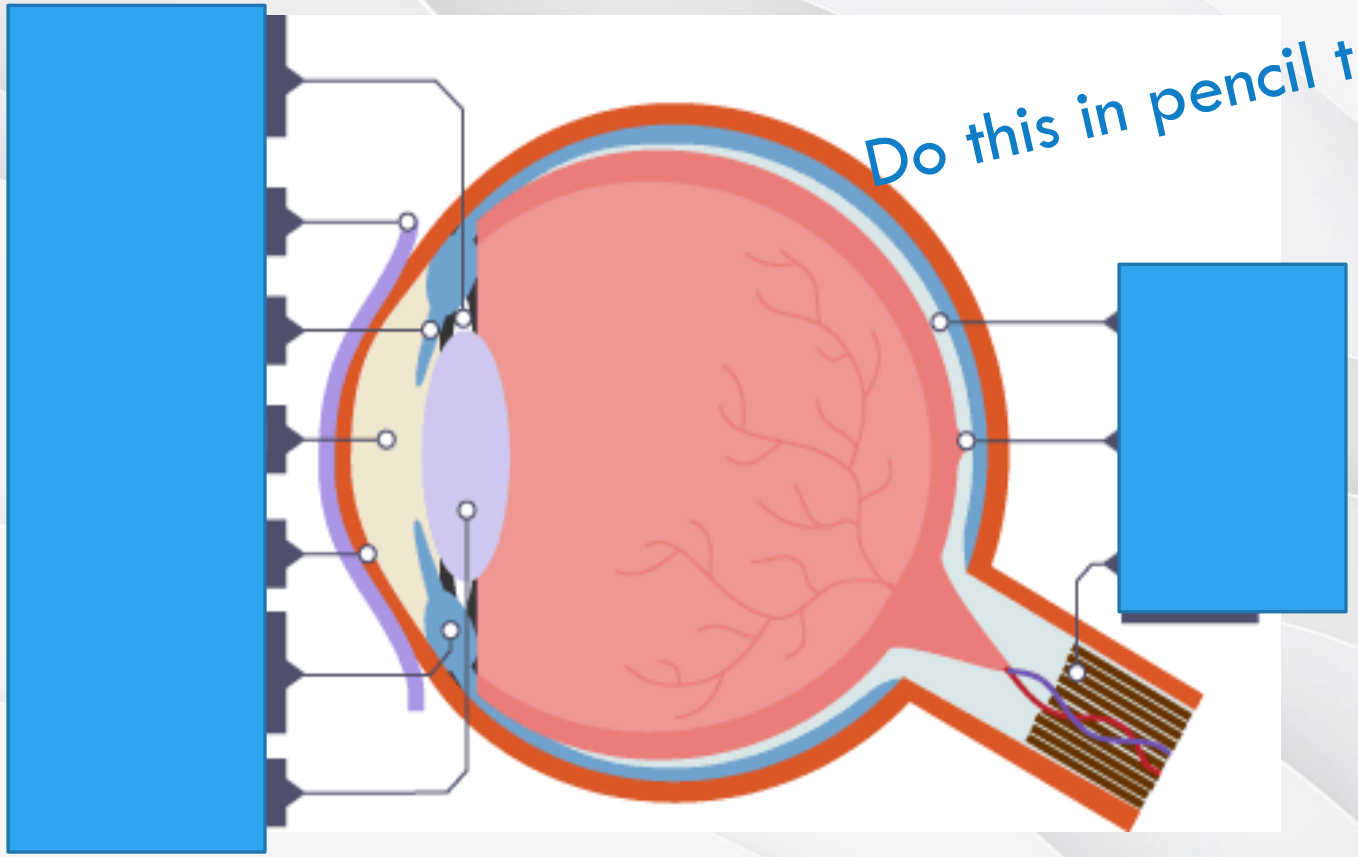
33. There is a collection of waves that all travel at the speed of light and these form the electromagnetic spectrum.
34. The order of the waves in the electromagnetic spectrum (from largest wavelength and lowest frequency) is Radio, Microwaves, IR, Visible, UV, X-ray, Gamma,
35. The higher the frequency the lower the wavelength and the lower the frequency the higher the wavelength for electromagnetic waves.
36. Some substances absorb EM waves, some reflect them and others transmit them
37. Give a use (application), detector, protector and source for each of the waves in the electromagnetic spectrum
38. See the table on page 3 of this revision sheet!

Mind Map

Copy the diagram and write down all you can remember on each section of the work



How many parts of the eye can you name?



Stretch: Do you know their function?