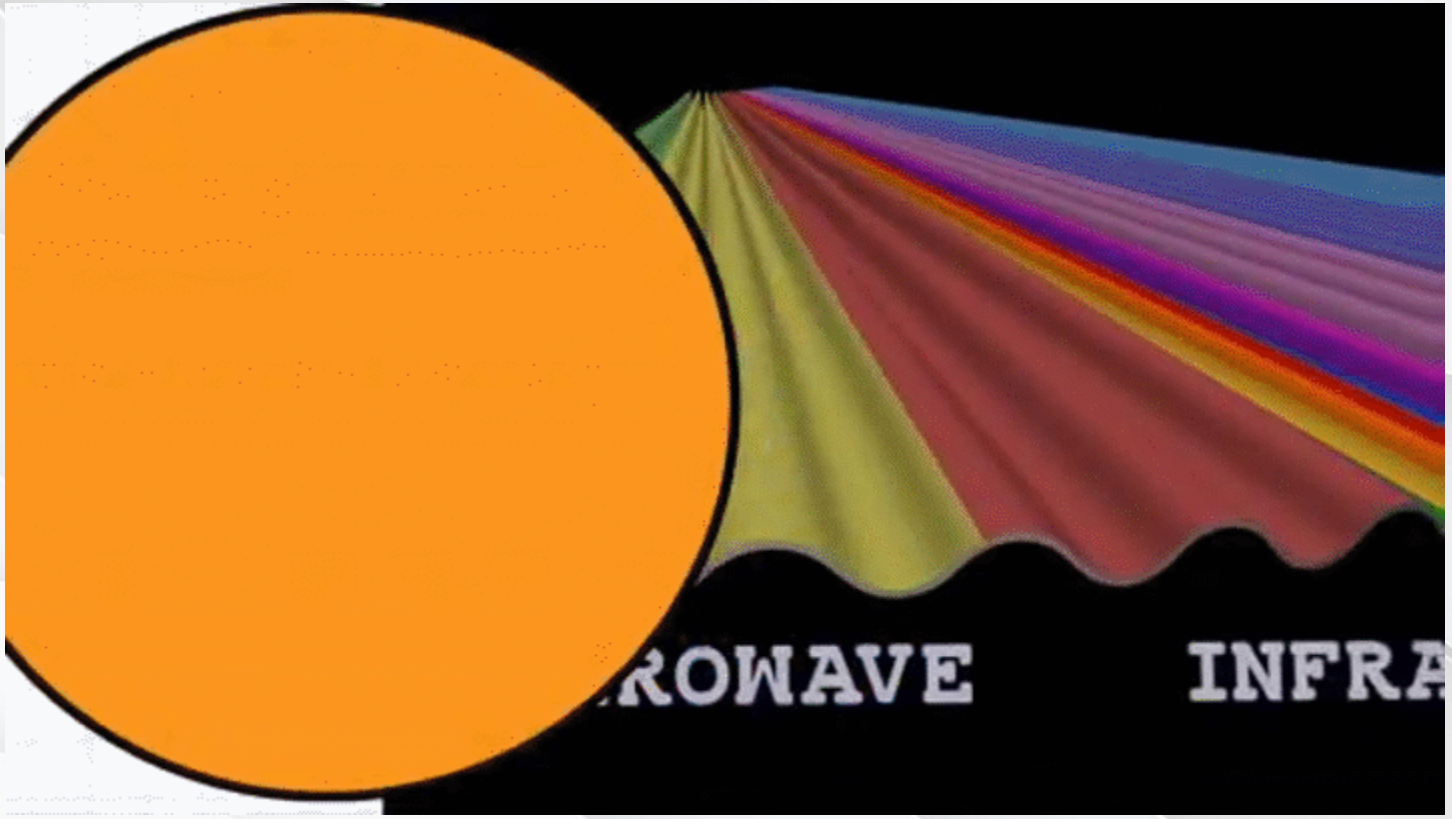
READY RESPECTFUL SAFE

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

LEARNING INTENTIONS: DESCRIBING WAVES Lesson 1

REVISE:Amplitude is the midpoint to the crest of a wave

REVISE: Wavelength is the distance between the same point on successive waves

REVISE: Describe the two types of waves, longitudinal and transverse.

REVISE:Sound and seismic p-waves are examples of longitudinal waves and the EM waves are transverse waves.

Frequency is the number of waves per second and is measured in Hertz, Hz,

Period is the time taken for one wave to pass a point, measured in seconds

Waves carry energy, the amplitude is a measure of the energy of a wave.

$$wavelength = \frac{distance}{no.of\ waves}, \quad \lambda = \frac{d}{N}$$

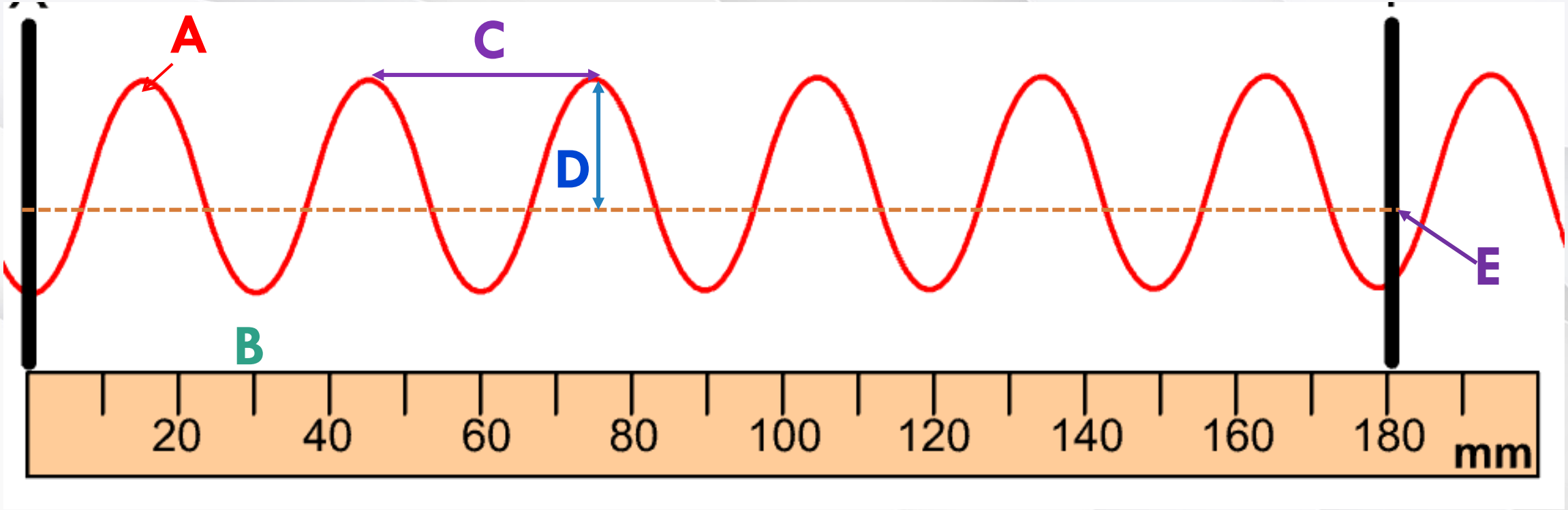
$$Frequency = \frac{no.of\ waves}{time}, \quad f = \frac{N}{t}$$

$$period = \frac{time}{no.of\ waves}. \quad T = \frac{1}{f}$$

Understand and correctly use the formulae v=d/t

Properties of waves, reflection, refraction, (diffraction- not covered),

DESCRIBING WAVES: REVISION FROM PHYSICS 1



amplitude

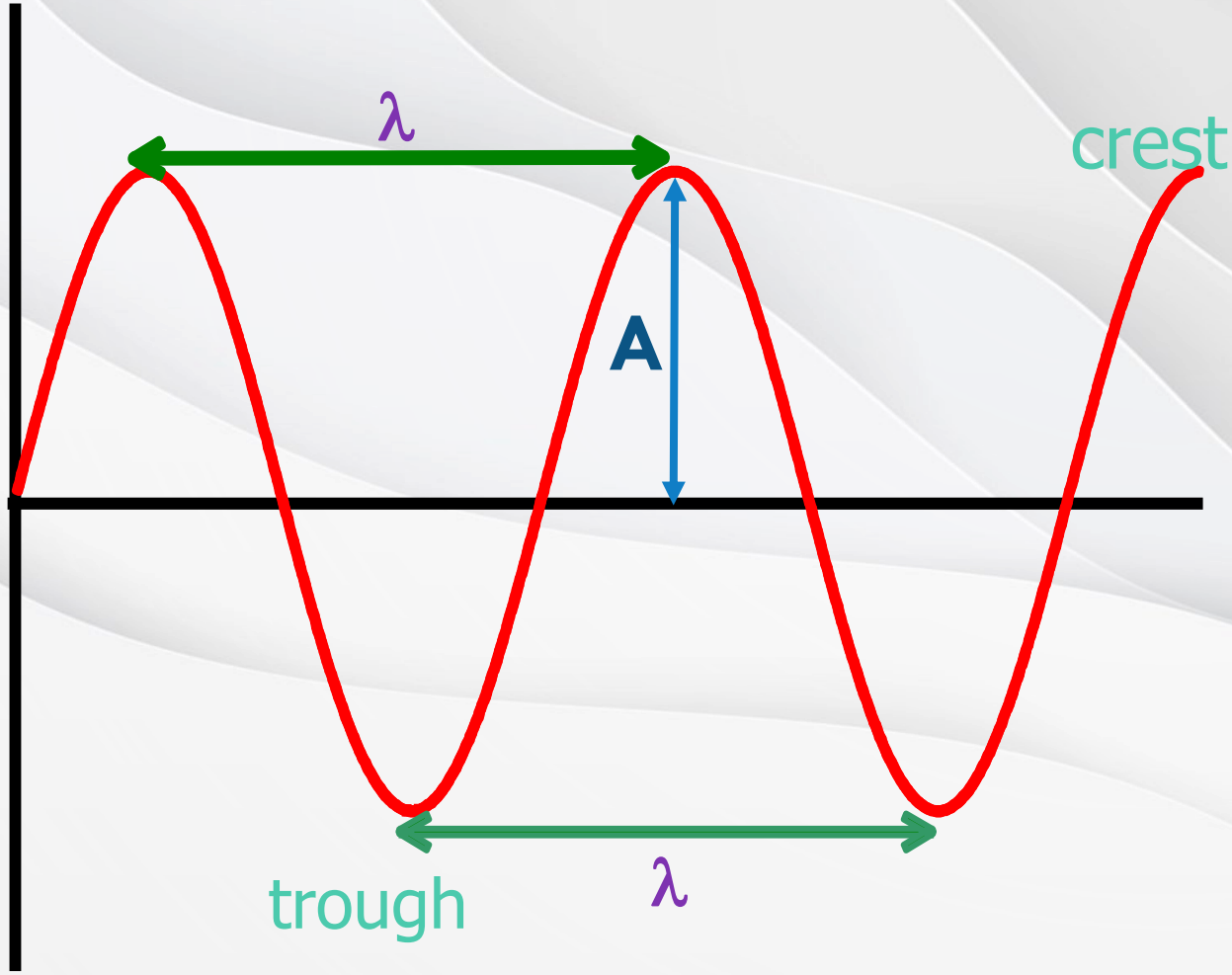
wavelength

Mean/ rest Position or midpoint

crest

trough

Describing a wave



Amplitude, A is the midpoint to the crest or trough of a wave.

Wavelength λ is the distance between the same point on waves next to each other.

Frequency, *f* is the number of waves per second and is measured in Hertz, Hz,

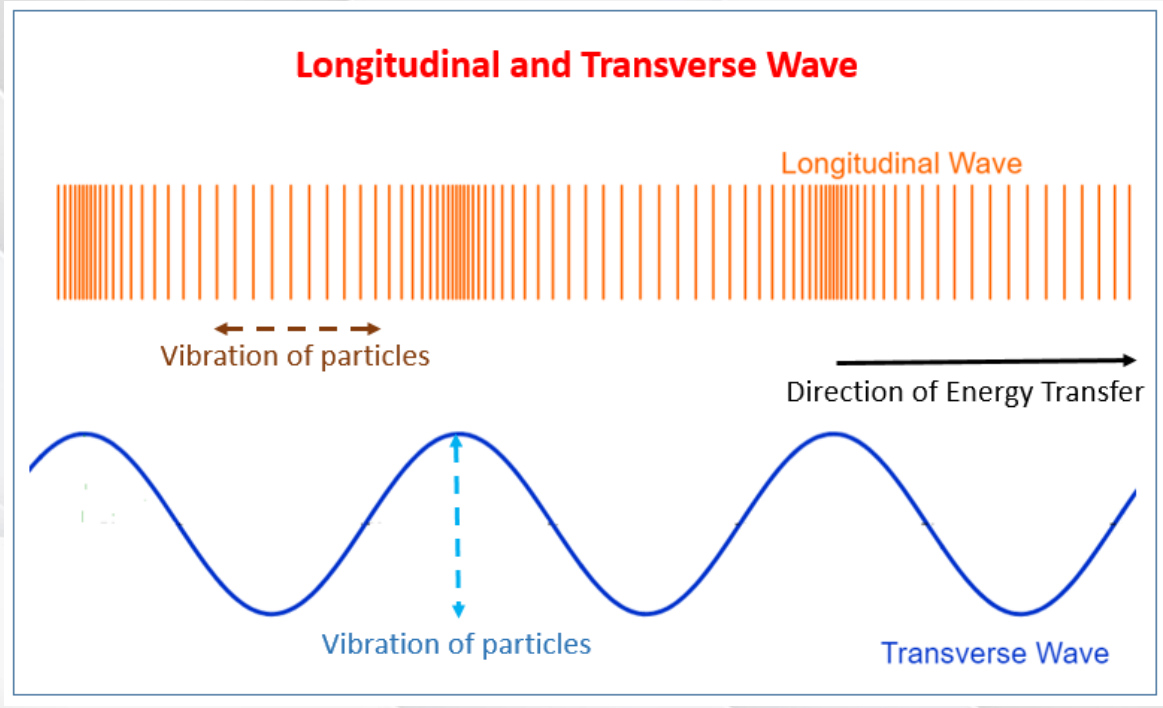
Wave term	Symbol	Definition	Unit	Unit symbol
Crest		highest point of a wave		
Trough		lowest point of a wave		
Wavelength	λ	horizontal distance between successive crests or troughs	metre	m
Amplitude	A	The distance between the midpoint to the crest or trough	metre	m
Wave Speed	v	distance travelled per unit time	metres per second	ms^{-1}
Period	T	the time it takes one wave to pass a point	seconds	s
Frequency	f	number of waves produced in one second	hertz	Hz

Longitude and transverse wave animations

https://physicsflashrepo.cyou/flash/physics-2-15/physics-2-15.html

https://physicsflashrepo.cyou/flash/int2/int2-wavesandoptics.html

TYPES OF WAVES



Using the slinky, lets go and make some waves:
You should

- Draw and explain transverse waves
- Draw and explain longitudinal waves
- See waves reflecting from an end

Longitude and transverse wave animations

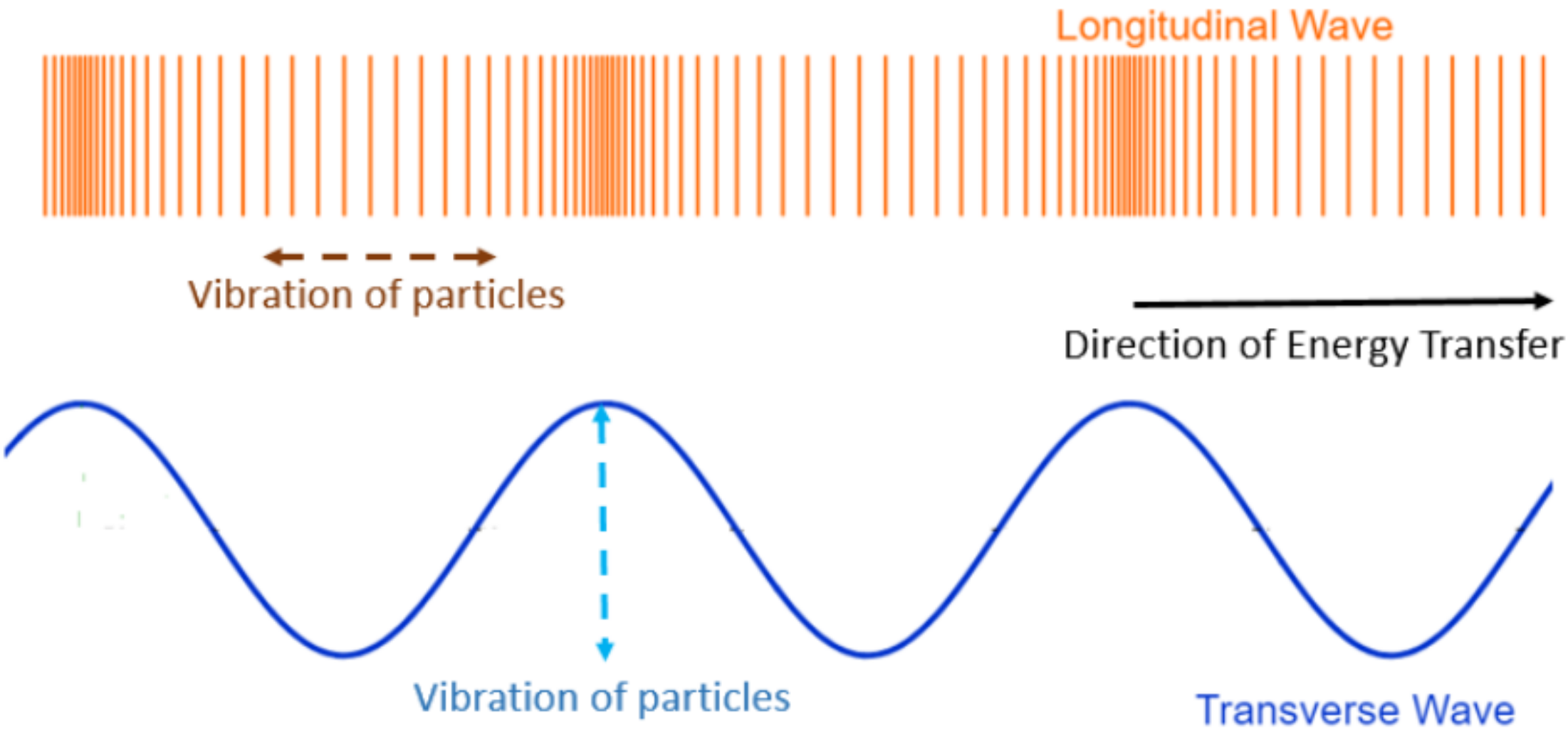
https://physicsflashrepo.cyou/flash/physics-2-15/physics-2-15.html
https://physicsflashrepo.cyou/flash/int2/int2-wavesandoptics.html

No text

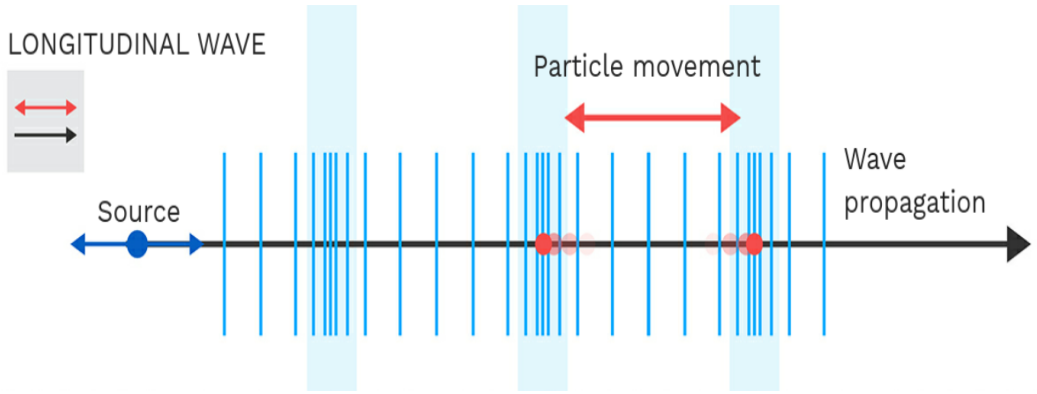
with text

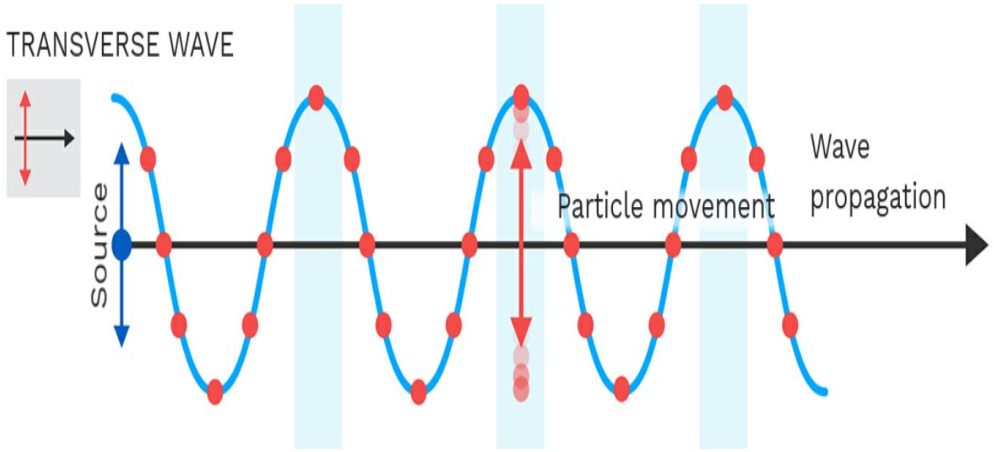
Longitudinal and Transverse Wave

Draw me!



LONGITUDINAL WAVE AND TRANSVERSE WAVE





LONGITUDINAL WAVE

Longitudinal waves are those waves in which the particles of the medium move parallel to the propagation of the wave. For example, sound waves are longitudinal waves

TRANSVERSE WAVE

Transverse waves are those waves in which the particles of the medium move perpendicular to the direction of the propagation of the wave. For example, ripples formed on the surface of the water, is a transverse wave.

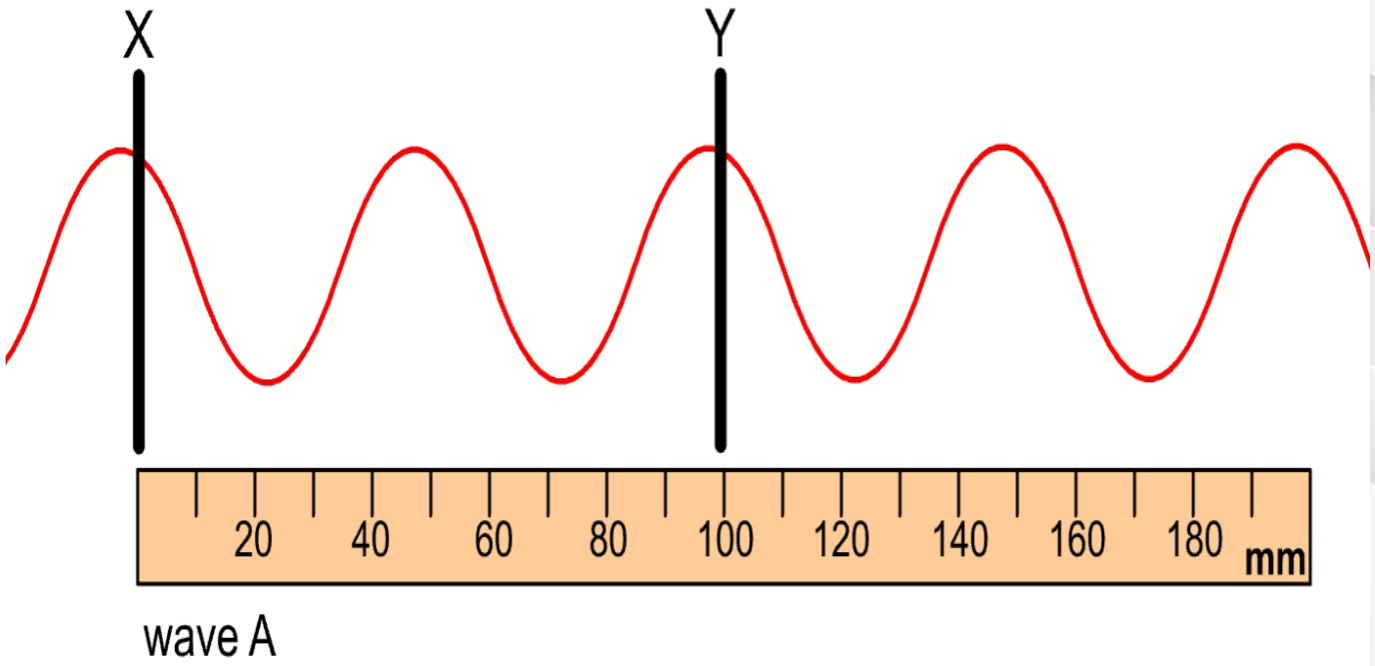
FREQUENCY AND PERIOD

frequency is the number of waves produced or passing a point per second. It is measured in Hertz, Hz

Period is the time for one wave to pass a point, it is measured in seconds, s

CAN YOU FIND THE NUMBER OF WAVES PASSING A POINT PER SECOND (FREQUENCY)?

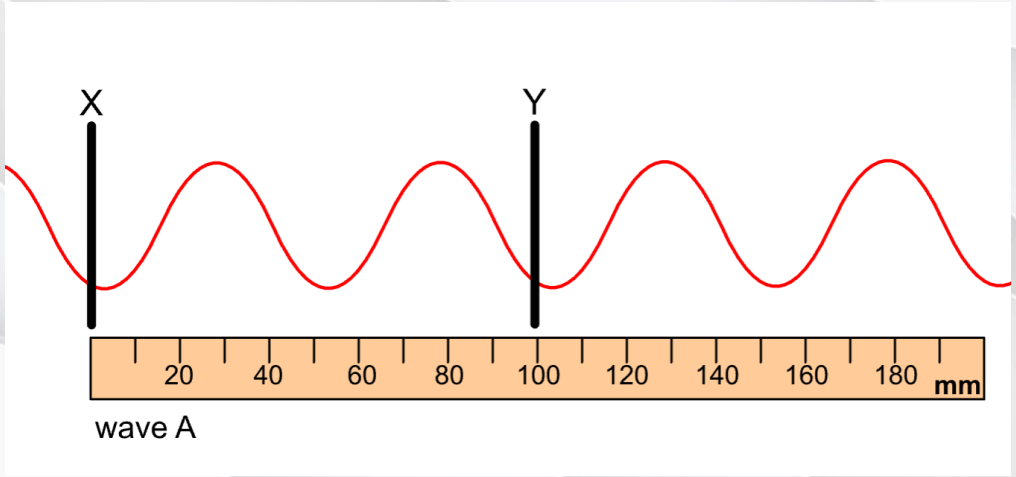
So how else can you find the frequency?



The best way is to TIME for 10 waves to pass point Y but don't forget the first crest is zero, not 1!

NOW A LITTLE BIT OF MATHS

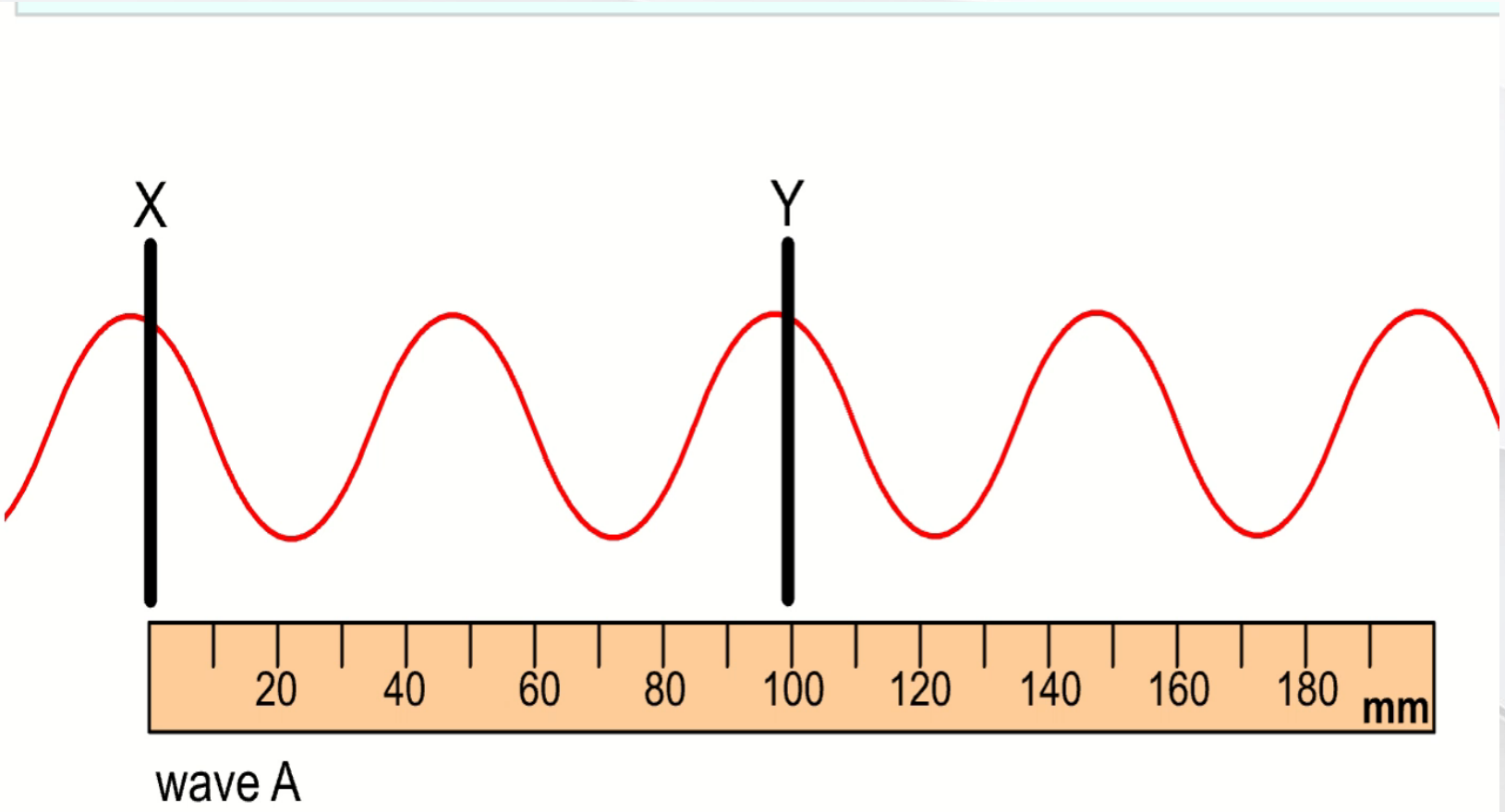
- IF 10 WAVES TAKE 20 SECONDS TO PASS Y THEN HOW LONG WILL IT TAKE 1 WAVE TO PASS POINT Y?
- THE TIME FOR 1 WAVE IS THE PERIOD, T, (s)
- $T = \frac{time}{number\ of\ waves} = \frac{20}{10} = 2s$
- THE FREQUENCY IS THE NUMBER OF WAVES PER SECOND.
- SO IF ONE WAVE TAKES 2 SECONDS TO PASS POINT Y IN 1 SECOND HOW MANY WAVES PASS?
- $f = \frac{number\ of\ waves}{time} = \frac{10}{20} = \frac{1}{T} = \frac{1}{2} = 0.5\ Hz$
- **NOW TRY THIS METHOD FOR WAVES A AND THEN GO FORWARD FOR WAVE B.**



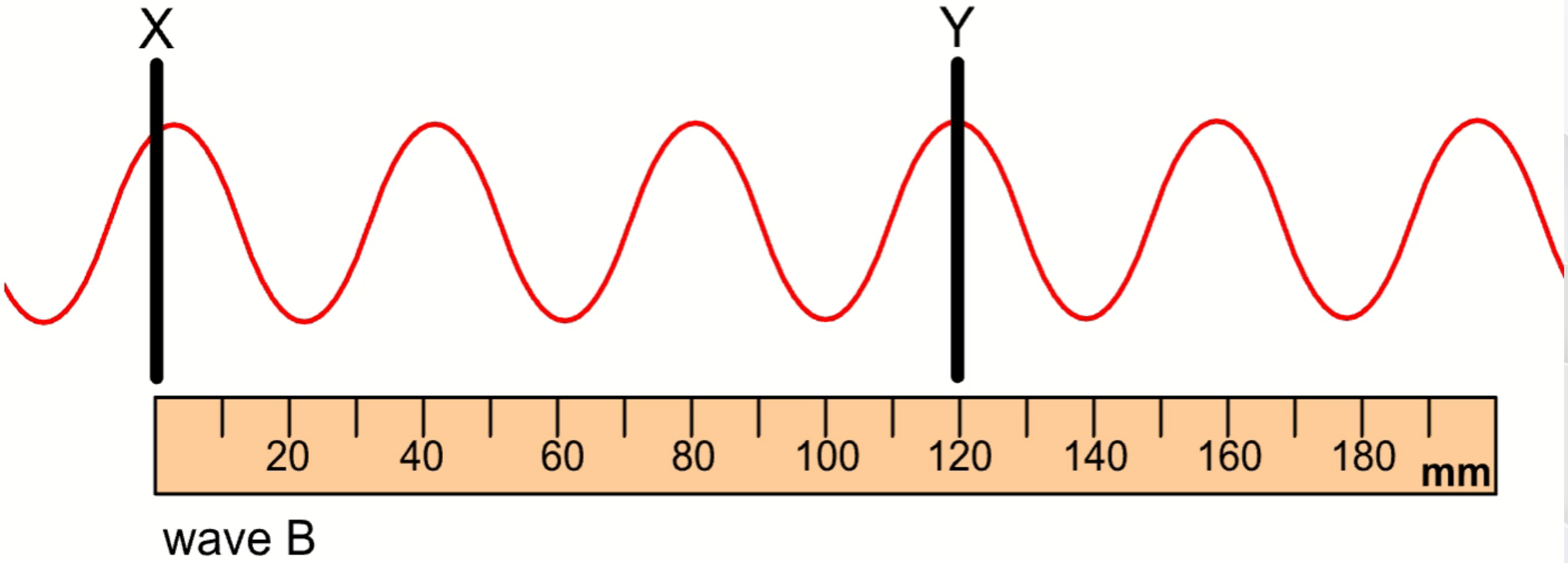
wave A

REPLACE THE NUMBERS IN OUR EXAMPLE WITH THOSE FOR WAVE A

- If 10 waves take 20 seconds to pass Y then how long will it take 1 wave to pass point Y?
- The time for 1 wave is the period, T
- $T = \frac{time}{number\ of\ waves} = \frac{20}{10} = 2s$
- The frequency is the number of waves per second.
- So if one wave takes 2 seconds to pass point Y in 1 second how many waves pass?
- $f = \frac{number\ of\ waves}{time} = \frac{1}{T} = \frac{1}{2} = 0.5\ Hz$



FIND THE FREQUENCY AND PERIOD FOR WAVE B



wave B

$$T = \frac{time}{number\ of\ waves} = \frac{???}{10} = ????s$$

The frequency is the number of waves per second.

$$f = \frac{number\ of\ waves}{time} = \frac{10}{????} = \frac{1}{T} = \frac{1}{????} = ????\ Hz$$

QUESTIONS ON FREQUENCY AND PERIOD.

1. State the frequency of the waves if 10 waves are produced in one second. **10 Hz**
2. Determine the frequency if 500 waves are produced in one second. **500 Hz**
3. If 10 waves are produced in 2.0 seconds, then 5 waves must be produced in 1.0 second. Calculate the frequency of the wave in this case. **5 Hz**
4. If 20 waves are produced in 2.0 seconds, determine the period of the waves. **0.1 s**
5. If 20 waves are produced in 2.0 seconds, calculate the frequency of the waves. **10 Hz**
6. 6000 waves are produced in 10 seconds. State the frequency of the source. **600 Hz**
7. It takes 0.2s for a source to produce one wave. State the period of the wave and calculate the frequency of the source. **0.2s 5 Hz**
8. 120 waves pass a point in one minute, calculate the frequency and period of the waves. **2 Hz, 0.5s**

Transverse/Longitudinal waves

Key Points

1. Transverse waves are those in which the vibrations are at right angles to the direction of travel
2. Longitudinal waves are those in which the vibrations are in the same direction as the direction of travel
3. Sound waves and seismic waves are longitudinal waves
4. All electromagnetic waves are transverse waves

Describing waves

Key Points

Wave term	Symbol	Definition	Unit	Unit symbol
Crest		highest point of a wave		
Trough		lowest point of a wave		
Wavelength	λ	horizontal distance between successive crests or troughs	metre	m
Amplitude	A	The distance between the midpoint to the crest or trough	metre	m
Wave Speed	v	distance travelled per unit time	metres per second	ms^{-1}
Period	T	the time it takes one wave to pass a point	seconds	s
Frequency	f	number of waves produced in one second	hertz	Hz

Transverse & Longitudinal

Key Points

The period is the time for one wave to pass a point

$$T = \frac{time}{number\ of\ waves}$$

The frequency is the number of waves per second.

$$f = \frac{number\ of\ waves}{time}$$

$$or$$

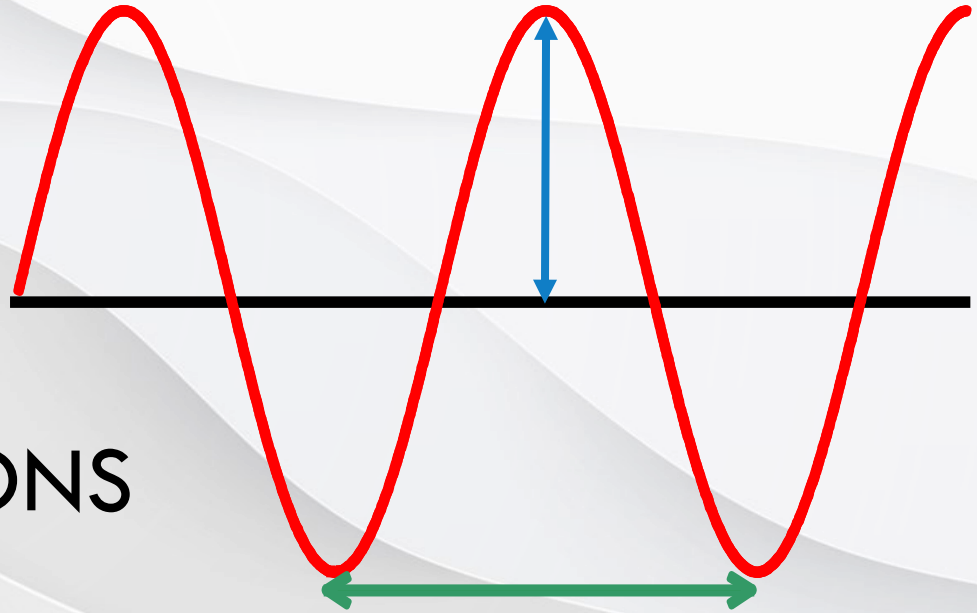
$$f = \frac{1}{T}$$

EXIT TICKET:

IF YOU'VE TIME LISTEN TO THE SONG

HTTPS://WWW.YOUTUBE.COM/WATCH?V=-H8HJXGTOX

Lesson 2



STARTER QUESTIONS

1. COPY AND LABEL THE DIAGRAM USING THE TERMS, *CREST, TROUGH, WAVELENGTH AND AMPLITUDE*.
2. LIST THE GROUP OF WAVES TO WHICH *LIGHT* BELONGS.
3. IN WHICH WAVES ARE THE VIBRATIONS AT *RIGHT ANGLES TO THE DIRECTION OF TRAVEL*.
4. STATE ONE EXAMPLE OF A LONGITUDINAL WAVE.
5. STATE ONE EXAMPLE OF A TRANSVERSE WAVE.

VISIBLE LIGHT LEARNING INTENTIONS

Lesson 2

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

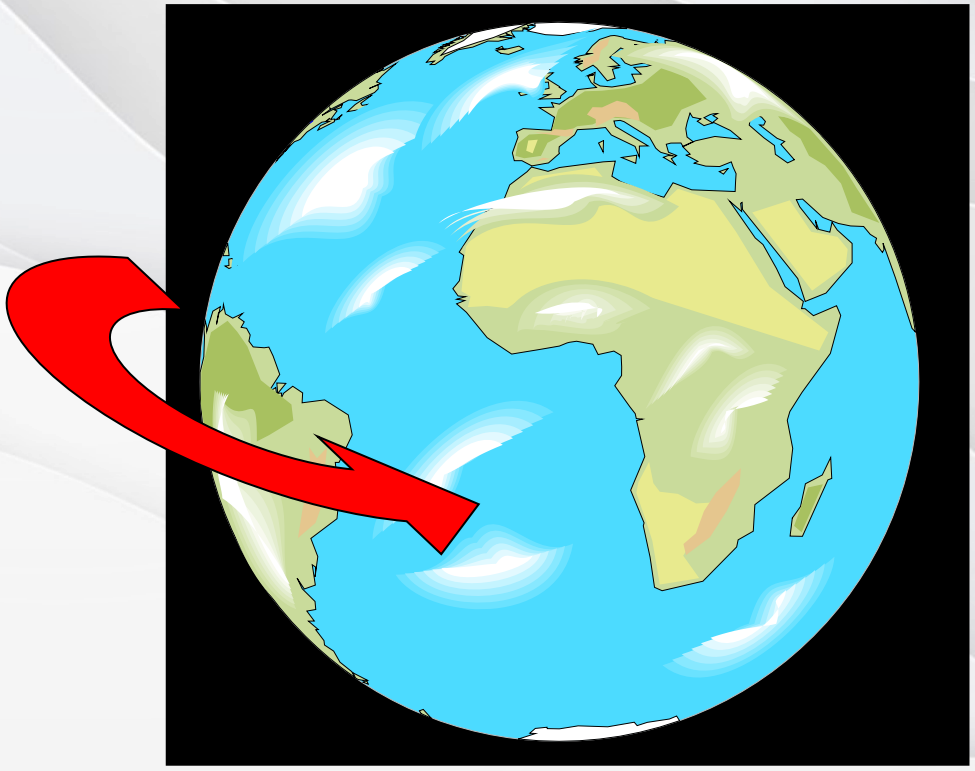
The speed of light in air is 300 million metres per second,

Written as 300 000 000 m/s

Colours are mixed to give us all the colours of the spectrum (a rainbow)

- 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)

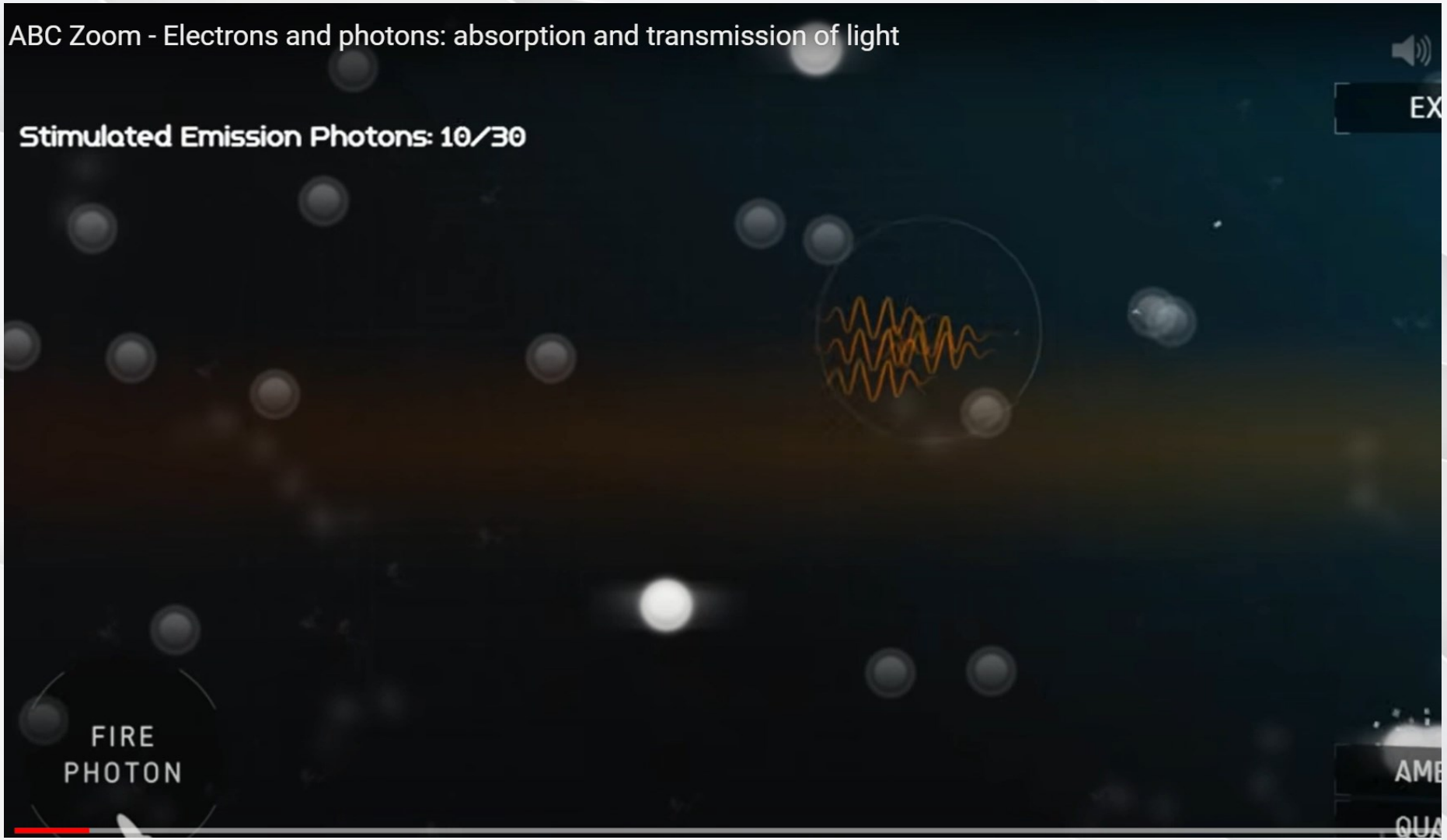


Extension

Here is a simple question with a difficult answer!

How is light made?

ONLY FOR THE MOST CURIOUS!

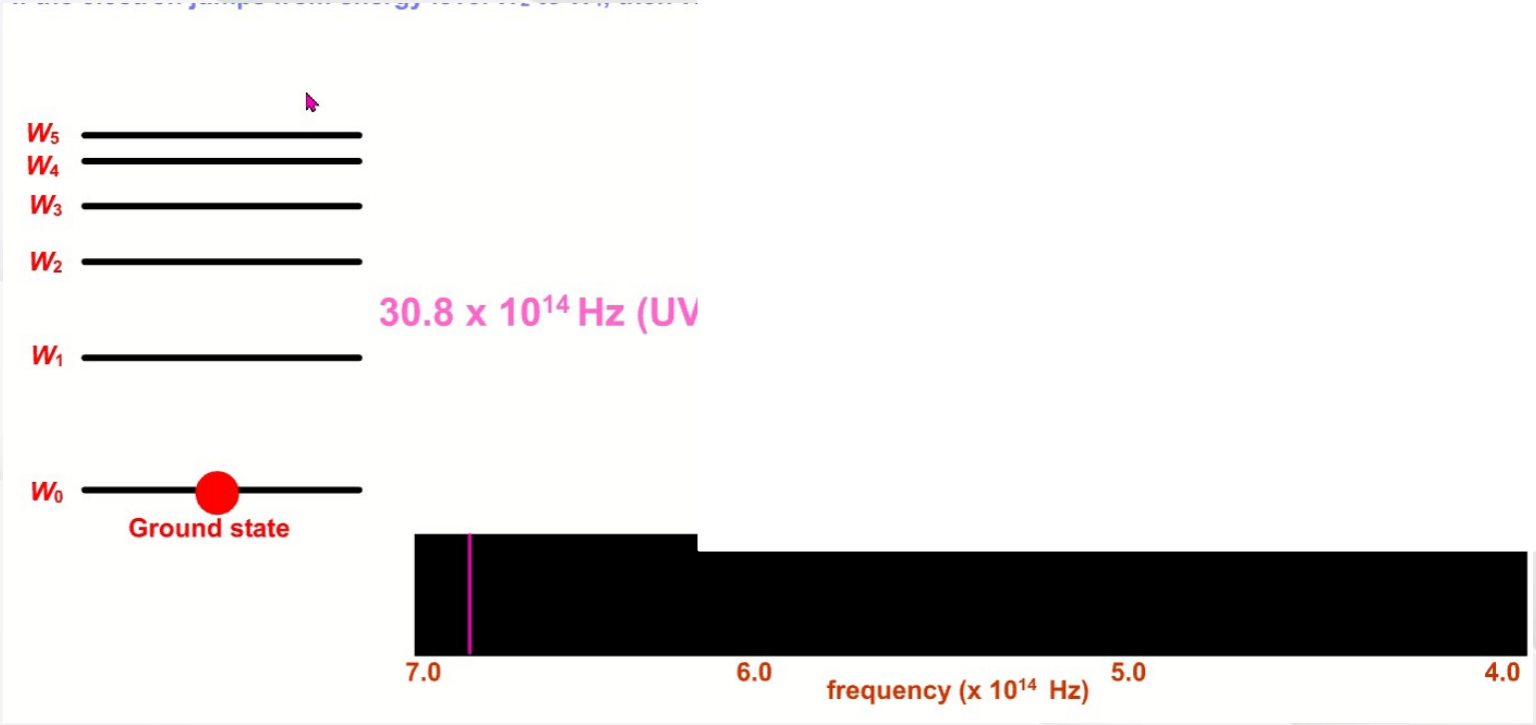


https://www.youtube.com/watch?v=N9nWdNadkIE

YES THINGS THAT BURN OR GET HOT GIVE OFF LIGHT

Extension only

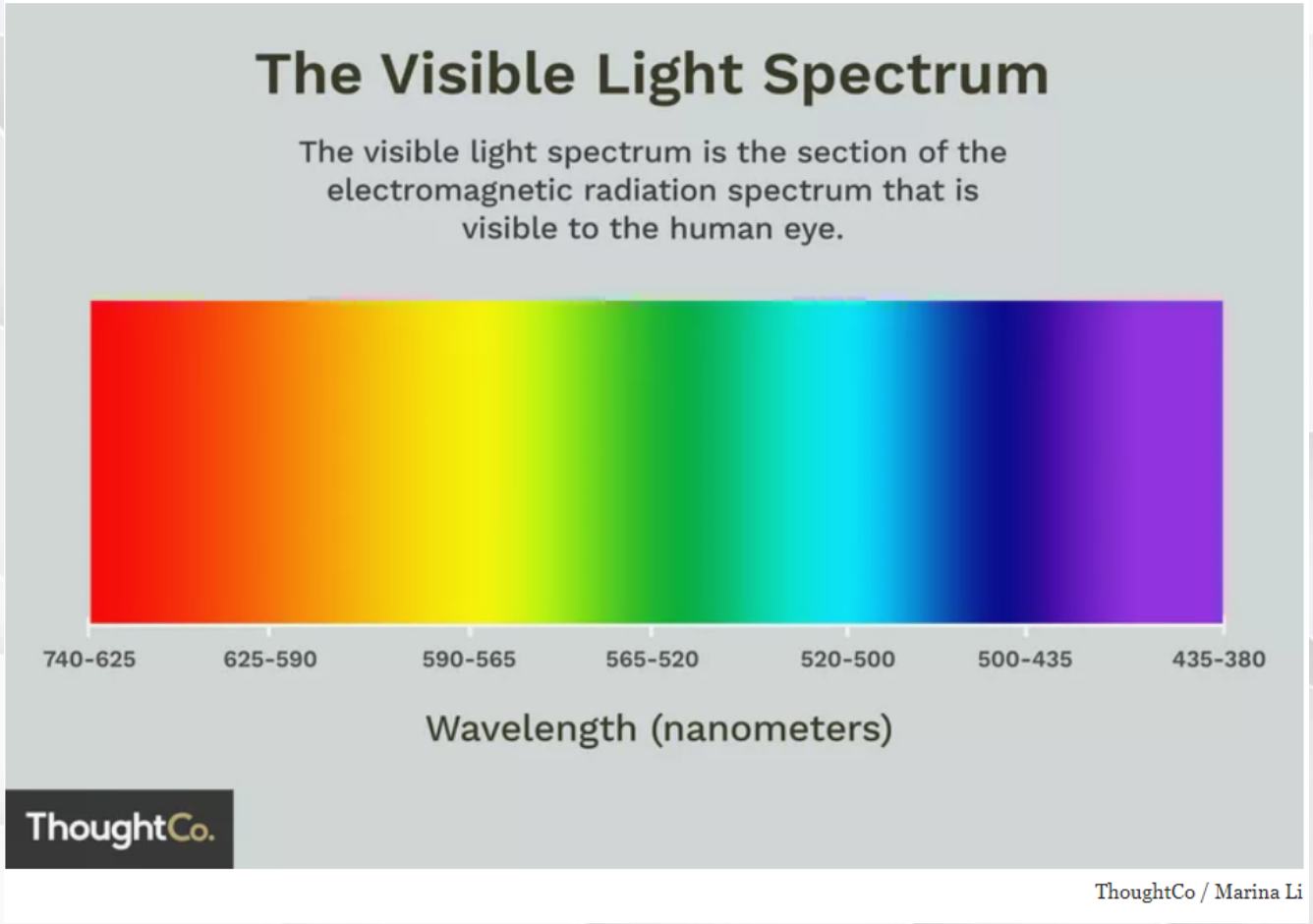
But how?



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

COLOUR MIXING

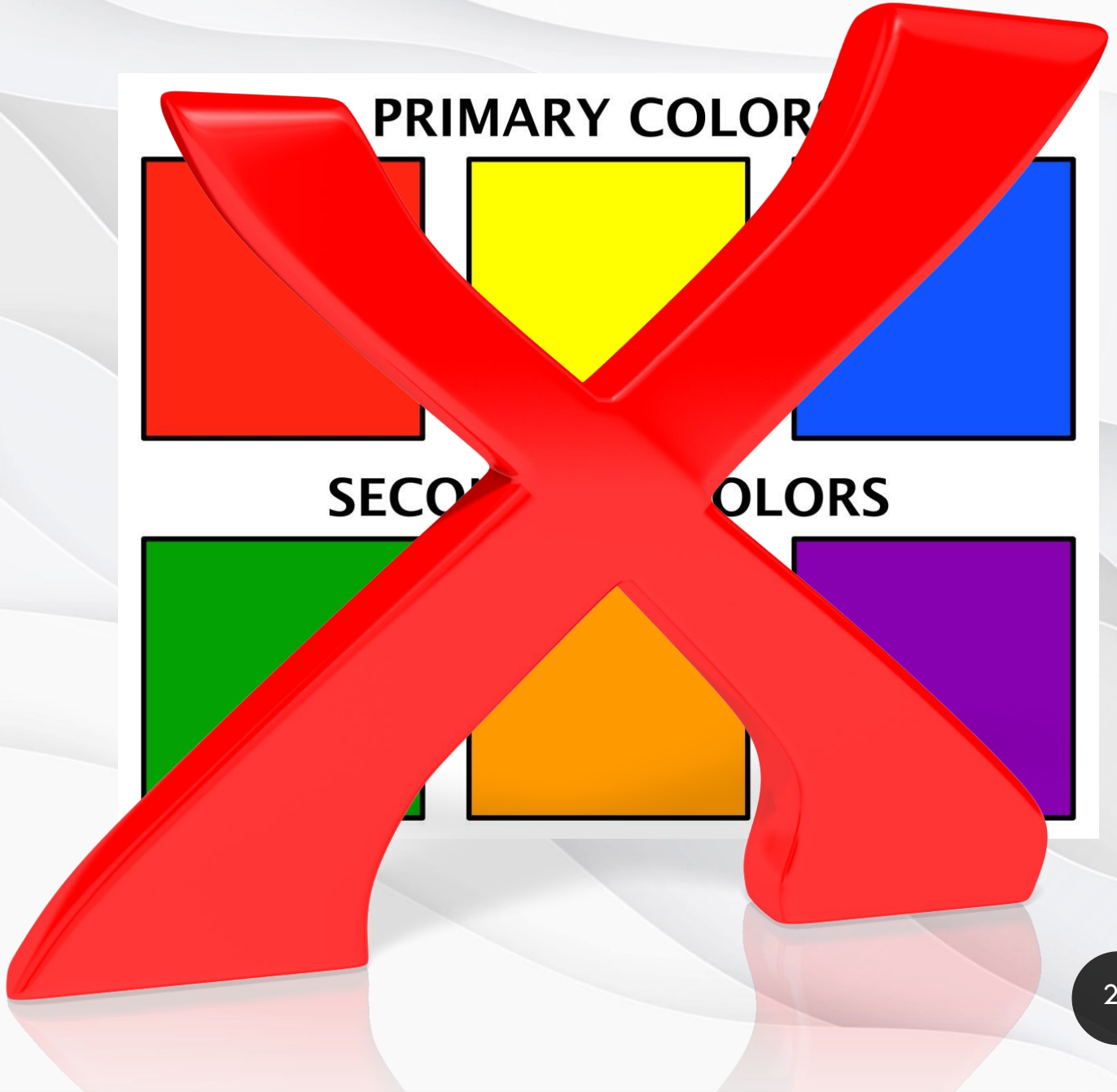
- When people talk about PRIMARY COLOURS what do they mean?



WHO'S RIGHT? ….BOTH

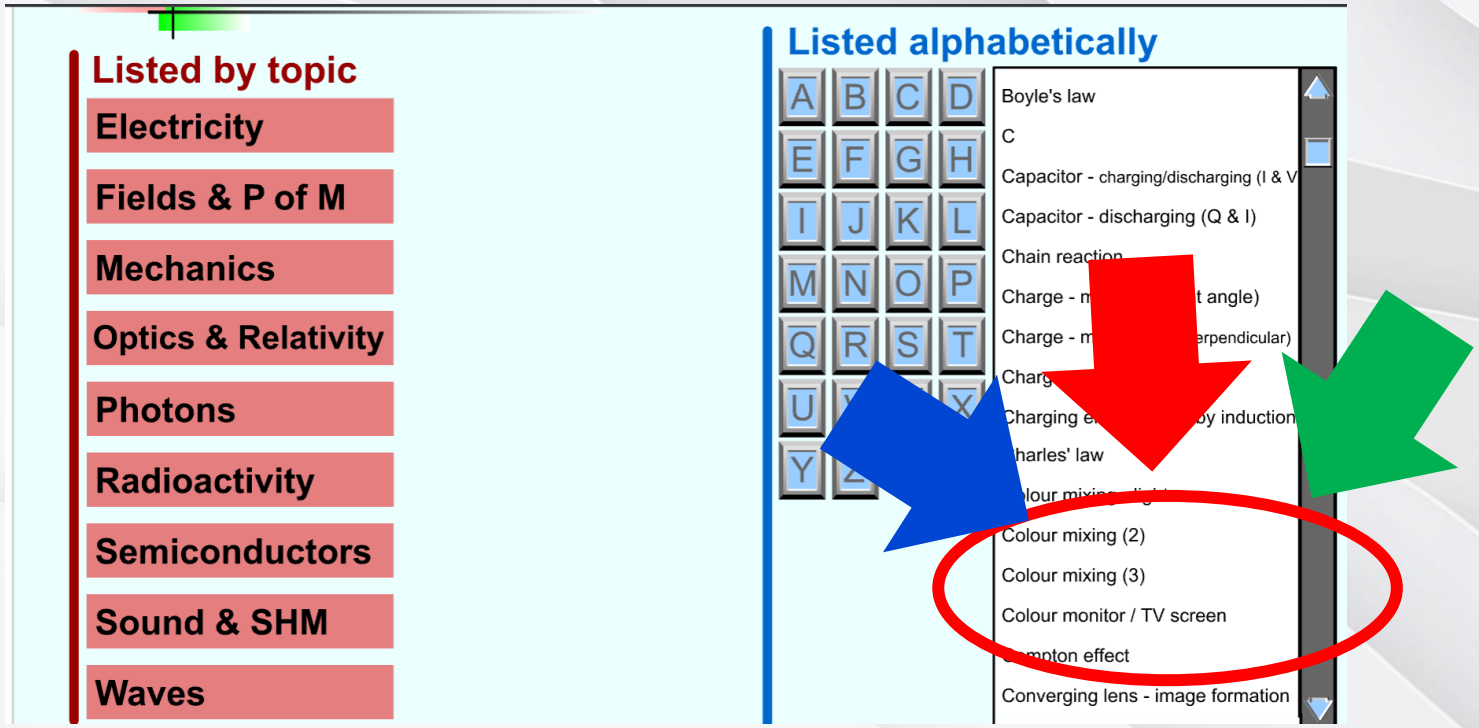
- In Art you might have been taught that the primary colours are
- **RED**, **BLUE**, and **YELLOW**

- IN SCIENCE IT IS DIFFERENT
- THE PRIMARY LIGHT COLOURS ARE **RED**, **BLUE**, AND **…….**

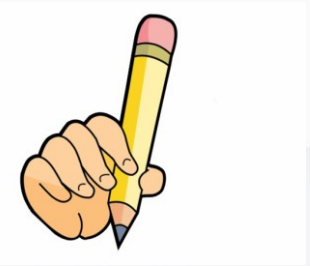


YOUR TEACHER HAS SET UP THE COLOUR MIXER

HTTPS://PHYSICSFLASHREPO.CYOU/FLASH/PHYSICS-2-15/PHYSICS-2-15.HTML



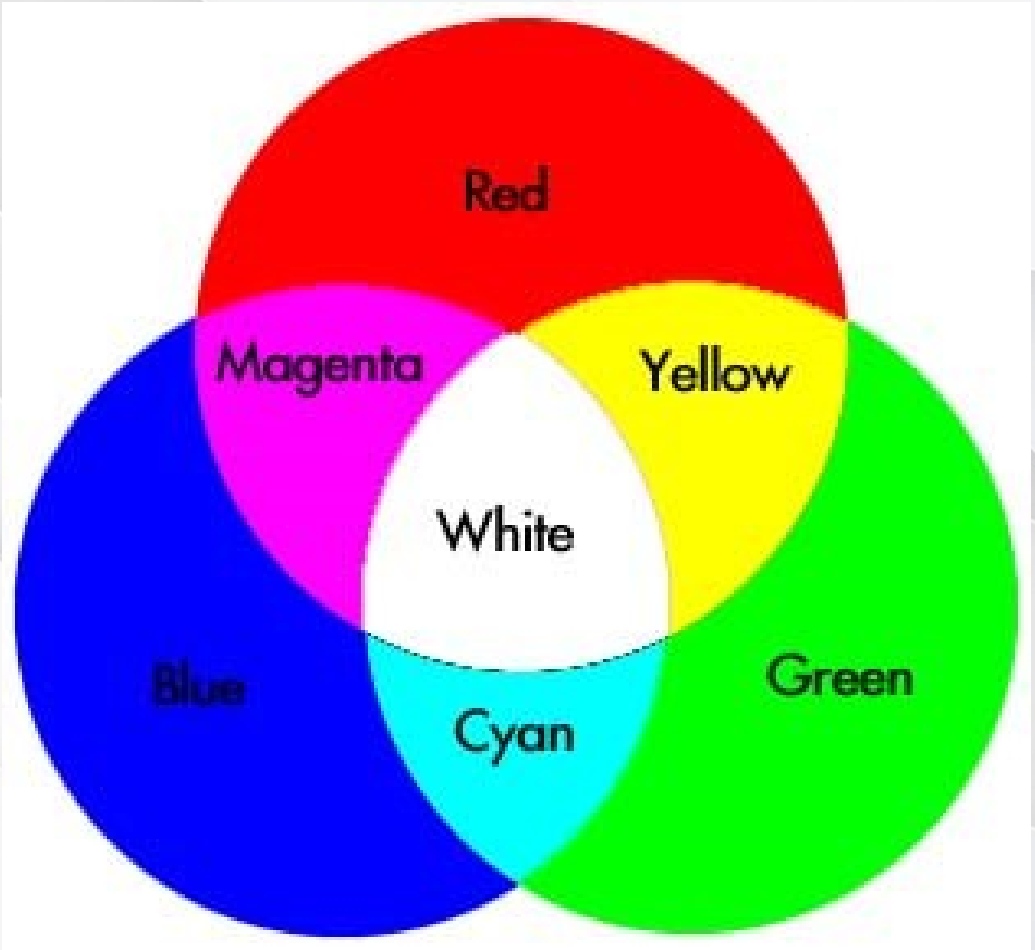
THE PRIMARY LIGHT COLOURS ARE



- RED , GREEN, BLUE

- THE SECONDARY COLOURS ARE
  - MAGENTA (MIX RED & BLUE)
  - CYAN (MIX BLUE & GREEN)
  - YELLOW (MIX RED & GREEN)

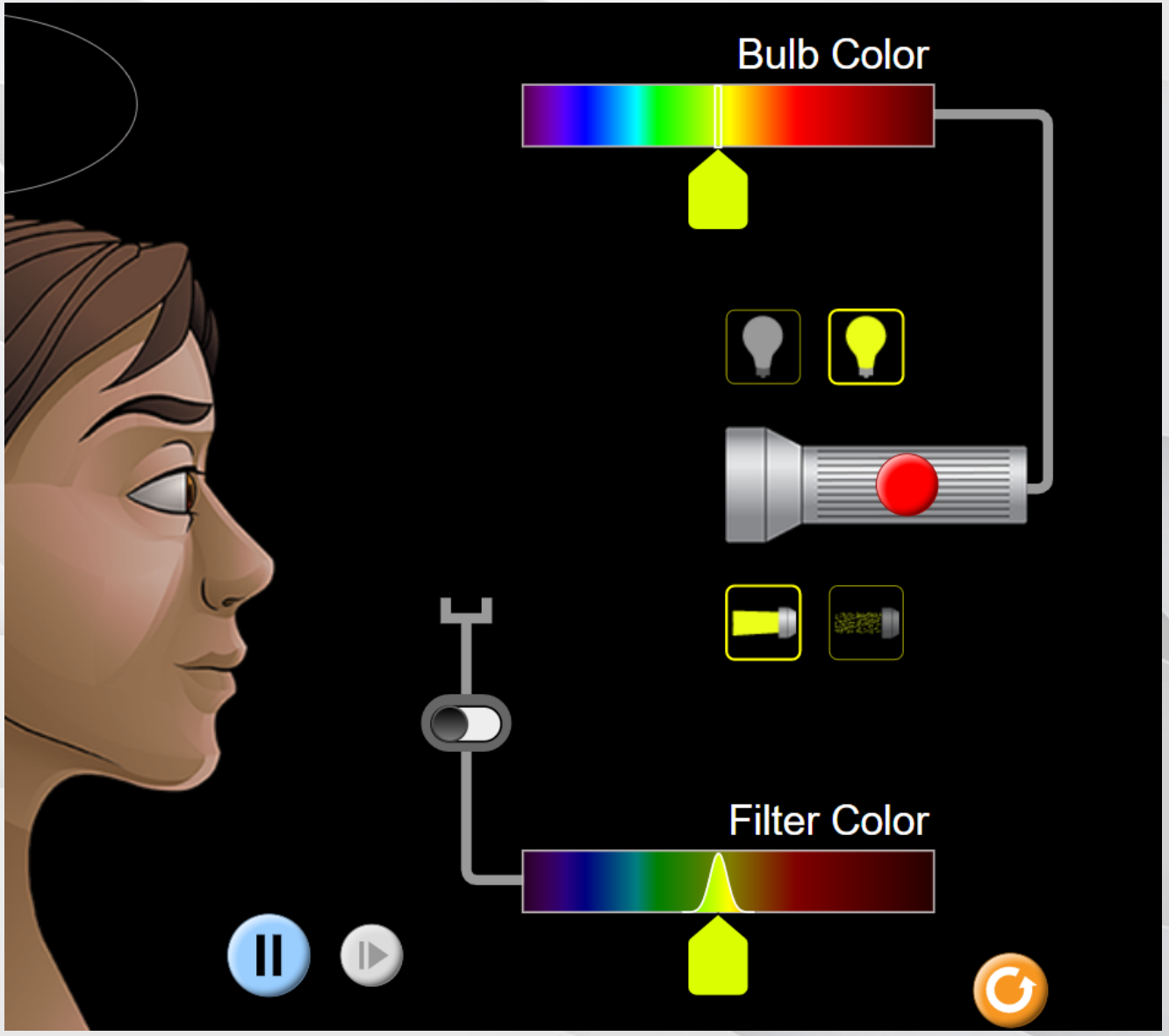
- ALL THE COLOURS MIXED MAKE
  - WHITE LIGHT



COLOUR VISION SIMULATOR

- HTTPS://PHET.COLORADO.EDU/SIMS/HTML/COLOR-VISION/LATEST/COLOR-VISION_EN.HTML

- **CAN YOU MAKE THE COLOUR ORANGE?**
- **CAN YOU MAKE THE COLOUR TAN?**
- **TRY TO MAKE THE COLOUR INDIGO**

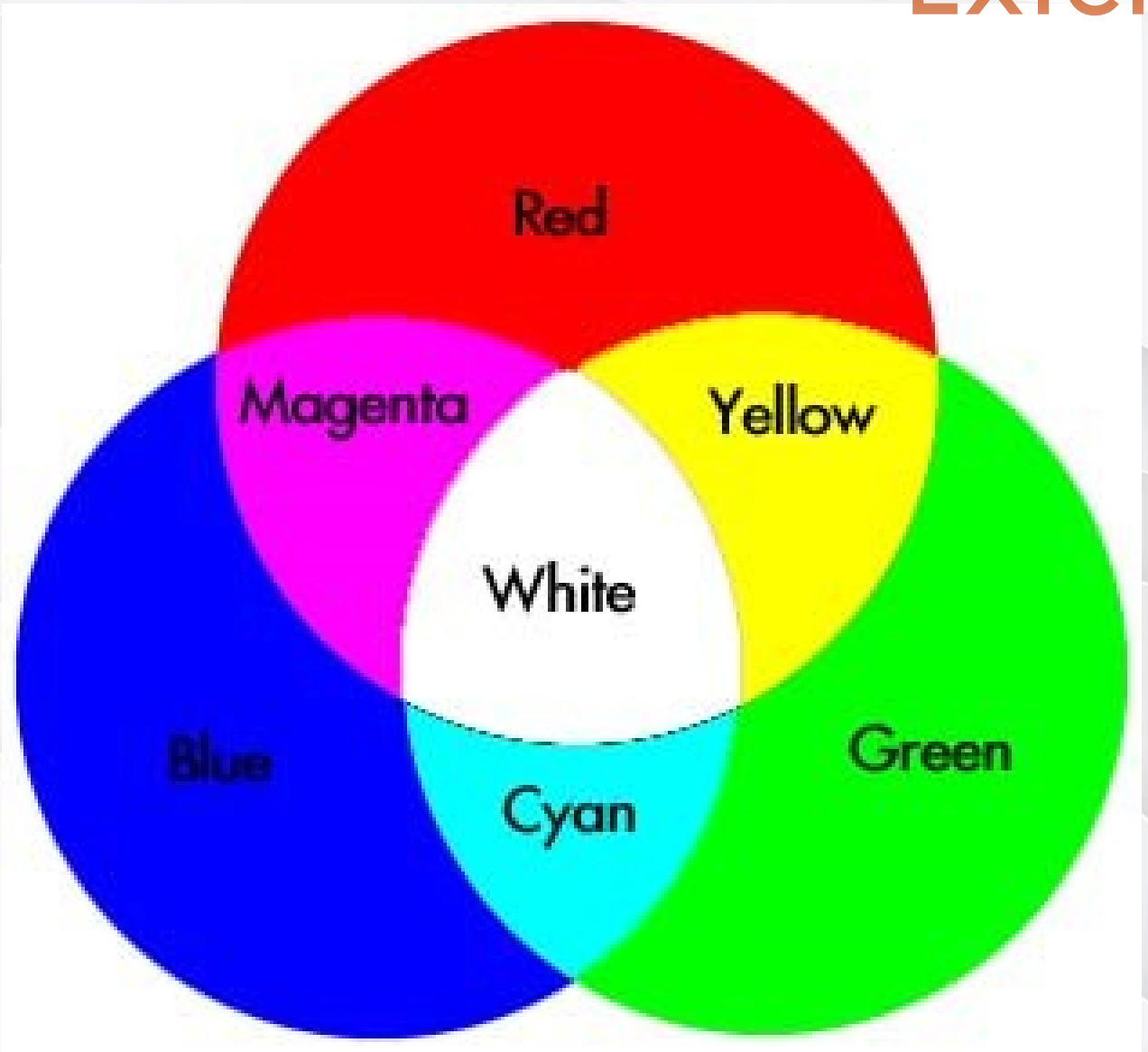


Extension

COLOUR MIXING

- HTTPS://WWW.CYBERPHYSICS.CO.UK/TOPICS/LIGHT/COLORADDITION.HTML

Going further, colour subtraction
Why are the cartridges in a colour printer magenta, yellow and cyan?



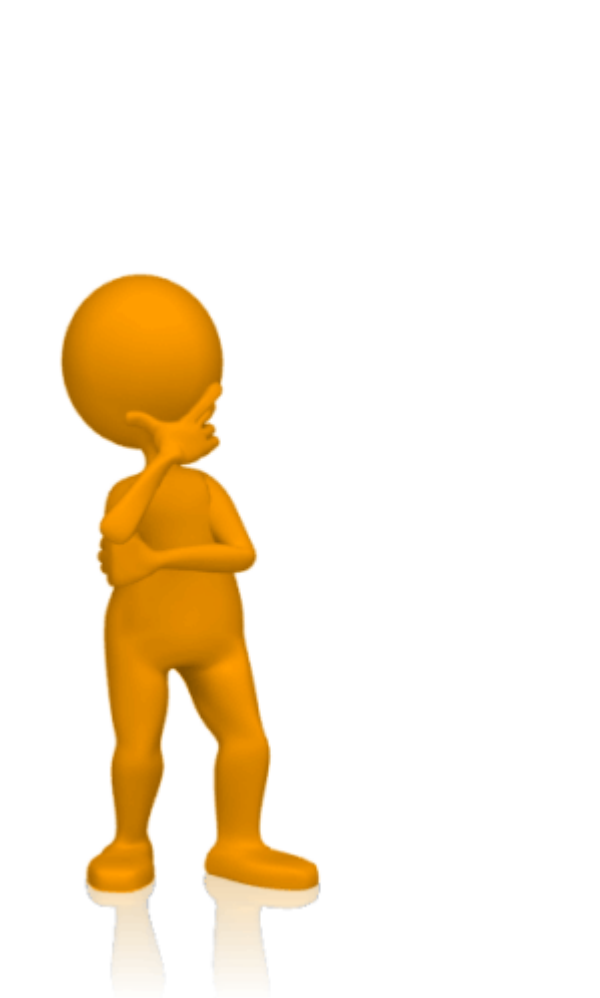
EXIT PASS

Exit Ticket

Record at least 2 primary light colours and at least 1 secondary light colour.

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

Lesson 3



Starter Questions

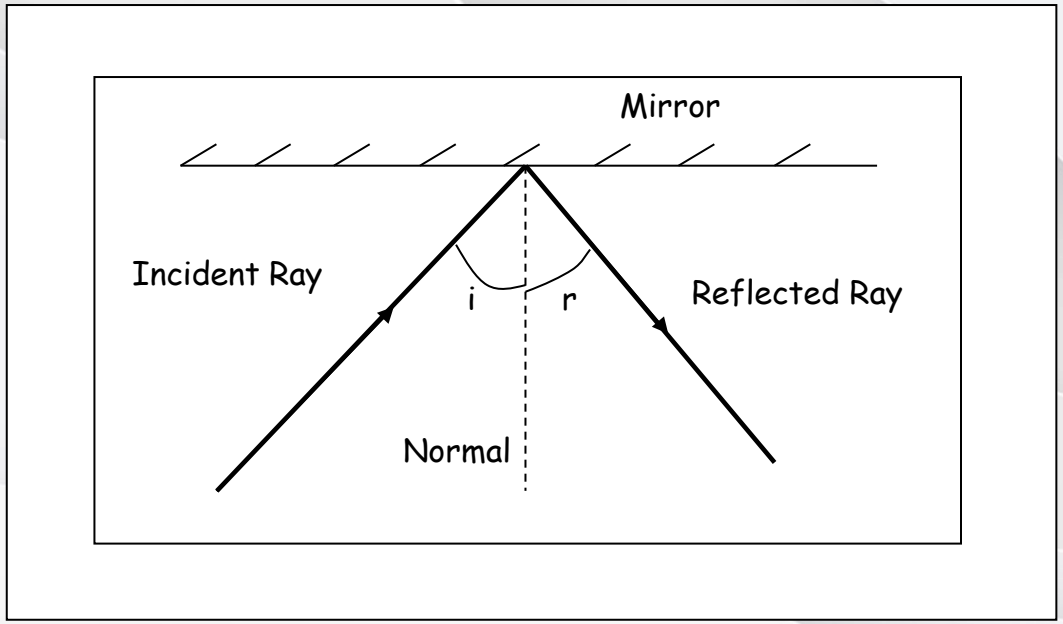
1. IF 6 WAVES PASS A POINT IN 2S, CALCULATE THE FREQUENCY OF THE WAVES?
2. IF 6 WAVES PASS A POINT IN 2S, CALCULATE THE PERIOD OF THE WAVES?
3. STATE THE PRIMARY LIGHT COLOURS
4. STATE WHAT COLOURS OF LIGHT ARE NEEDED TO MAKE THE COLOUR YELLOW
5. HOW DO WE MAKE ORANGE WITH LIGHT?

Lesson 3

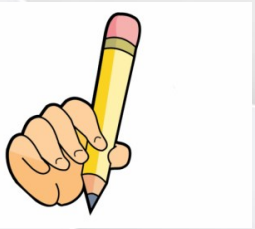
By the end of this lesson I will

- Know some properties of waves
- Learn the terms, normal, incident ray, reflected ray, angle of incidence, angle of reflection
- Complete a practical to find the link between the angle of incidence and the angle of reflection
- State the principle of reversibility of a ray of light

REFLECTION OF LIGHT

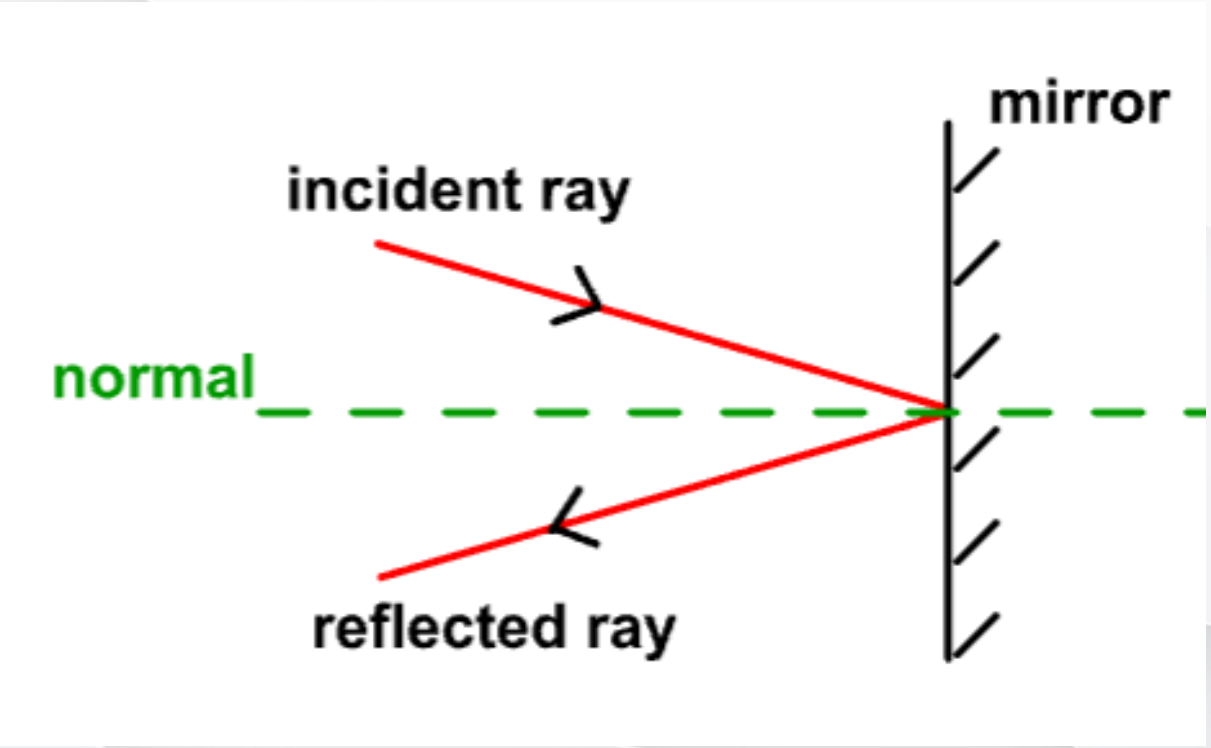


When light reflects off a mirror, we can study what happens to it. However, we need to understand some terms first of all.



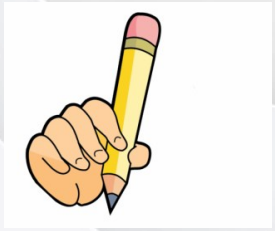
WORDBANK

- **Normal**: an imaginary line at right angles from a surface at the point where the incident ray strikes the mirror. All angles are measured from the normal



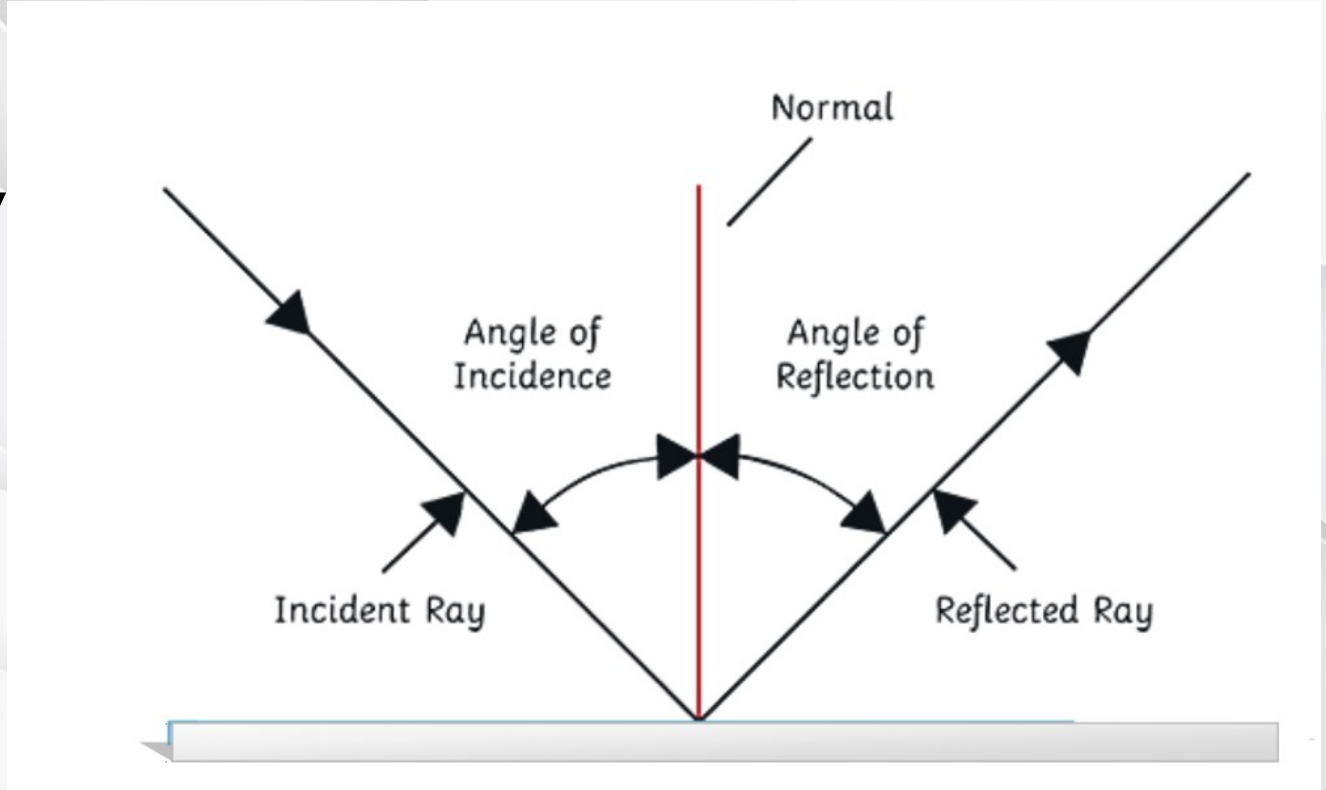
Incident ray: the incident ray is the beam of light that is being shone on to a mirror.

Reflected ray: is the beam of light that has bounced off a mirror.

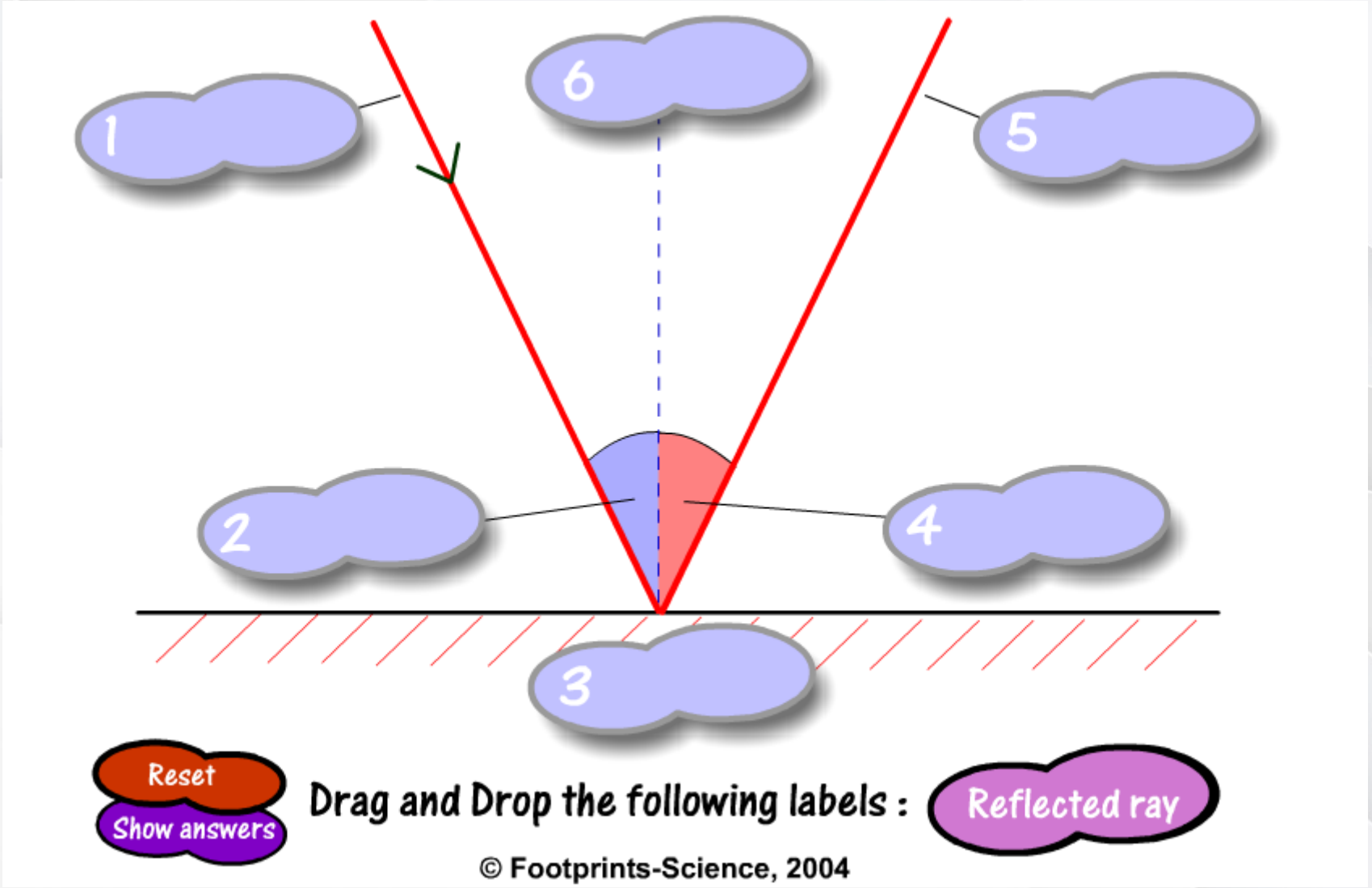


WORDBANK (CONTINUED)

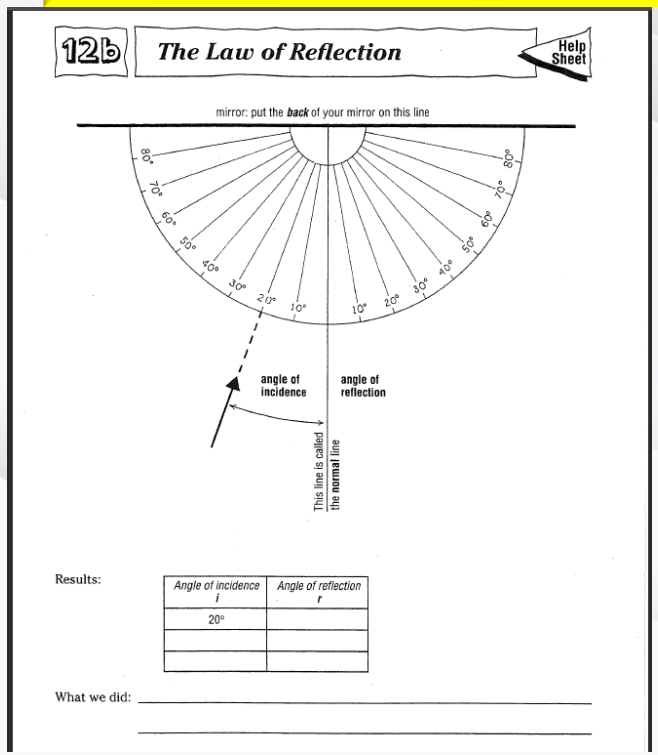
- **Angle of incidence**: the angle measured from the normal to the incident ray
- **Reflected ray**: the angle measured from the normal to the reflected ray.
- ALL ANGLES ARE MEASURED FROM THE NORMAL



Reflection


1
6
5
2
4
3
Reset
Show answers
Drag and Drop the following labels :
Reflected ray
© Footprints-Science, 2004

REFLECTION OF LIGHT


12b The Law of Reflection

Help Sheet

mirror: put the *back* of your mirror on this line

angle of incidence

angle of reflection

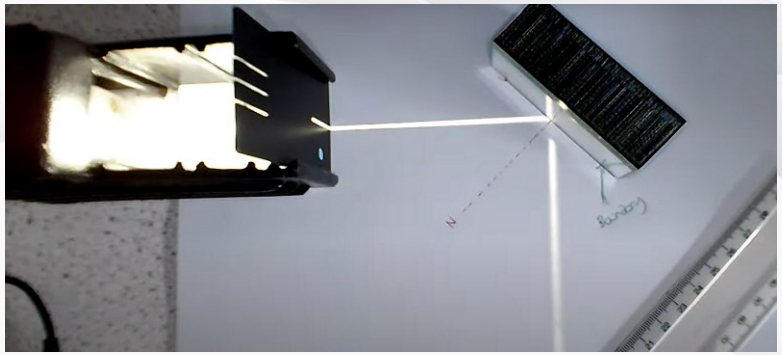
This line is called the **normal** line

Results:

Angle of incidence i	Angle of reflection r
20°	

What we did: _____

how the angle of incidence relates to the angle of reflection



1. COLLECT A SHEET (ONE EACH)
2. SET UP THE EQUIPMENT AS SHOWN
3. CAREFULLY HOLD THE MIRROR ALONG THE LINE MARKED. YOU'LL NEED A FRIEND TO HELP YOU.
4. SHINE A THIN BEAM OF LIGHT 10° FROM THE NORMAL,
5. MARK WHERE IT COMES OUT (THE REFLECTED RAY)
6. MOVE THE BOX TO THE 20° LINE AND MARK WHERE IT COMES OUT
7. REPEAT FOR ALL ANGLES
8. REPEAT BY SHINING THE RAY ALONG THE 10° ANGLE OF REFLECTION LINE. WHAT DO YOU NOTICE?

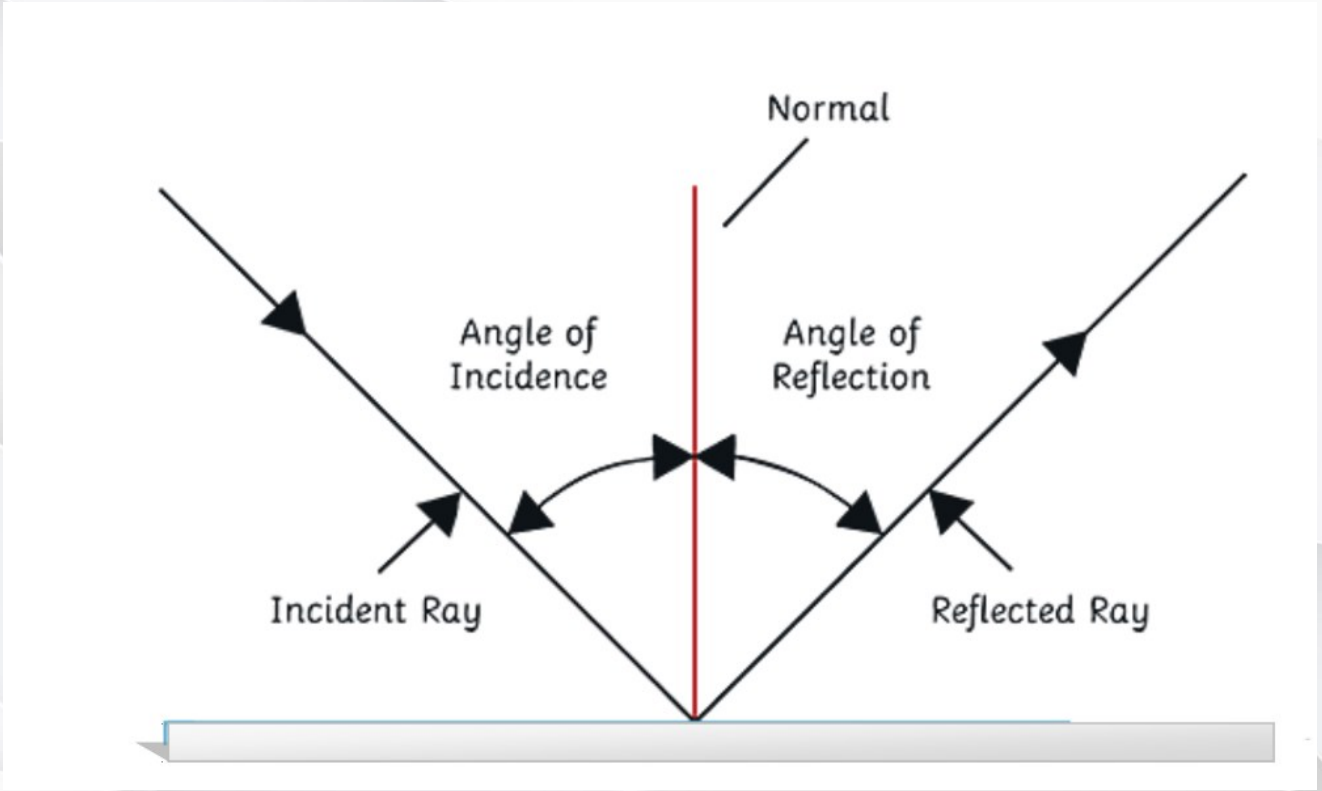
REFLECTION OF LIGHT

Experiment

Write out a brief scientific report in your jotter. This guide should help you:

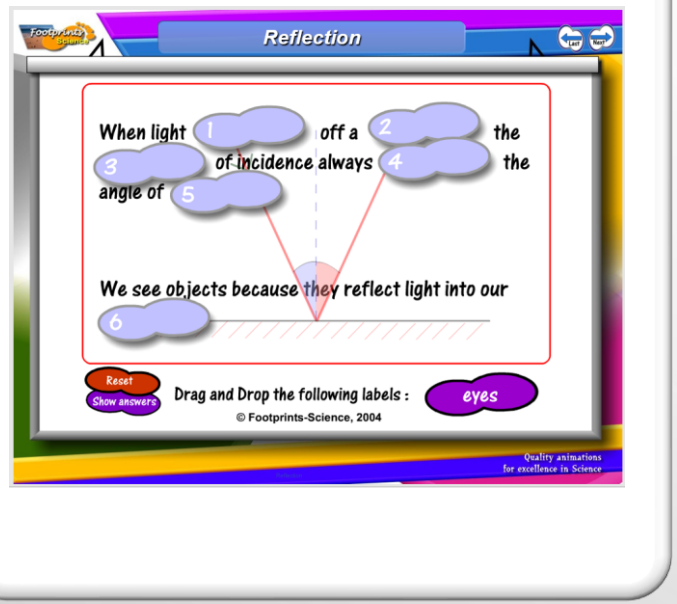
Aim: What are you trying to find out?
Method: How are you going to carry out the experiment? A labelled diagram is needed.
Hypothesis: What do you think will happen?
At this point, you are ready to start the experiment.
Results: A table of results and a graph is often required.
Conclusion: What did you find out? Was your hypothesis correct?

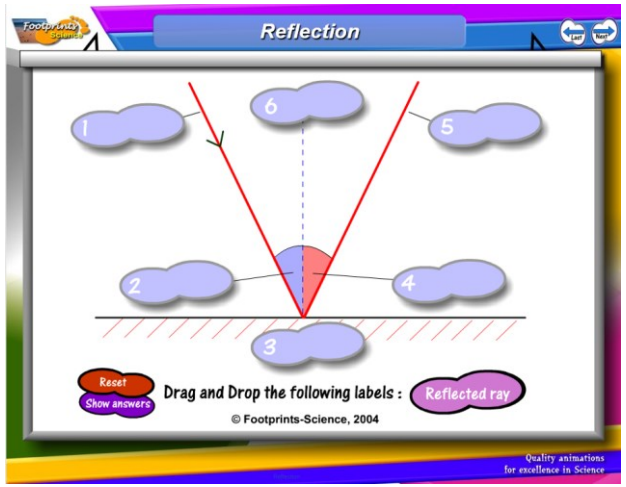
CONCLUSION

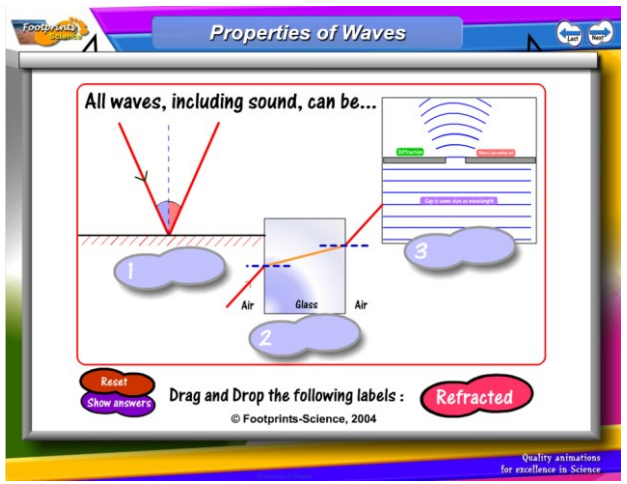


THE ANGLE OF INCIDENCE _____ THE ANGLE OF REFLECTION.

https://simpop.org/reflection/reflection.htm







FOOTPRINT SCIENCE

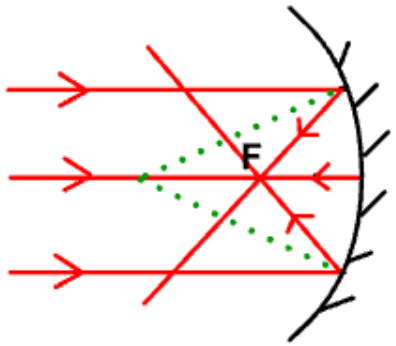
THERE ARE SOME GREAT EXAMPLES OF REFLECTION IN THE FOOTPRINT SCIENCE STUDENTS COULD TRY THESE

https://glowscotland.sharepoint.com/:p:/r/sites/LCKAS2Science/Shared%20Documents/General/CLASS%20RESOURCES/Footprints%20Science/Physical%20processes/Properties%20of%20Waves.pptm?d=w5901974f42a64d94ac93081a1104bcdd&csf=1&web=1&e=l1dSRA

Curved mirrors

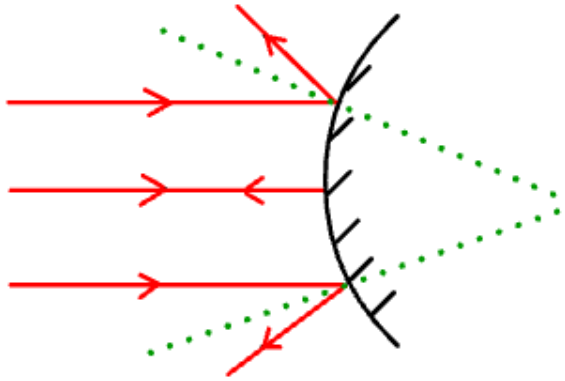
Light can be reflected from curved mirrors.

The CONCAVE mirror has a focussing effect. Parallel rays of light are brought to a single point, called the focus F.



Concave mirror

At each point on the curve of the mirror $i = r$.



Convex mirror

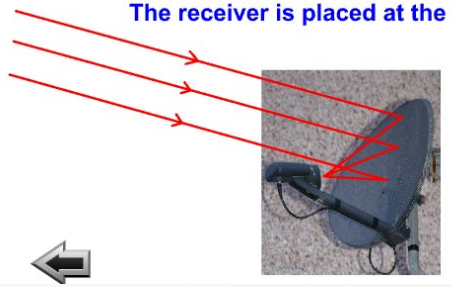
The convex mirror has the effect of making the incident parallel light spread outwards or diverge.

- HTTPS://PHYSICSFLASHREPO.CYOU/FLASH/INT2/INT2-WAVESANDOPTICS.HTML
- REPEAT THE REFLECTION EXPERIMENT USING A CONCAVE AND CONVEX MIRROR, IT IS BEST IF YOU USE THE THREE SLITS ON THE RAY BOX SLIT, BUT YOU CAN USE ONE AND MOVE THE RAY

Uses of curved mirrors

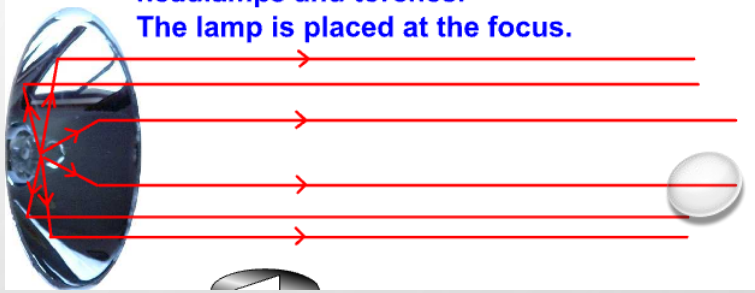
Curved reflectors are used in satellite communication to receive and transmit radio and TV.

The receiver is placed at the focus.

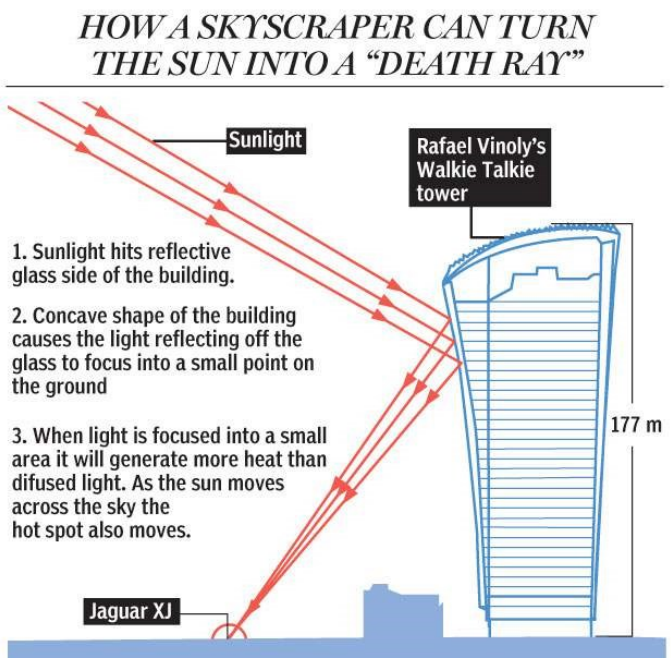


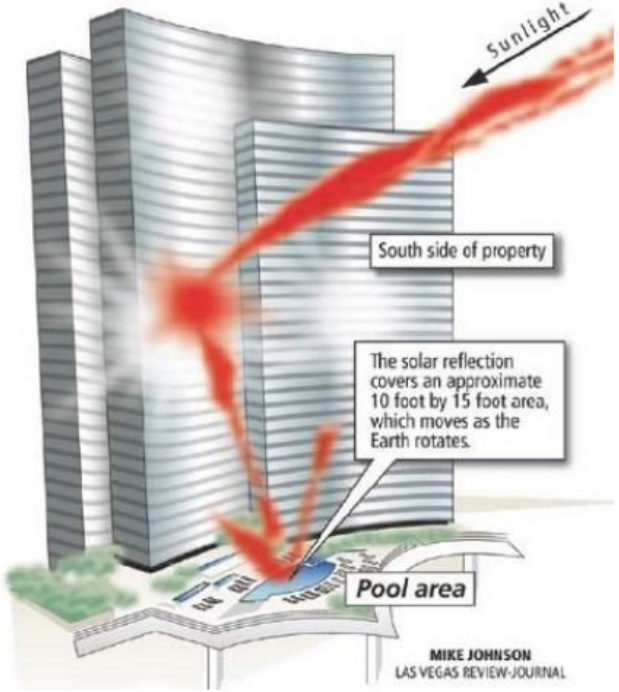
Curved reflectors are used in car headlamps and torches.

The lamp is placed at the focus.



EXTENSION





- IF YOU'VE TIME LOOK UP THE WALKIE TALKIE BUILDING IN LONDON AND FIND OUT WHAT THE ARCHITECTS OUGHT TO HAVE THOUGHT ABOUT IN THE DESIGN.
- LOOK UP THE VDARA HOTEL LAS VEGAS WHAT SHOULD THE ARCHITECTS HAVE KNOWN?

EXIT PASS

1. State the law of reflection
2. State from where all angles are measured.
3. State the meaning of the term *angle of incidence*
4. State the meaning of the term *angle of reflection.*
5. *Why doesn't light reflect off a black surface?*
6. *Or join in the song below!*

HTTPS://WWW.YOUTUBE.COM/WATCH?V=-H8HJXGT

Lesson 4

STARTER QUESTIONS

1. LIST THE GROUP OF WAVES TO WHICH LIGHT BELONGS.
2. IN WHICH WAVES ARE THE VIBRATIONS AT RIGHT ANGLES TO THE DIRECTION OF TRAVEL.
3. STATE THE MEANING OF THE TERM “NORMAL” WITH LIGHT
4. STATE THE LAW OF REFLECTION.
5. STATE HOW ANGLES ARE MEASURED WHEN USING LIGHT.

Lesson 4

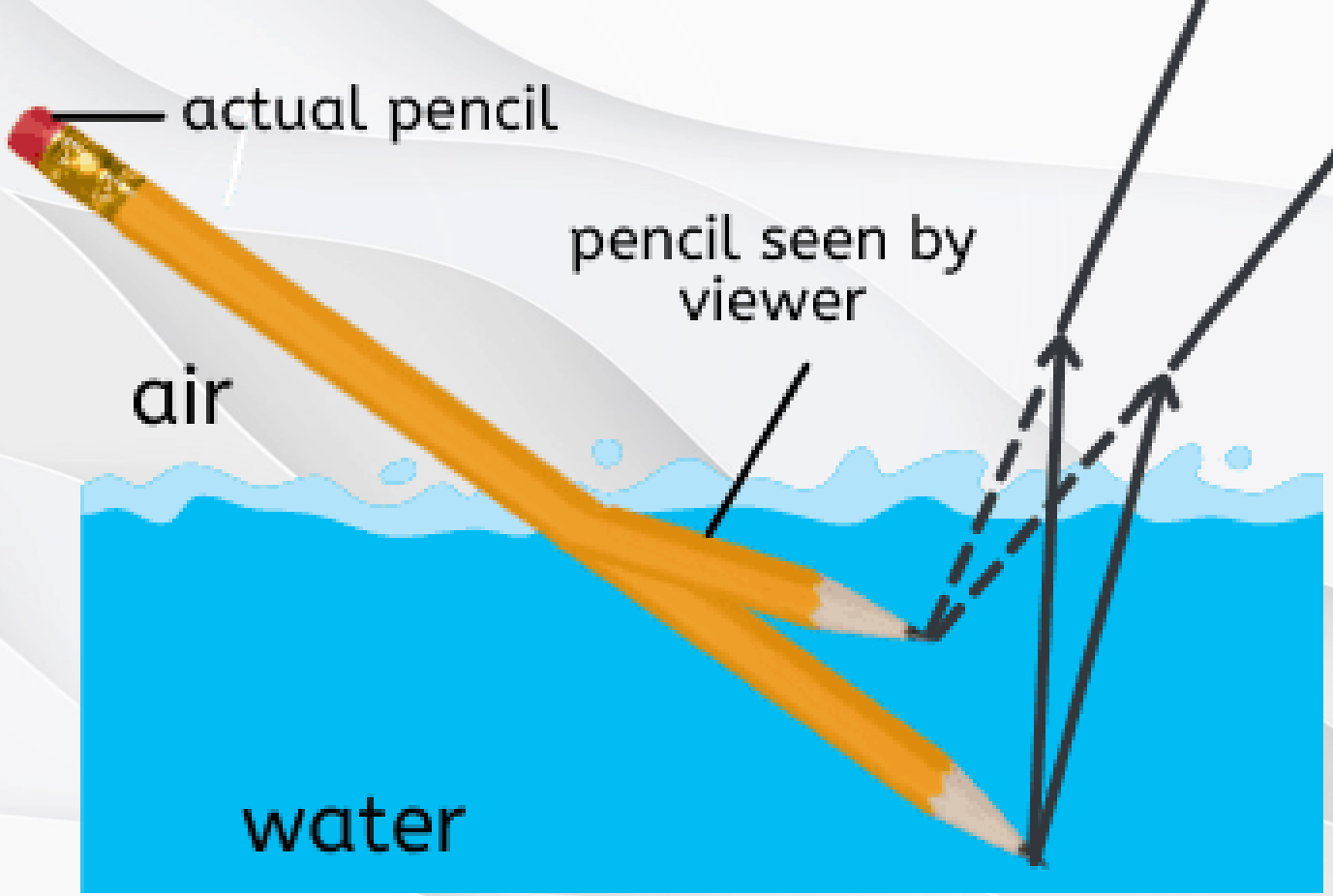
By the end of this lesson I will

Know the meaning of the term refraction.

Know what happens to a ray of light as it enters and leaves a glass/ Perspex book.

Complete a practical to find how the angle of incidence and the angle of refraction change when entering a block

WHY?



REFRACTION

REFRACTION DEFINITION

- Refraction is a change in the speed and wavelength of a wave as it moves into a material of different optical densities and it can lead to a change in direction of the wave.

REFRACTION- DEFINITION

Never say the word BEND with REFRACTION, it is a change of direction

- **REFRACTION** IS THE **REDUCTION** IN SPEED AND WAVELENGTH AS A WAVE MOVES INTO A MORE OPTICALLY DENSE MATERIAL. THIS OFTEN INVOLVES A CHANGE OF DIRECTION. (FREQUENCY STAYS THE SAME)

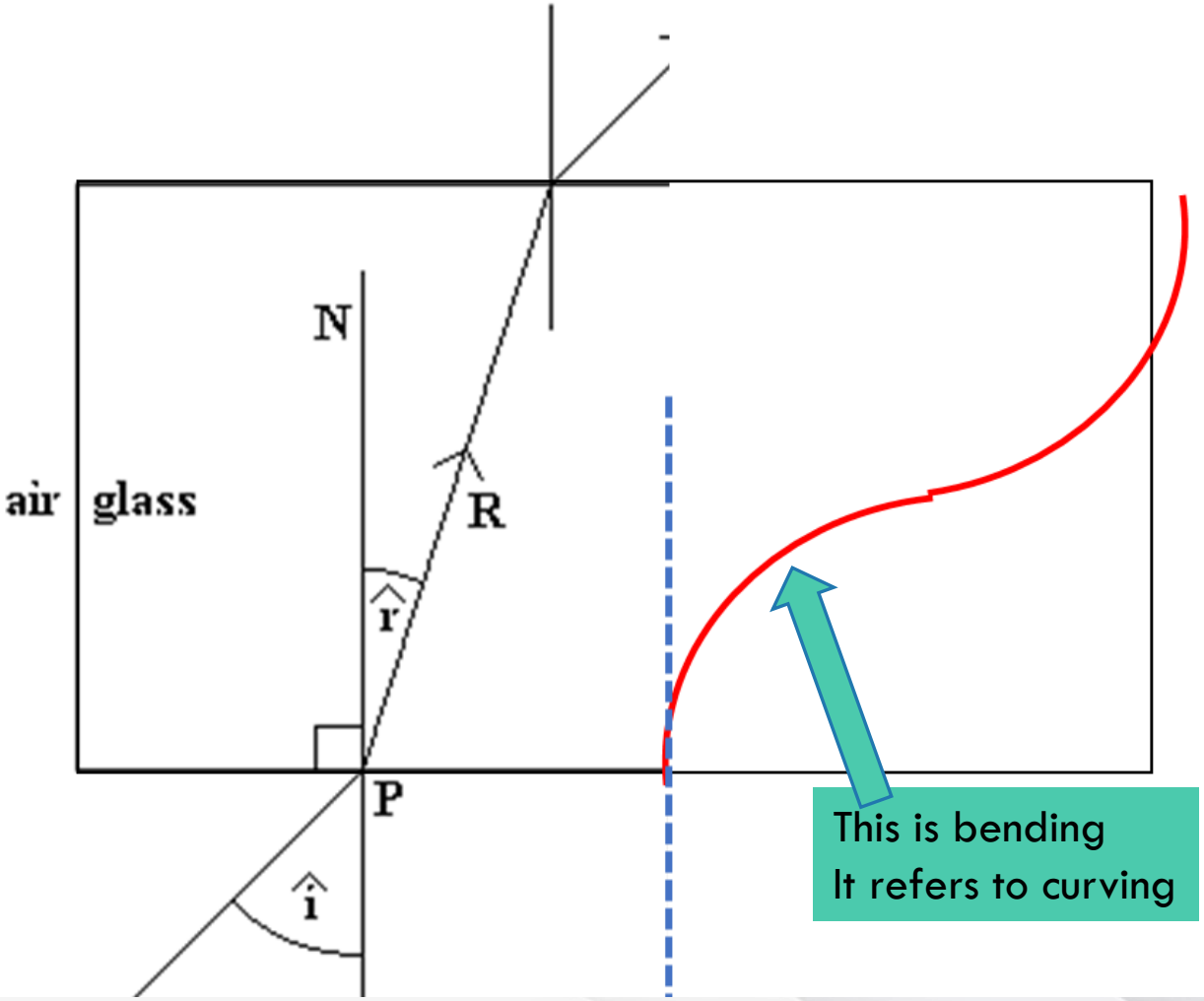
OR

Refraction is the **increase** in speed and wavelength as a wave moves into a less optically dense material. This often involves a change of direction. (frequency stays the same)

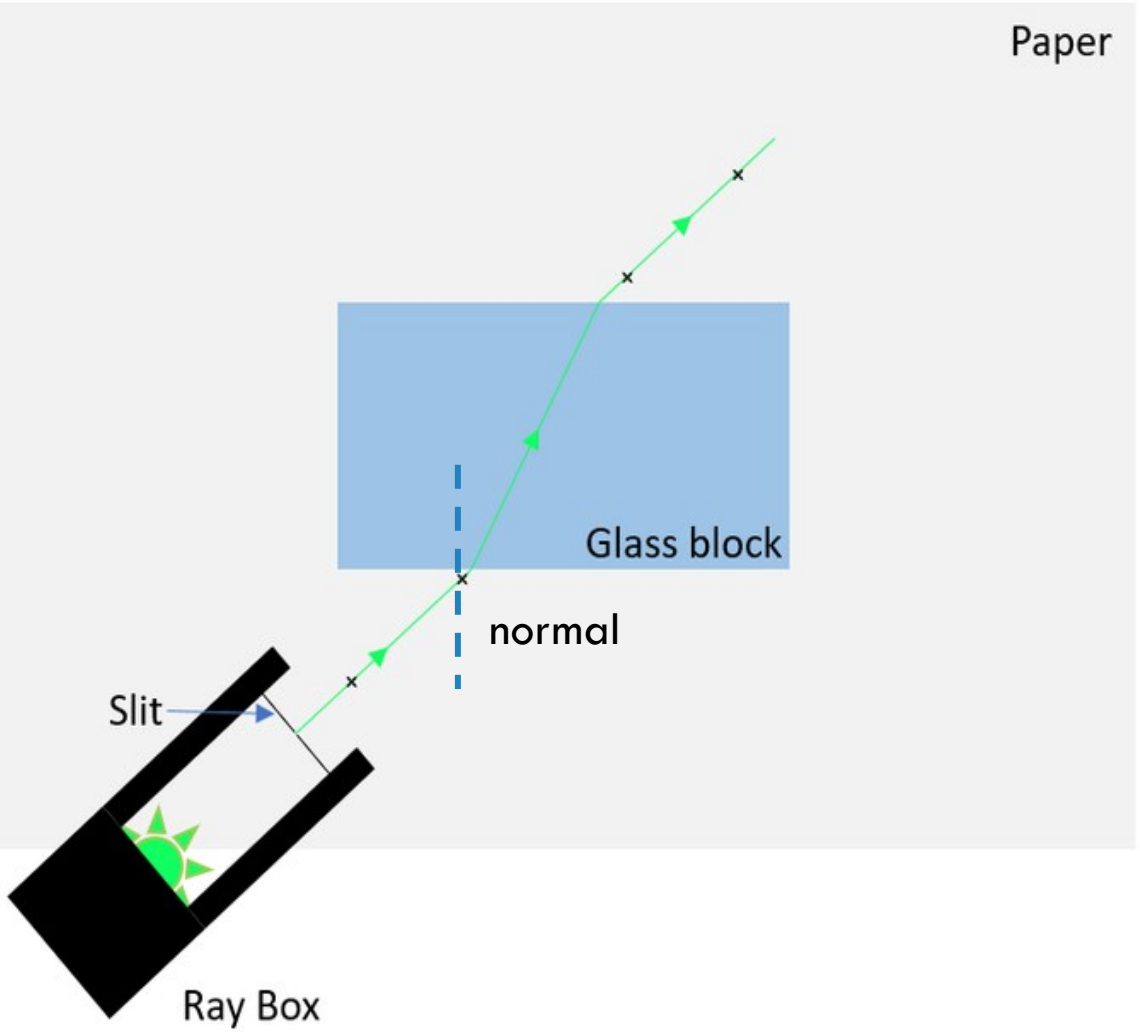
YOU'LL EVEN SEE REFRACTION AND BENDING IN TEXT BOOKS!

- Never say Refraction is the bending

x

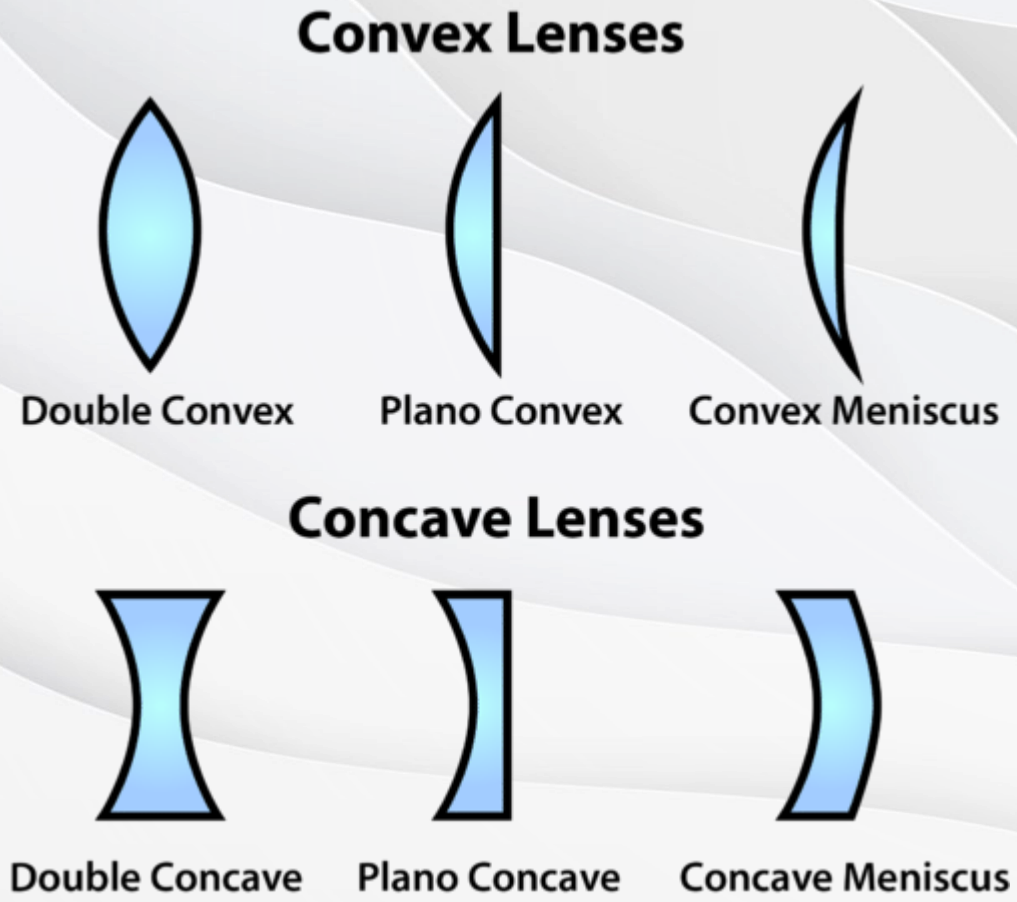


EXPERIMENT



1. Draw around a rectangular perspex block, **using a pencil only.**
2. Remove the block and draw on the normal 1/3 up from the bottom of the block, using a protractor.
3. Replace the block exactly on the line.
4. Shine a single ray into the block at the spot between the normal and surface.
5. Mark where the ray enters and exits.
6. Remove the block and join up the lines with a ruler. **What do you notice?**

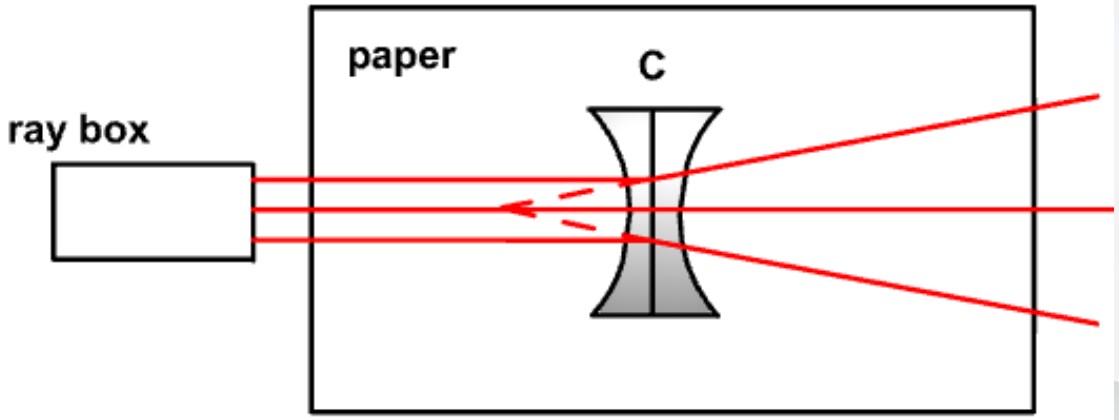
LENSES (NB SINGULAR IS LENS!!)

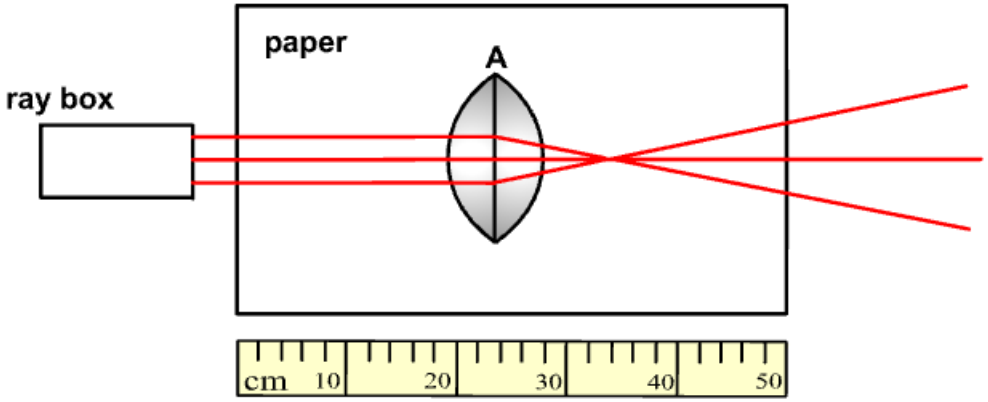


We will use thick and thin double convex and double concave lenses

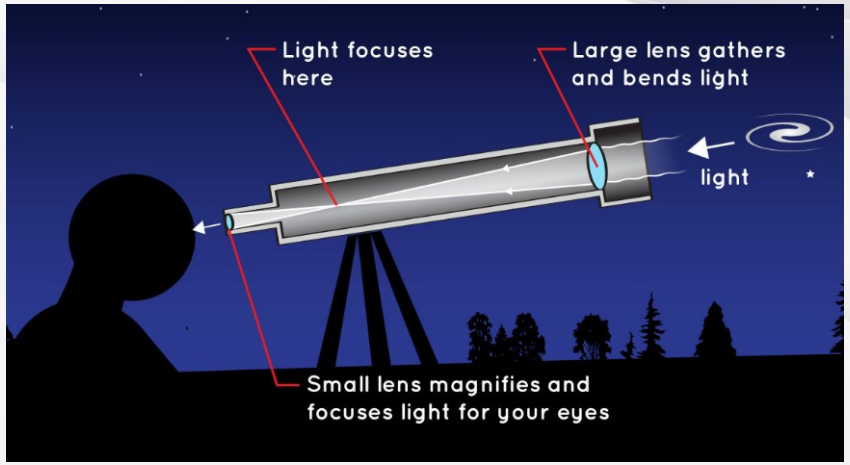
LENSES

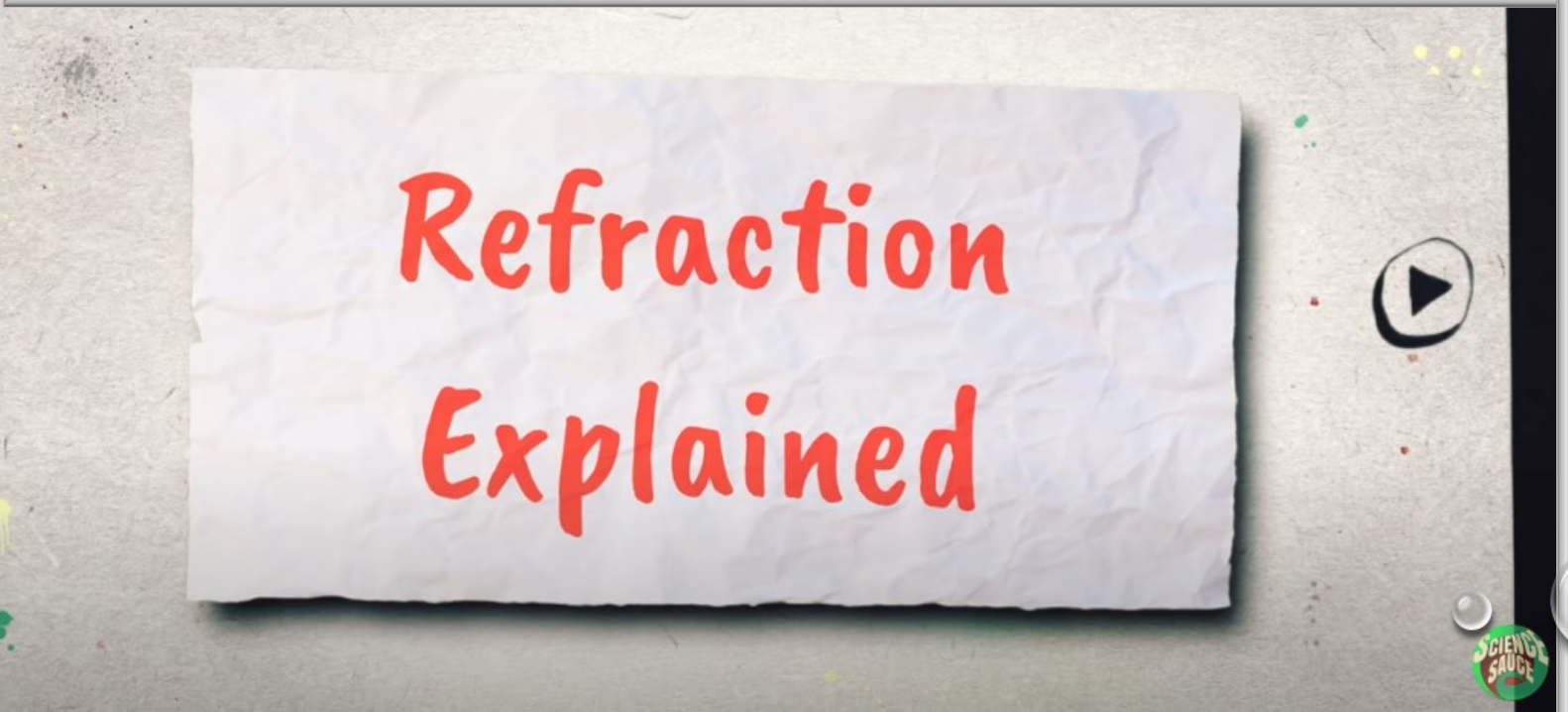
- **TIP YOUR JOTTER SIDEWAYS, AND DRAW AROUND EACH LENS, IN PENCIL, ON THE <u>LEFT</u> OF SIDE OF EACH PAGE. (NOT LIKE IN THE PICTURE!)**
- DRAW AROUND EACH OF THE 4 LENSES,. **THE 4 LENSES ARE** FAT AND THIN CONVEX AND FAT AND THIN CONCAVE
- SHINE 3 RAYS FROM YOUR RAYBOX (THE RAYS SHOULD COME OUT PARALLEL FROM THE RAYBOX)
- MARK THE RAYS GOING INTO THE LENS AND COMING OUT
- **THE MIDDLE RAY OUGHT TO GO STRAIGHT THROUGH WITHOUT DIVERTING**





USES OF CONCAVE AND CONVEX LENSES





A MODEL TO EXPLAIN REFRACTION

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

LOCKERBIE ACADEMY VIDEO FOR THE S1 THE VISIBLE AND BEYOND COURSE.

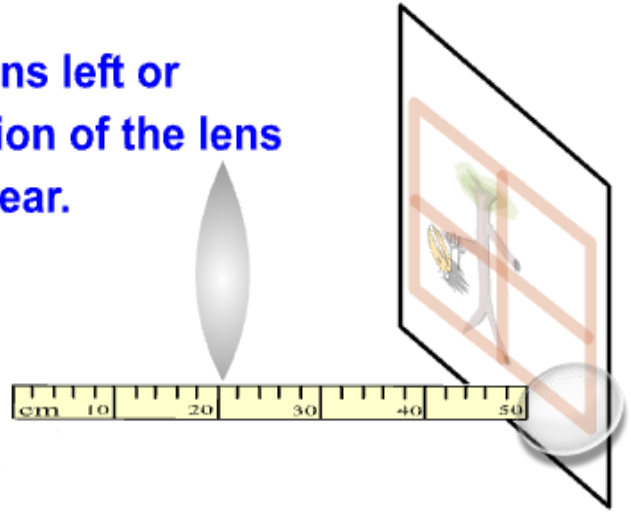
- HTTPS://WWW.YOUTUBE.COM/WATCH?V=ZARXPU43-LS

  BUT PLEASE POINT OUT IT IS NOT CORRECT TO SAY THAT THE LIGHT IS BENT.

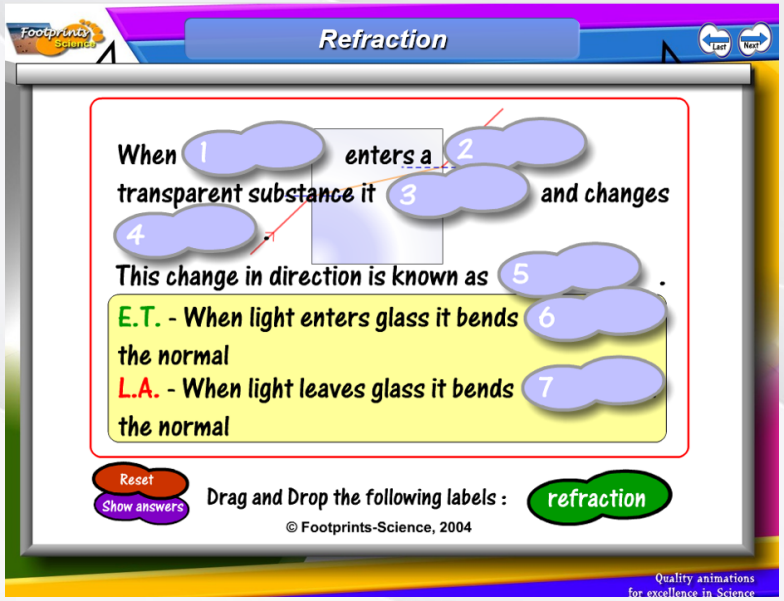
EXTENSION

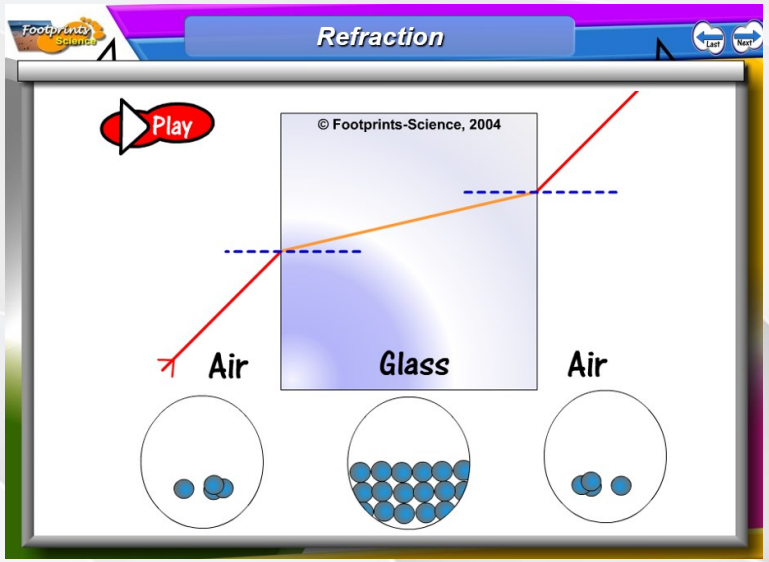
The focal length, f, of a converging lens can be measured by obtaining a clear image of a distant object on a wall. With a distant object, the light rays incident on the lens are parallel. Hence the distance of the clear image from the lens is equal to the focal length. We can then measure the distance from the lens to the wall to obtain the focal length of the lens.

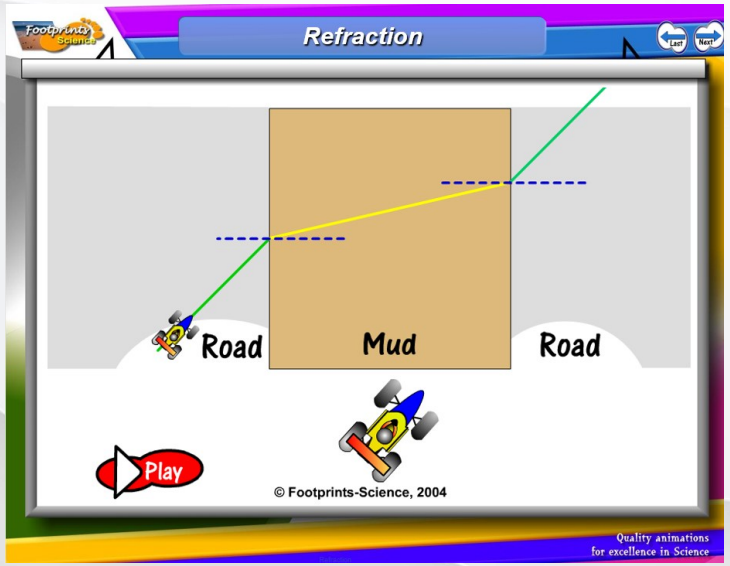
Click and drag the lens left or right. Find the position of the lens when the image is clear.



Find the focal length of a double convex lens, NB you must focus on a distant object and not the window. Use a white screen rather than a wall to capture the image







FOOTPRINT SCIENCE

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https://glowscotland.sharepoint.com/:p:/r/sites/LCKAS2Science/Shared%20Documents/General/CLASS%20RESOURCES/Footprints%20Science/Physical%20processes/Properties%20of%20Waves.pptm?d=w5901974f42a64d94ac93081a1104bcdd&csf=1&web=1&e=I1dSRA

EXIT PASS

Exit Ticket

Record the definition of refraction

Lessons 5 & 6

STARTER BINGO

- MAKE A GRID AS SHOWN, CHOOSE 9 WORDS TO PUT IN THE GRID. YOUR TEACHER WILL GIVE YOU SOME DEFINITIONS, CROSS OFF THE ONES THAT THE TEACHER DESCRIBES AND PUT YOUR HAND UP WHEN YOU GET A ROW.

- Longitudinal
- transverse
- Amplitude
- Crest
- Trough
- Wavelength
- Frequency
- Period
- Reflection
- Convex
- concave

- Lens
- Refraction
- Angle of incidence
- Angle of reflection
- Angle of refraction
- Normal
- Incident ray
- Reflected ray
- Refracted ray

- Primary light colours
- Cyan
- Magenta
- Yellow
- white

THE EYE

Lesson 5

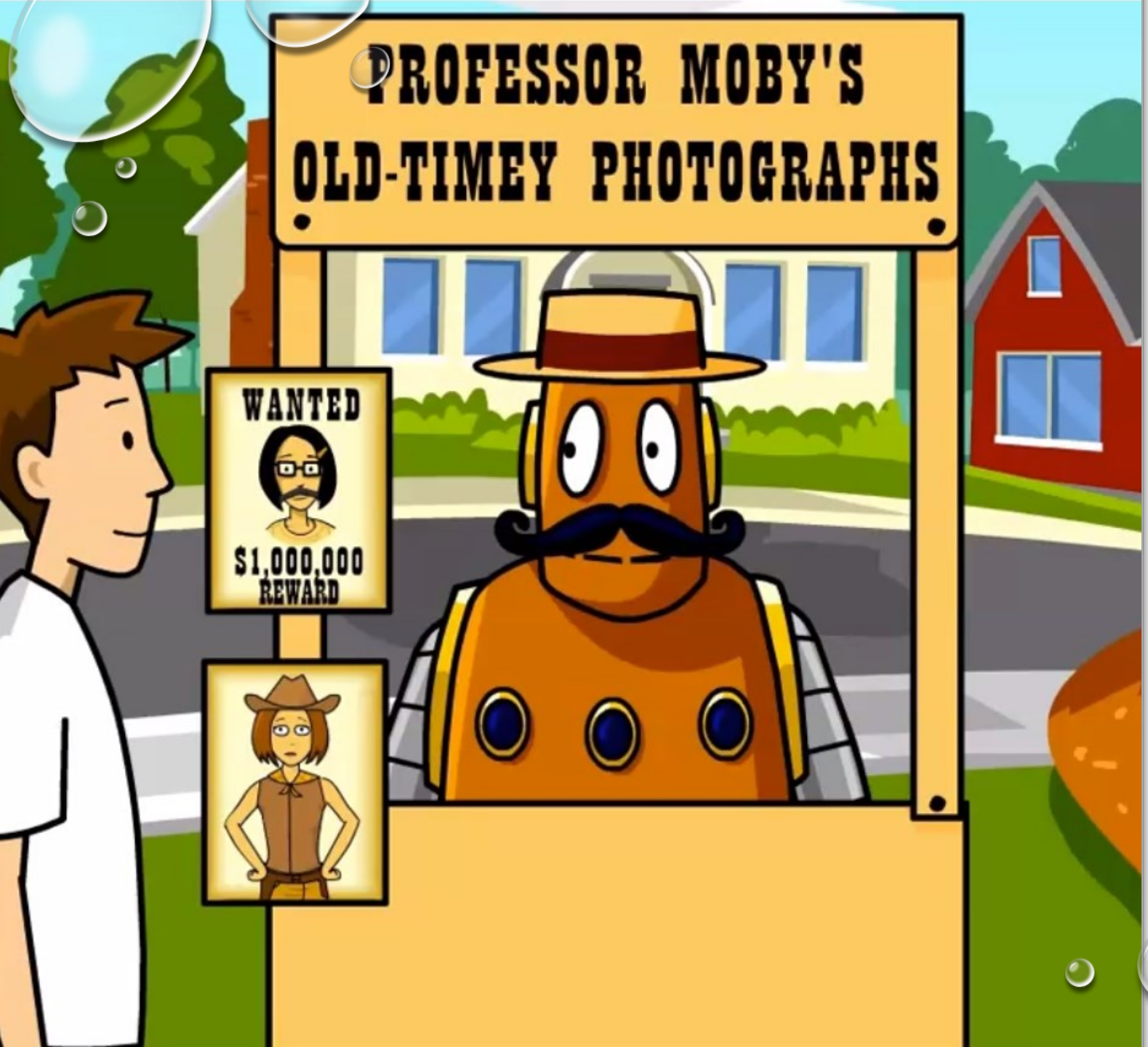
- LEARNING INTENTIONS

Understand how we see

Label a diagram of the eye

Know how the eye changes in bright light

State the function of parts of the eye

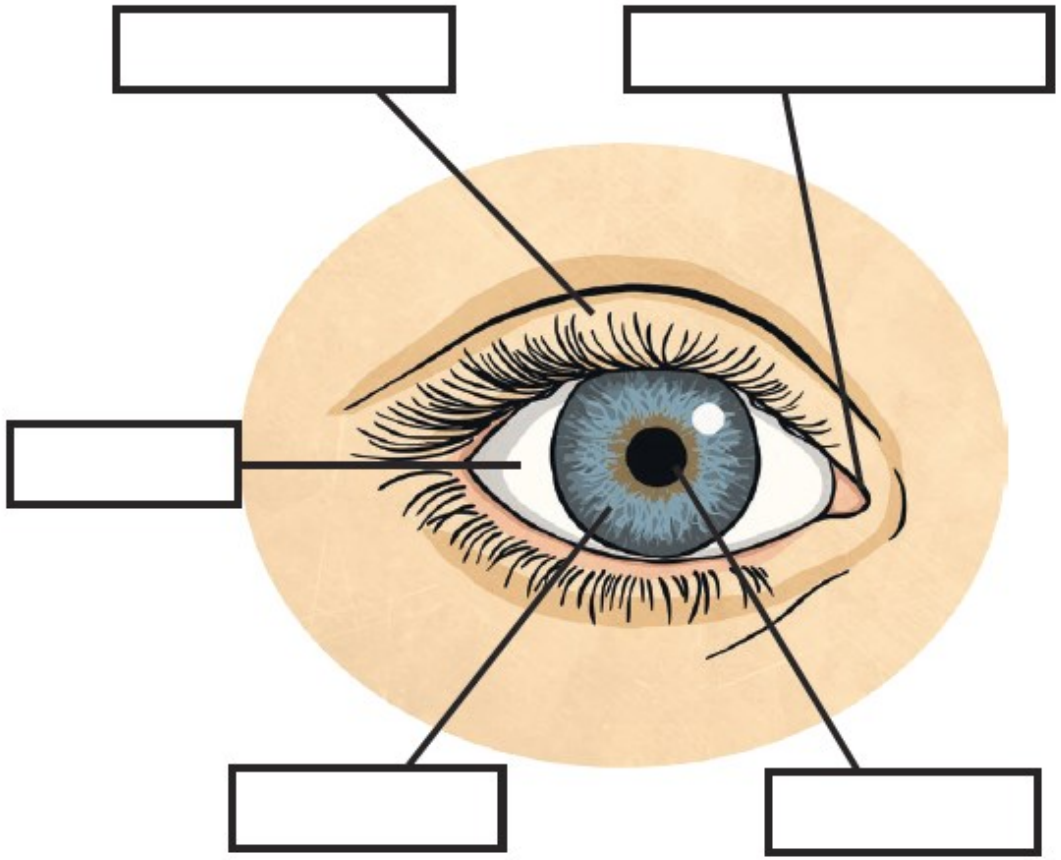


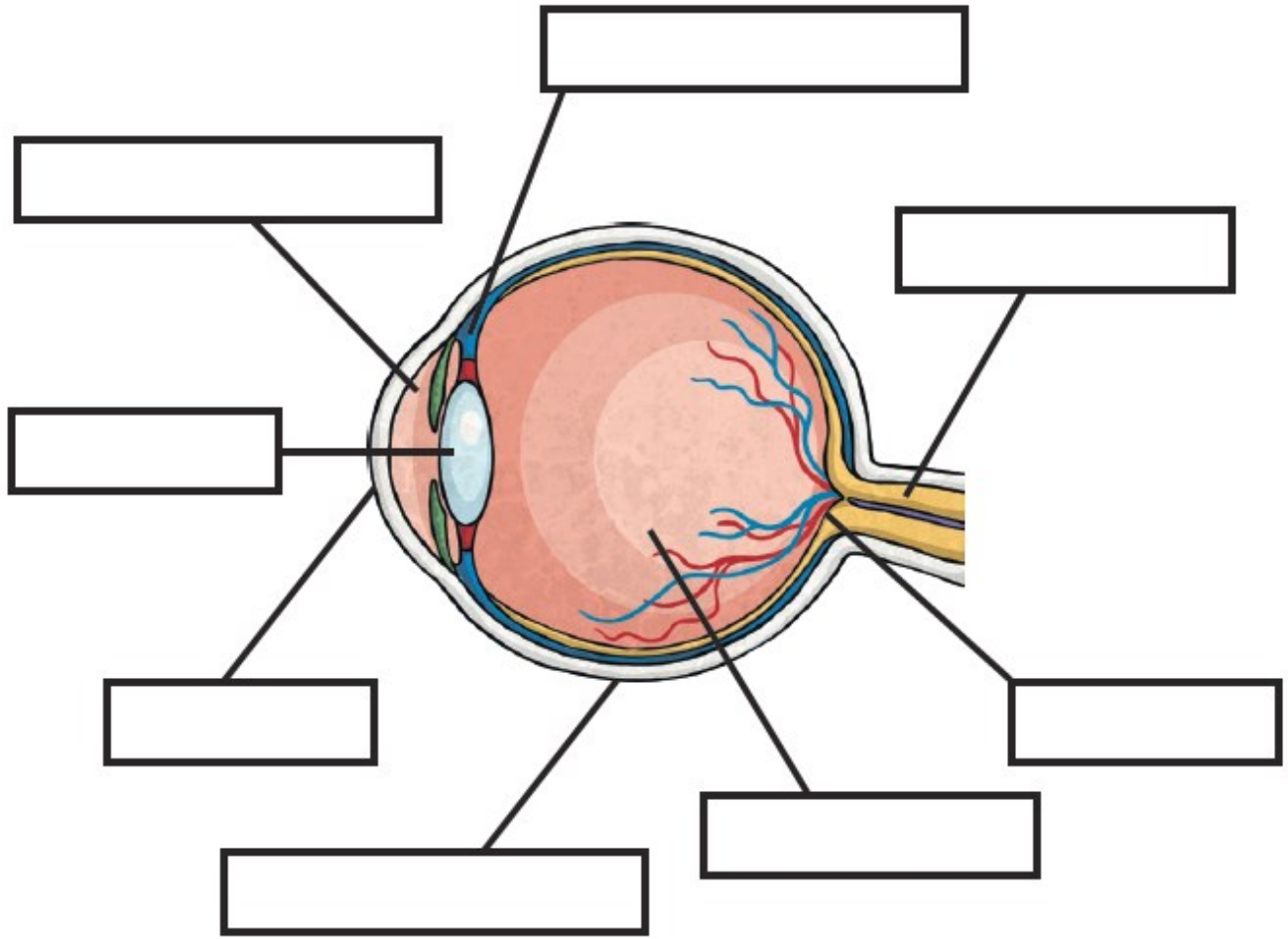
BRAINPOP THE EYE

- HTTPS://SCREENCAST-O-MATIC.COM/WATCH/CRVTBI976X

Parts of the Eye

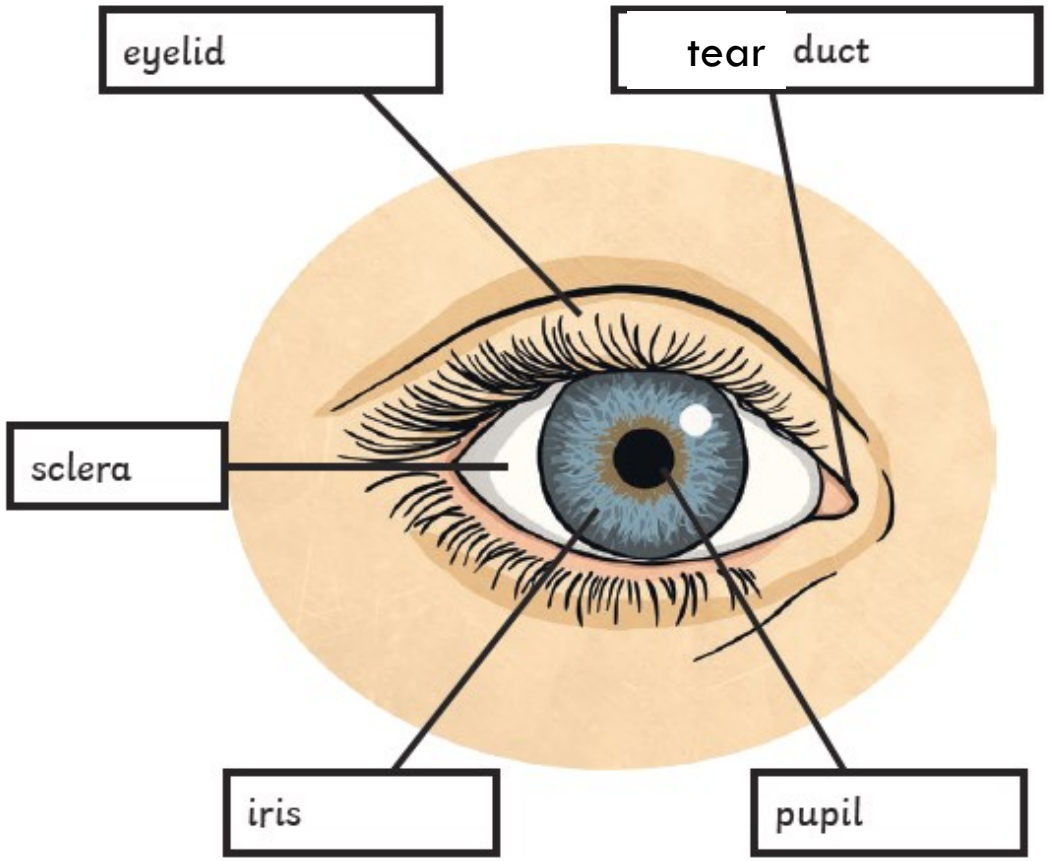
Can you label the parts of the eye in the diagrams below?

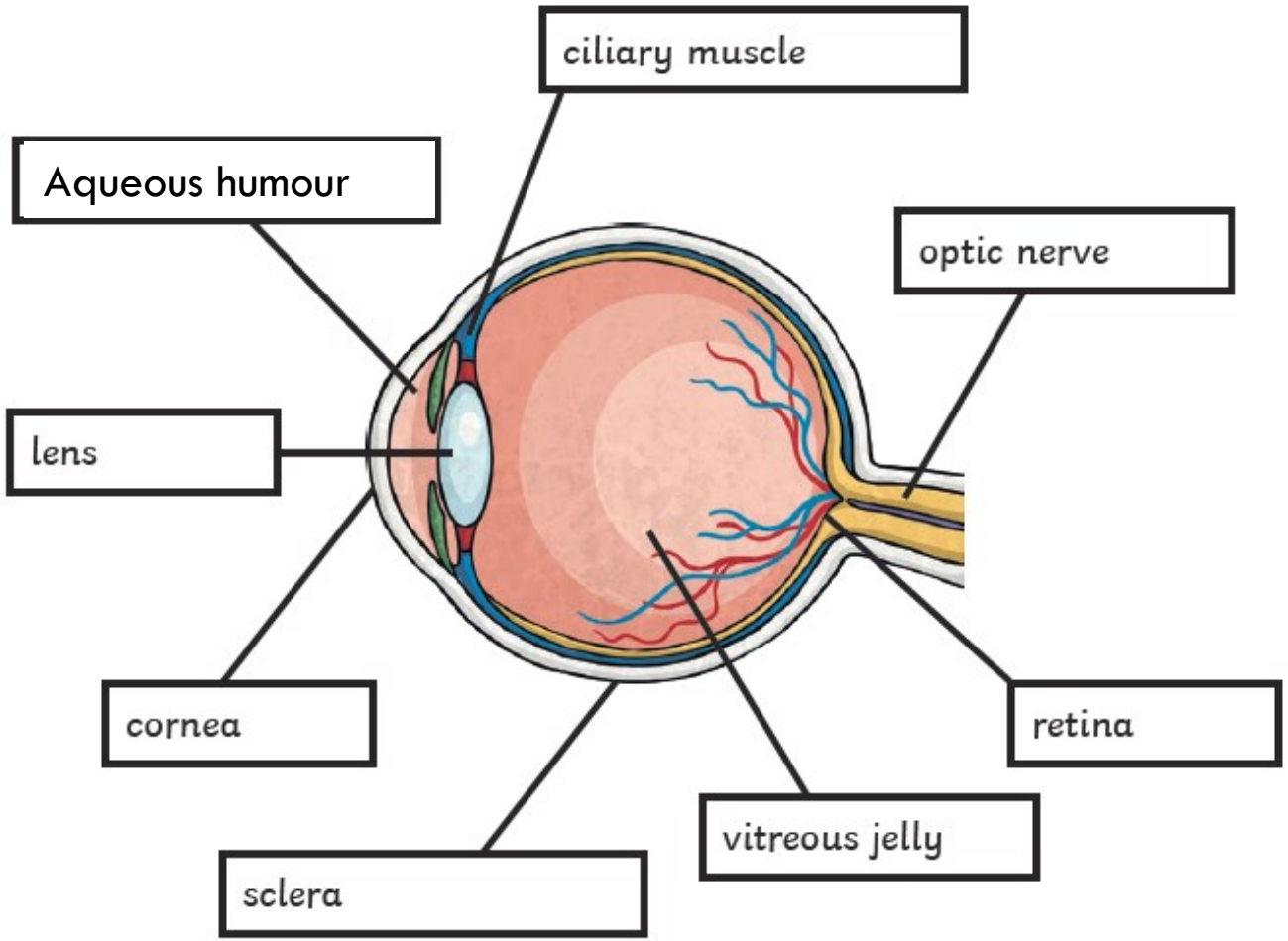


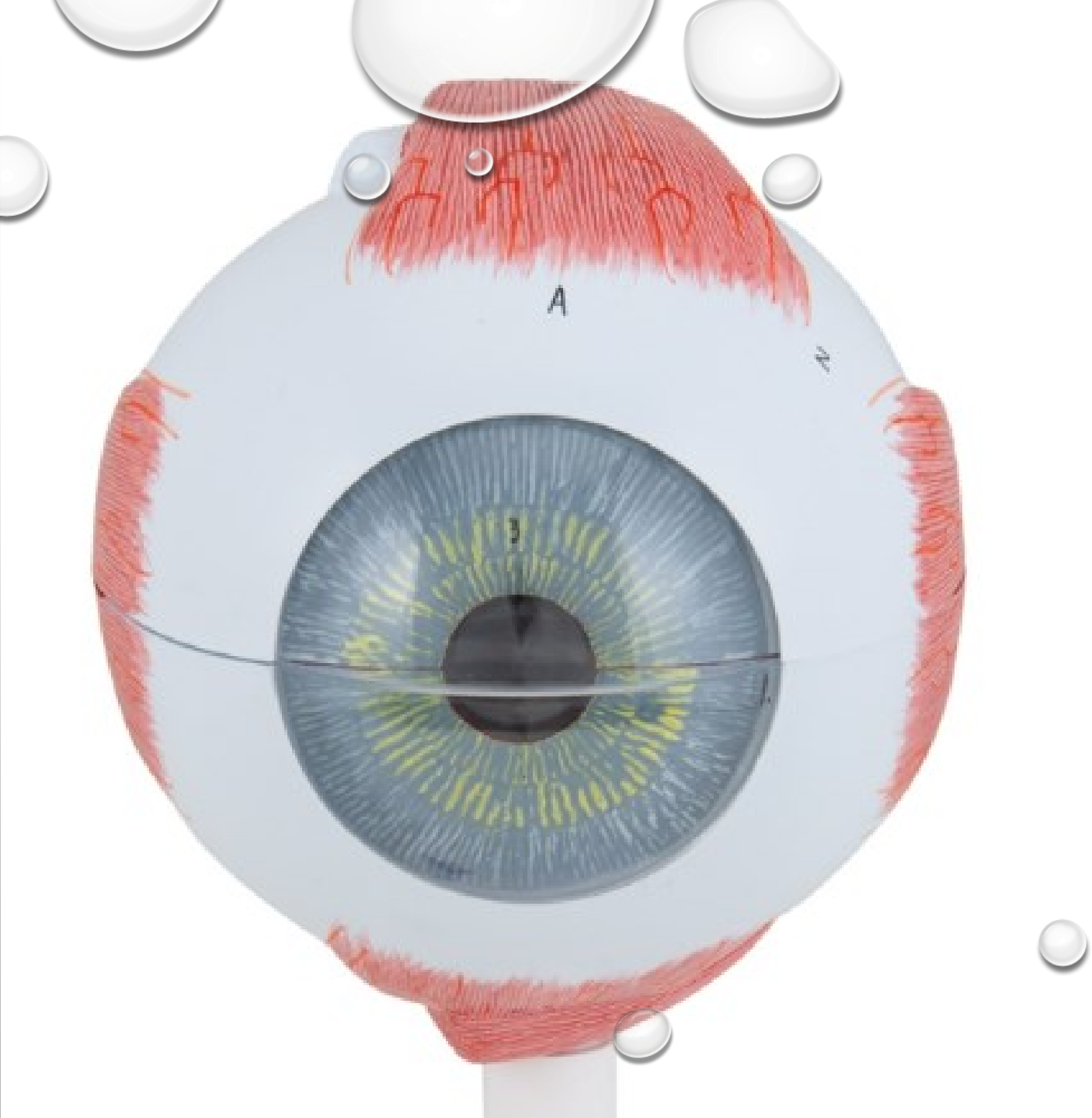


Parts of the Eye

Can you label the parts of the eye in the diagrams below?







LOOK AT THE MODEL EYE

CAN YOU NAME THE PARTS THAT YOU'VE MARKED ON YOUR DIAGRAM?

HTTPS://WWW.YOUTUBE.COM/WATCH?V=2DVTGEVZBRA

https://www.youtube.com/watch?v=7IBtIGvS1Gc
(advanced explanation, for the very few)

https://www.youtube.com/watch?v=9OS-9pG1IT0
Nice simple explanation

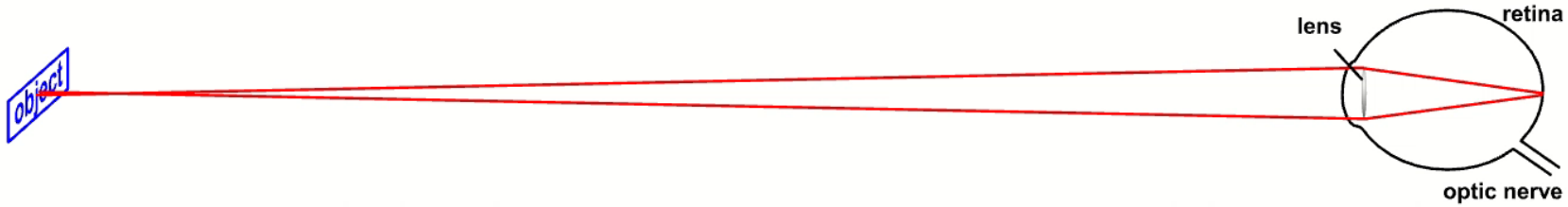
https://www.youtube.com/watch?v=KoUyMuMVJQY
Seeing colour

https://www.youtube.com/watch?v=JDVVr6vEvbs
The best one but still talks about bending the light URGH!

https://www.youtube.com/watch?v=evQsOFQju08
Mind bending on colour perception
https://www.youtube.com/watch?v=af78RPi6ayE
Go and really learn with this Royal Institution Lecture

The eye

Light from the objects we look at enters the eye and passes through a lens. An image is formed on the retina at the back of the eye. The optic nerve carries information to the brain.



Click the object on the left of the screen and drag it towards the right, closer to the eye. The distance from the object to the lens decreases. The distance from the lens to the retina stays the same. How can objects at different distances away remain in focus? The lens changes shape! For objects close to the eye the lens becomes fatter, bends the light more, and hence produces a sharp image on the retina.

The ability of the lens to change shape is called its accommodation. The muscles which change the shape of the lens tend to weaken as a person gets older. For a normal eye the nearest point for a clear image is about 25 cm.

For a distant object, for example objects on the horizon, the muscles relax and the lens becomes thinner.

Notice that the eye forms a REAL image on the retina. Hence the image is always INVERTED, but the brain adjusts for this!

PARTS OF THE EYE AND THEIR FUNCTION

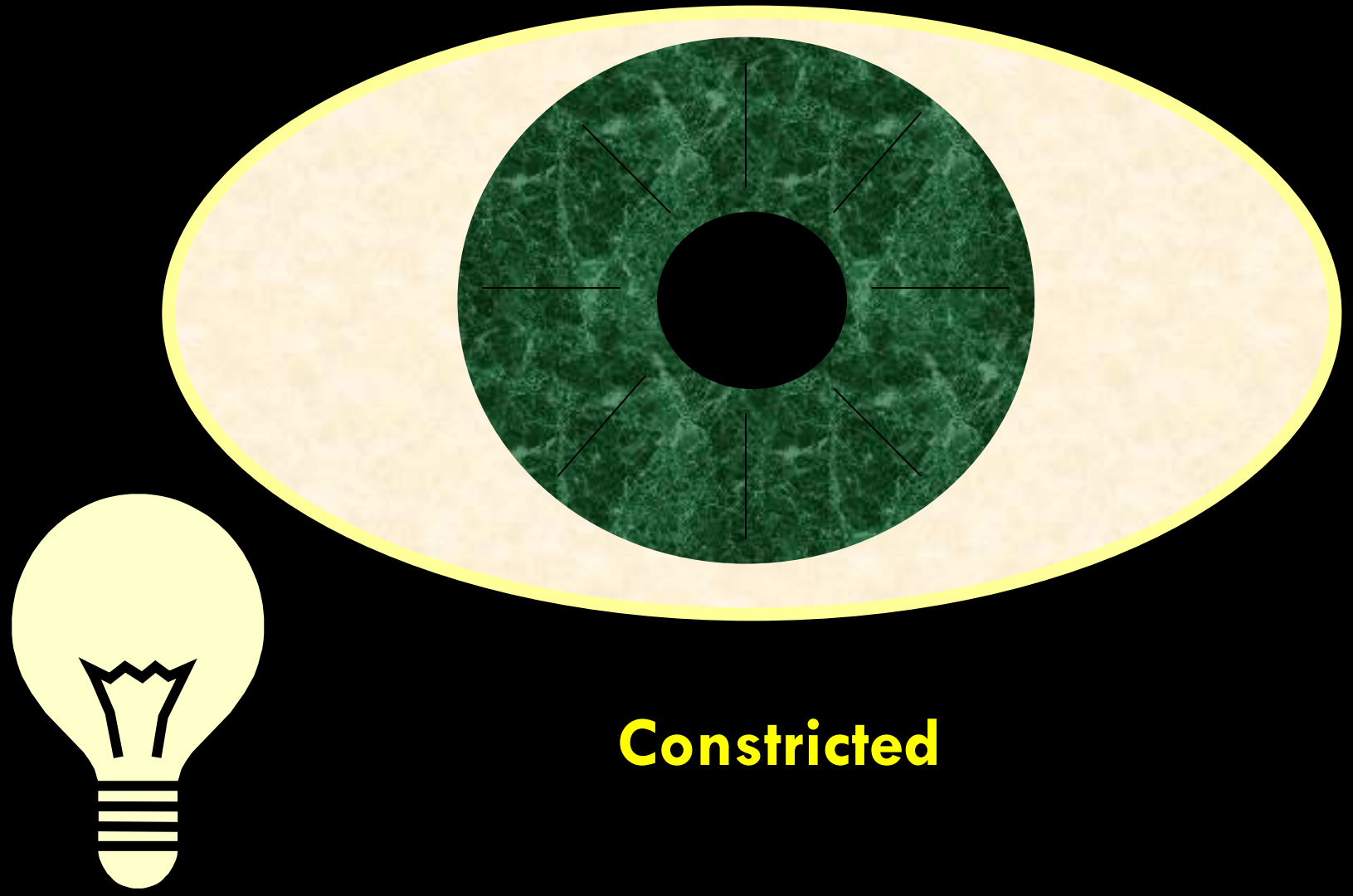
- MATCH UP THE FUNCTION AND PART

What makes up an eye		
FUNCTION		PART
a light sensitive layer that lines the interior of the eye. It is composed of light sensitive cells known as rods and cones.		cone cells
the circular opening in the centre of the iris through which light passes into the lens of the eye.		cornea
a small indentation at the centre of the macula and is the area with the greatest concentration of cone cells.		fovea
a transparent structure situated behind your pupil. It is enclosed in a thin transparent capsule and helps to refract incoming light and focus it onto the retina.		iris
a yellow spot on the retina at the back of the eye which surrounds the fovea.		lens
one of the two types of light-sensitive cells in the retina of the eye and used in dim light		macula
regulates the amount of light that enters your eye.		optic nerve
the second type of light sensitive cells in the retina of the eye. It is thought that there are three types of cones, each sensitive to the wavelength of a different primary colour – red, green or blue.		pupil
the transparent circular part of the front of the eyeball. It refracts the light entering the eye onto the lens		retina
the white part of the eye, a tough covering with which the cornea forms the external protective coat of the eye.		rod cells
where the signals leaves the eye transfers all the visual information to the brain.		sclera

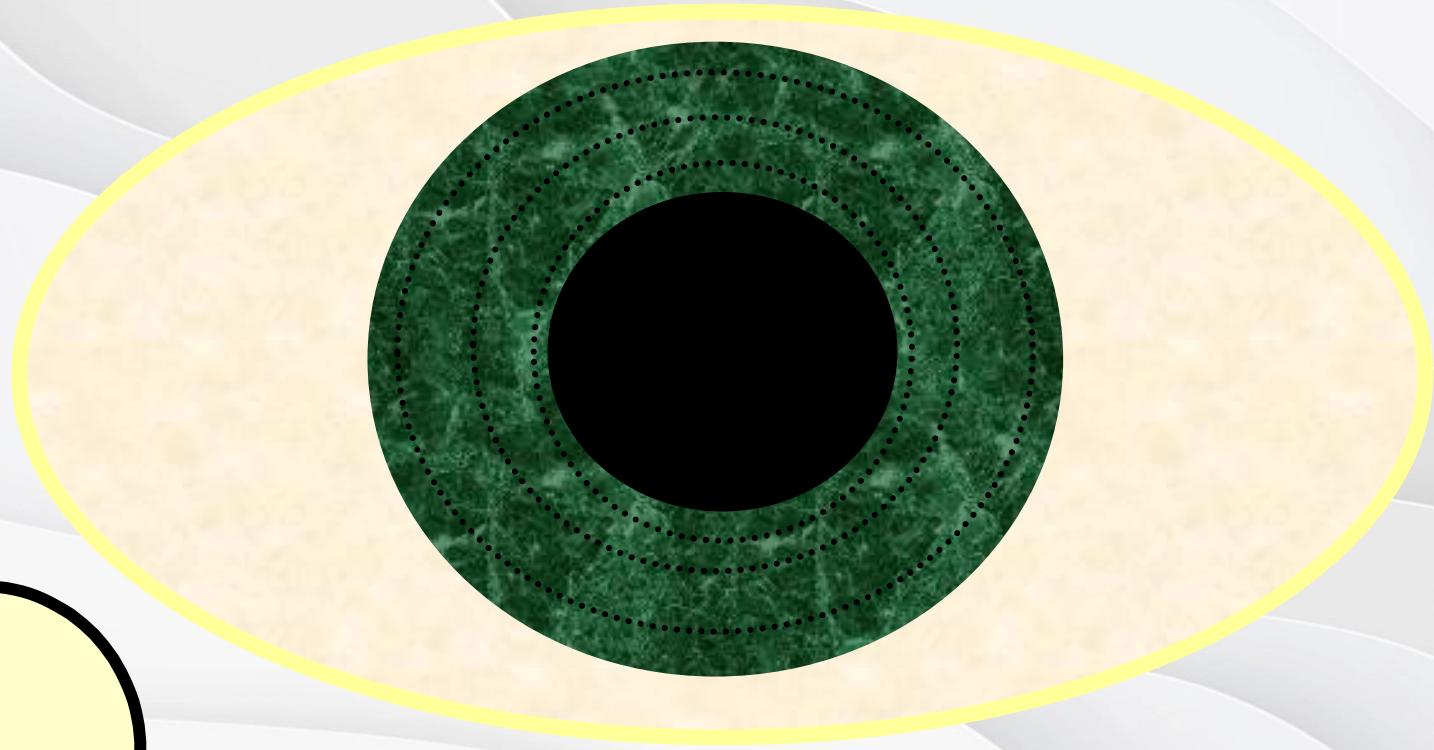
What makes up an eye	
a light sensitive layer that lines the interior of the eye. It is composed of light sensitive cells known as rods and cones.	**retina**
the circular opening in the centre of the iris through which light passes into the lens of the eye.	**pupil**
a small indentation at the centre of the macula and is the area with the greatest concentration of cone cells.	**fovea**
a transparent structure situated behind your pupil. It is enclosed in a thin transparent capsule and helps to refract incoming light and focus it onto the retina.	**lens**
a yellow spot on the retina at the back of the eye which surrounds the fovea.	**macula**
a type of light-sensitive cells in the retina of the eye and used in dim light	**rod cells**
regulates the amount of light that enters your eye.	**iris**
A type of light sensitive cells in the retina of the eye. It is thought that there are three types of cones, each sensitive to the wavelength of a different primary colour – red, green or blue.	**cone cells**
the transparent circular part of the front of the eyeball. It refracts the light entering the eye onto the lens	**cornea**
the white part of the eye, a tough covering with which the cornea forms the external protective coat of the eye.	**sclera**
where the signals leave the eye transferring the visual information to the brain.	**optic nerve**

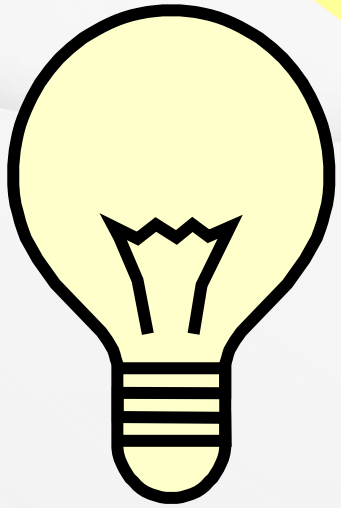
Eye dissection

1. Cut away the fat around the eye. Can you see the **optic nerve** at the back?
2. Cut around the middle of the eye (the **sclera)** until you have two halves, liquid **vitreous humour** will seep out. Remove this and look at the consistency.
3. Take out the lens and see what this is like on a piece of writing (use laminated sheets). It ought to magnify the writing.
4. Carefully remove the iris and notice the shape and size of the iris and pupil
5. Cut the cornea (the transparent covering at the front of the eye) and some liquid, called the **aqueous humour,** will come out.
6. Check out the retina, can you see the layers? Can you spot the fovea?



Constricted





Dilated

CHECKING YOUR BLIND SPOT

To do and notice

- Hold the card at eye level about an arm's length away. Make sure that the cross is on the right.
- Close your right eye and look directly at the cross with your left eye. Notice that you can also see the dot.
- Focus on the cross, but be aware of the dot as you slowly bring the card toward your face. The dot will disappear, and then reappear, as you bring the card toward your face. Try moving the card closer and farther to pinpoint exactly where this happens.
- Now close your left eye and look directly at the dot with your right eye. This time the cross will disappear and reappear as you bring the card slowly toward your face.
- Try the activity again, this time rotating the card so that the dot and cross are not directly across from each other. Are the results the same?

Sama is walking along an unlit street at night. A car comes round the corner, 200 m away, with its headlights on.

Explain, in detail, how Sama's eyes will react as the car drives directly towards her.

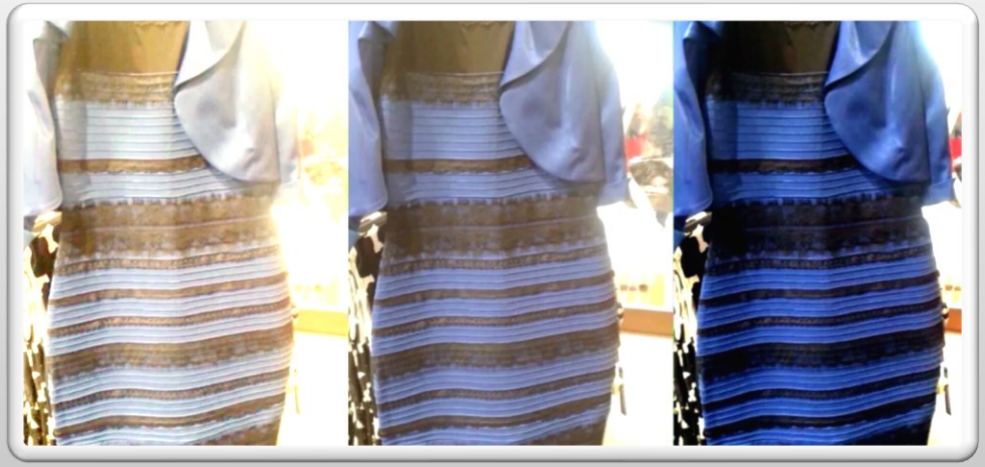
Lesson 6

EYE BINGO

- MAKE A GRID AS SHOWN, CHOOSE 9 WORDS TO PUT IN THE GRID. YOUR TEACHER WILL GIVE YOU SOME DEFINITIONS, CROSS OFF THE ONES THAT THE TEACHER DESCRIBES AND PUT YOUR HAND UP WHEN YOU GET A ROW.

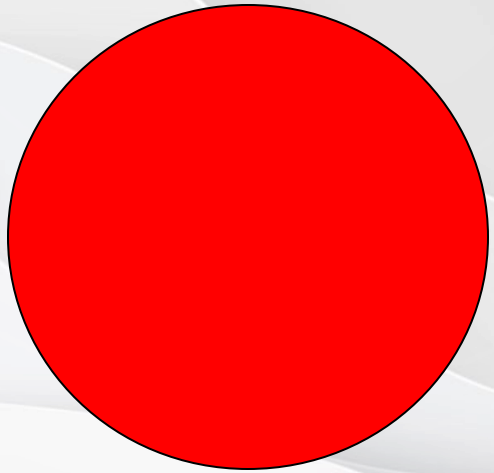
- Retina
- Sclera
- Fovea
- Cornea
- Iris
- Pupil
- Lens
- Optic nerve
- Tear duct
- Aqueous humour
- Vitreous humour
- Eyelid
- Eye brow
- Ciliary muscle
- brain

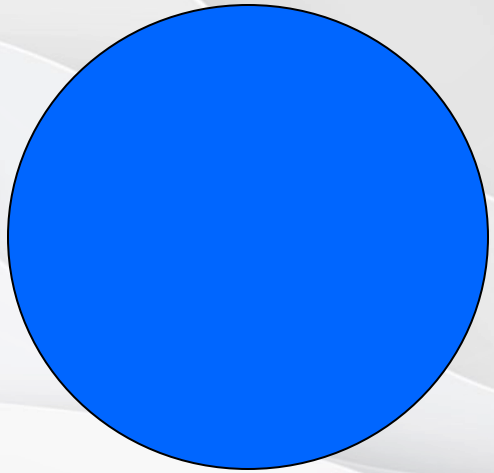
COLOUR PERCEPTION/ PERSISTENCE AND THE EYE

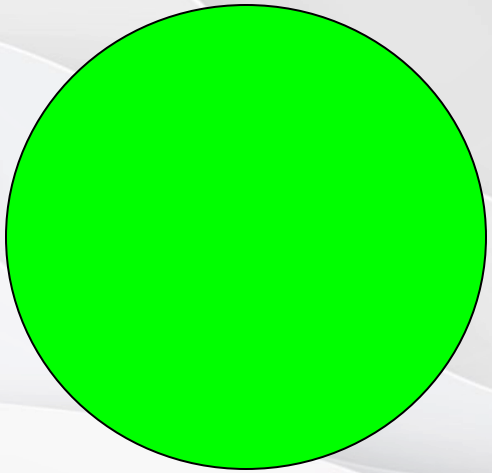


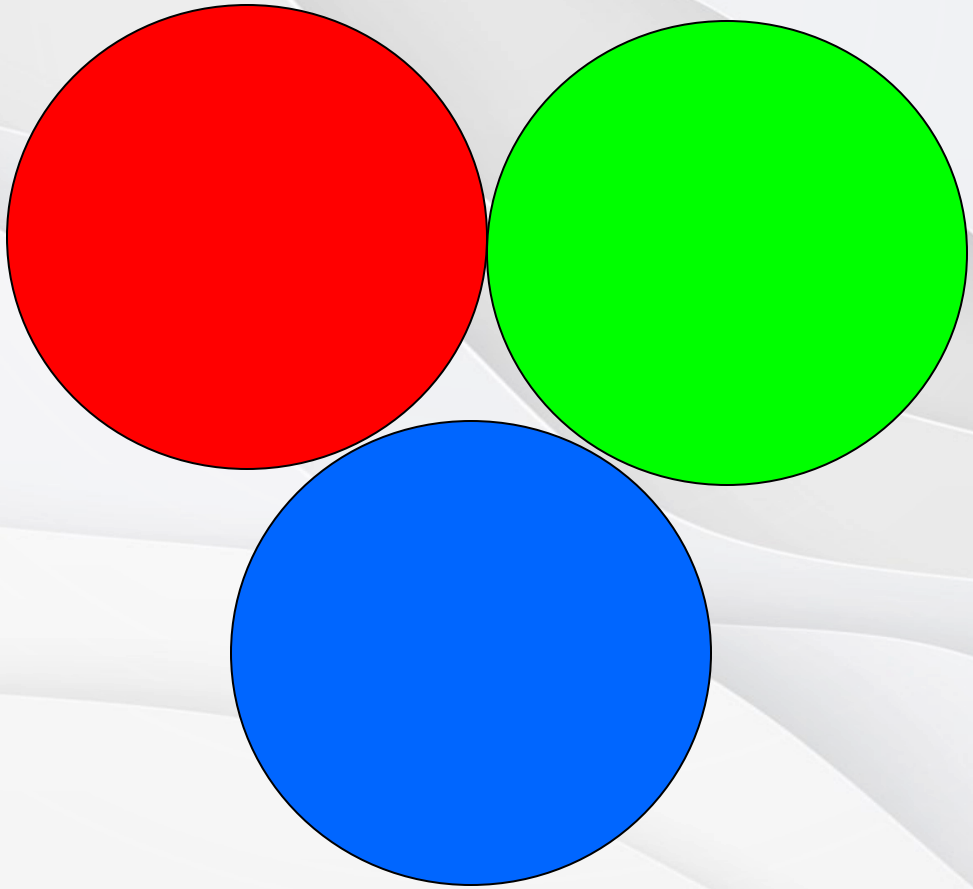
- FOR EACH OF THE NEXT FEW SLIDES
  - RECORD THE COLOUR OF THE DOT, THEY WILL APPEAR IN THE ORDER RED, BLUE, GREEN
  - STARE AND FOCUS ON THE DOT FOR THE FULL 30 SECONDS
  - WHEN THE BLANK SLIDE POPS UP, RECORD WHAT YOU APPEAR TO SEE ON THE SCREEN (NOTE THE COLOUR)

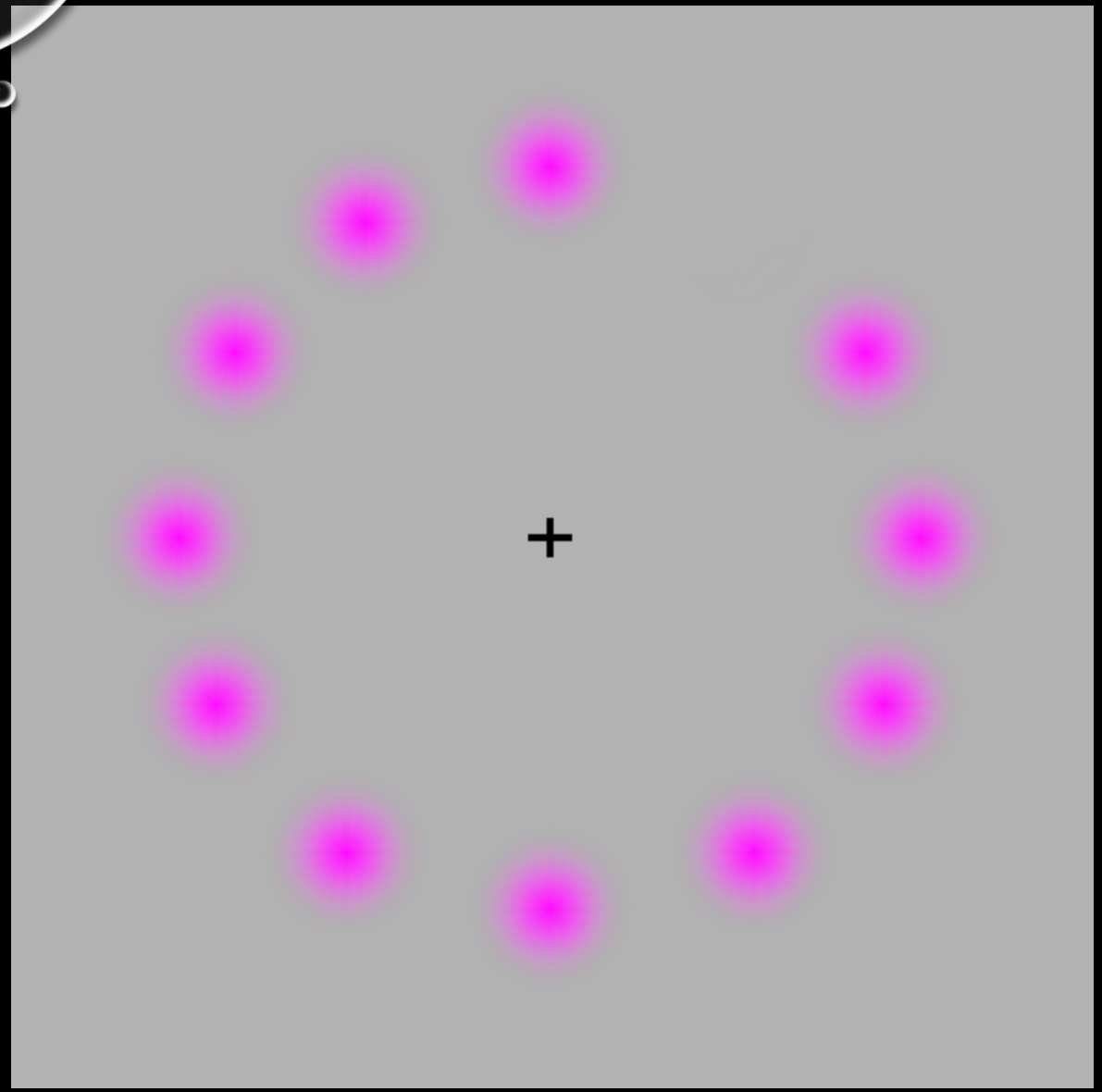
- THIS IS WHY IT IS IMPORTANT NOT TO STARE AT SCREENS ON THE SUN FOR LONG PERIODS
- THIS IS OCCURRING AS YOU HAVE "OVERLOADED" YOUR SENSE CELLS AND THE SIGNALS ARE STILL BEING SENT TO THE BRAIN, EVEN THOUGH THE IMAGE IS NO LONGER THERE.









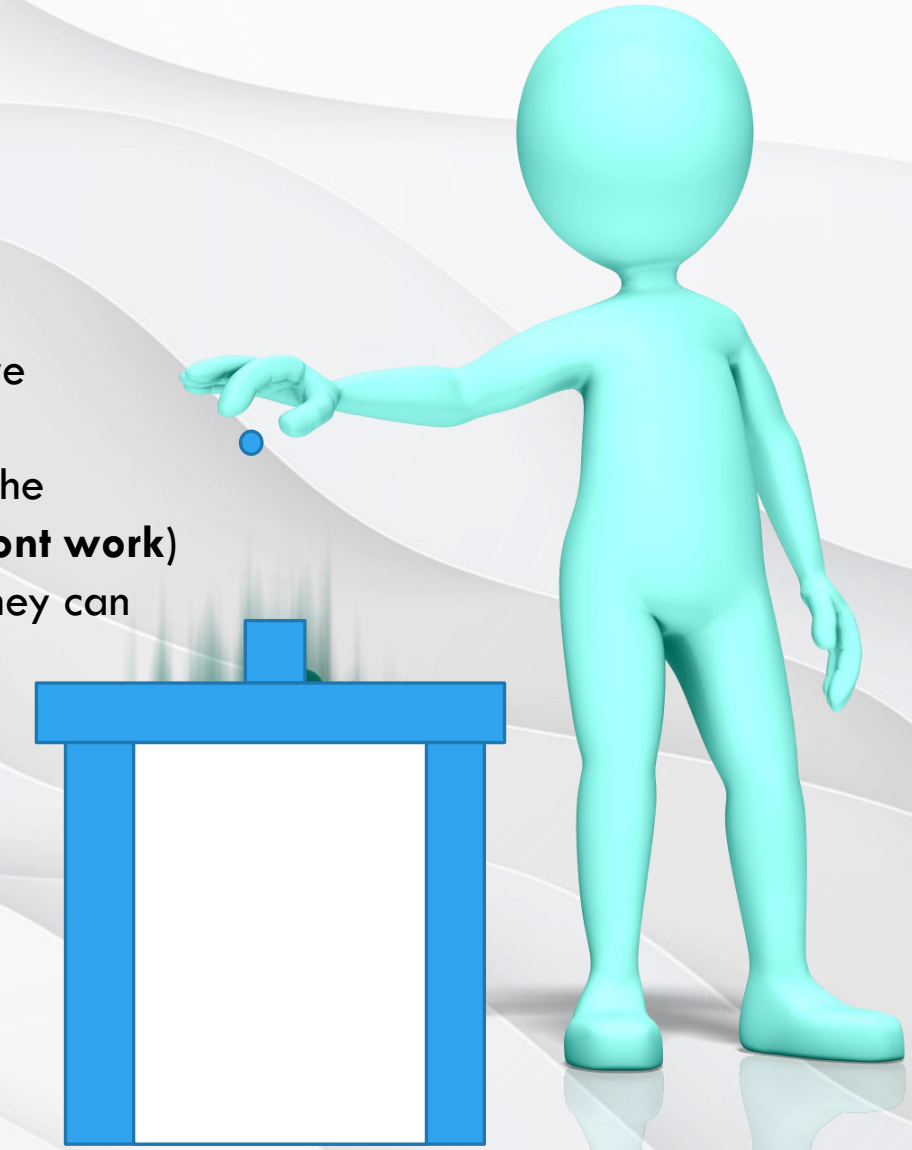


If you follow the pink dot moving, the dots will remain pink, but if you stare at the plus sign in the centre, the rotating dot will turn green. That's cool, but now try this... focus on the plus sign in the centre for a short period and all the pink dots will disappear and all you will see is the green dot going around! cool huh?

Why do we have 2 eyes?

In pairs

1. Place a plastic beaker on the desk
2. Student one move to the far side of the classroom and cover one eye
3. The other student extend their arm with an eraser or coin
4. Get student one to direct the person until their arm is directly over the beaker. (Their arm should be at **least 60 cm above the cup or it wont work**)
5. When student one thinks student 2's arm is directly above the cup they can say drop.
6. Does the eraser fall into the cup?
7. Repeat covering the other eye, and then
8. repeat with both eyes open
9. Why do we have 2 eyes?

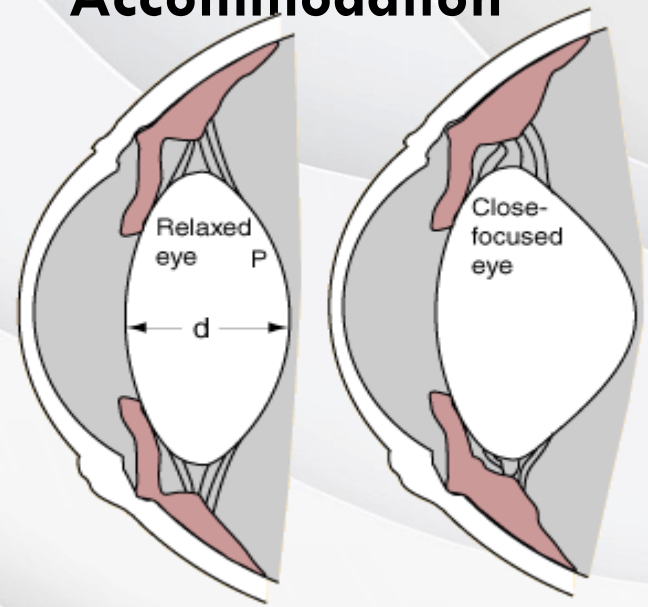


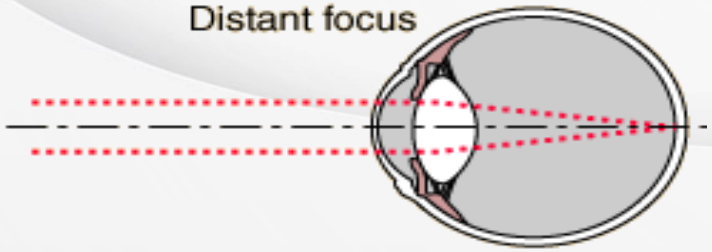
Peripheral Vision

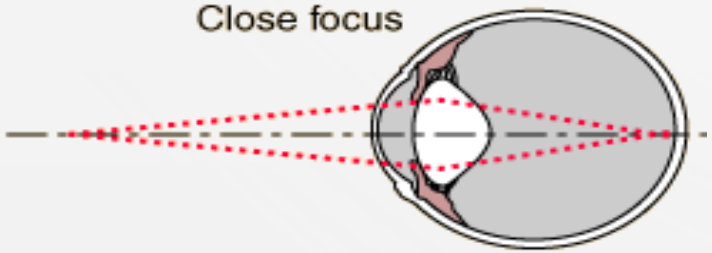
1. Extend your arms and raise your index finger
2. Move your arms around in front of your body and notice where you can see your index finger pointing up.
3. Where is your field of vision?
4. Repeat this with one eye closed
5. Repeat with the other eye closed?
6. Are you surprised how your field of vision changes with one eye closed?

Put your finger in front of your nose and focus on your finger. The focus on a distant object out of the window. Why does your vision blur for a second or so?

Accommodation







When objects are near, the lens needs to be **thicker**

The ciliary muscles **contract** which **loosens** the suspensory ligaments

The more rounded lens enables light to focus correctly on the **retina**

When objects are far, the lens needs to be **thinner**

The ciliary muscles **relax** which **tightens** the suspensory ligaments

The less rounded lens enables light to focus correctly on the **retina**

For anyone not wishing to do the dissection:

Watch the video

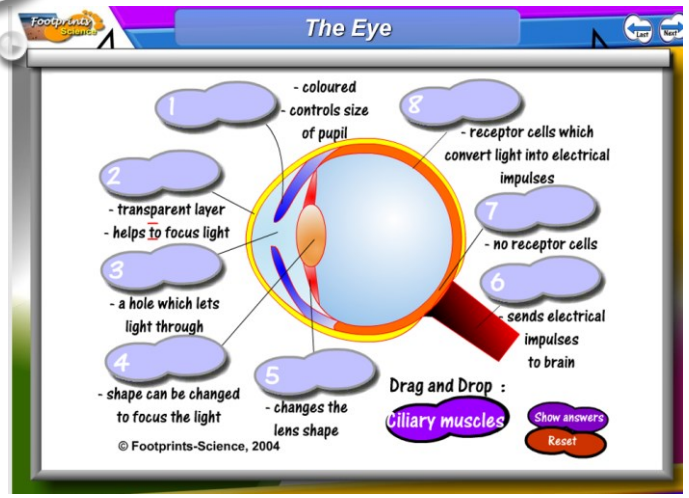
https://www.youtube.com/watch?v=YcedXDN6a88

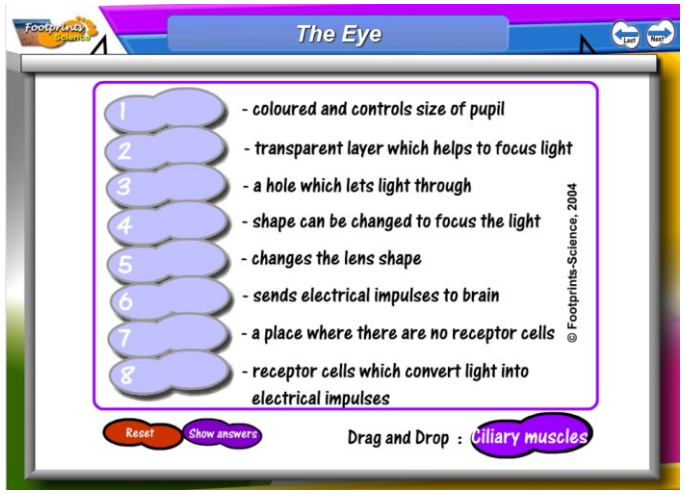
Or complete the following worksheet

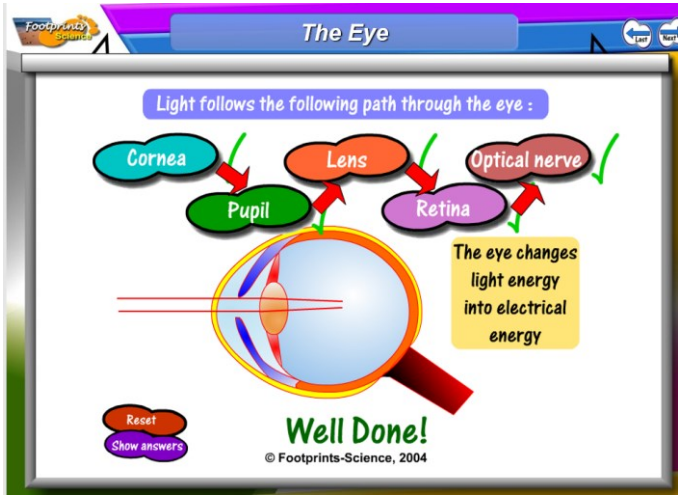
Sense Organs

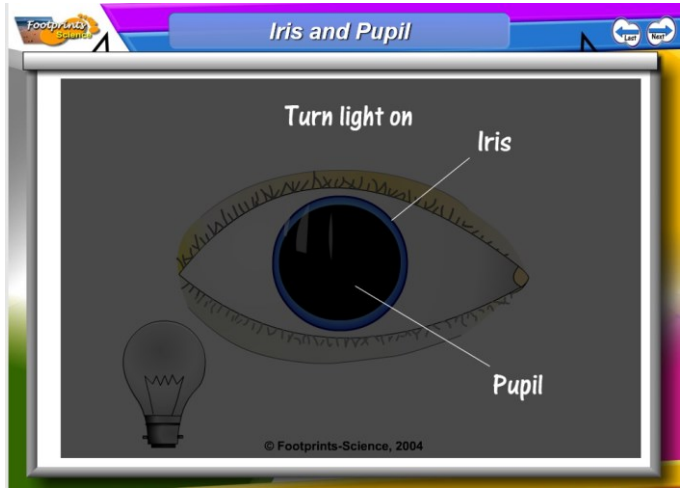
Key Points

1. The brain can only understand electrical impulses
2. Receptors in the eyes change light into electrical impulses
3. Receptors in the ears change sound into electrical impulses
4. The iris can change the size of the pupil depending on light intensity









FOOTPRINT SCIENCE

THERE ARE SOME GREAT EXAMPLES OF REFLECTION IN THE FOOTPRINT SCIENCE STUDENTS COULD TRY THESE

https://glowscotland.sharepoint.com/:p:/r/sites/LCKAS2Science/Shared%20Documents/General/CLASS%20RESOURCES/Footprints%20Science/Life%20Processes%20and%20Living%20Things/Sense%20Organs.ppt?d=w3b711d4f3f734cc4a006817c0b127fa5&csf=1&web=1&e=0s1QuM

HOMEWORK RESEARCH TASK

FURTHER WORK

- FIND OUT AND WRITE ABOUT ONE OR TWO THE FOLLOWING:

(A) ANIMALS AND INSECTS EYES

(B) PLAYING SPORT WITH ONLY ONE EYE

(C) EYE MAKE UP

(D) EYE PROTECTION IN WORK

(E) PERSPECTIVE IN ART

(F) BRAILLE AND PROBLEMS FOR THE BLIND

(G) COMMUNICATING WITH OUR EYES

EXIT PASS

Exit Ticket

State 2 parts of the eye and give their function

Lesson 7

EYE BINGO

- MAKE A GRID AS SHOWN, CHOOSE 9 WORDS TO PUT IN THE GRID. YOUR TEACHER WILL GIVE YOU SOME DEFINITIONS, CROSS OFF THE ONES THAT THE TEACHER DESCRIBES AND PUT YOUR HAND UP WHEN YOU GET A ROW.

- Retina
- Sclera
- Fovea
- Cornea
- Iris
- Pupil
- Lens
- Optic nerve
- Tear duct
- Aqueous humour
- Vitreous humour
- Eyelid
- Eye brow
- Ciliary muscle
- brain

Lesson 7

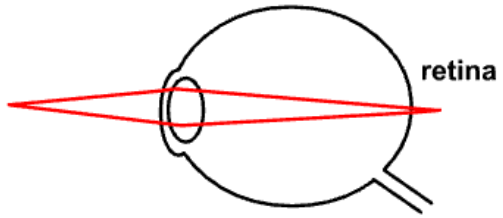
EYE DEFECTS

- FIND OUT ABOUT SOME EYE DEFECTS, LONG AND SHORT SIGHT (HYPEROPIA AND MYOPIA)
- FIND OUT ABOUT COLOUR DEFICIENCY (COLOUR BLINDNESS)
- CORRECT LONG AND SHORT SIGHT
- TEST YOUR SIGHT FOR COLOUR-BLINDNESS

Long and short sight

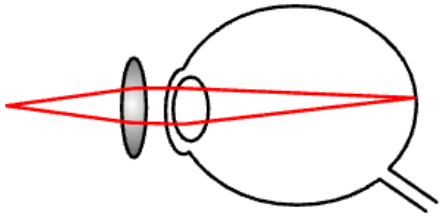
Sometimes the lens of the eye is NOT able to refract light ON to the retina but provides too little refraction ~~bending~~, see below left, or too much bending see below right.

Long sight

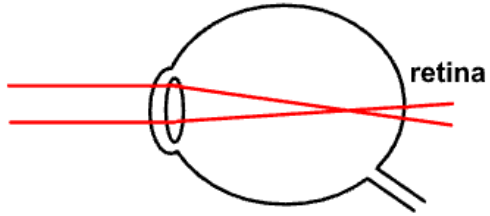


The eye lens brings the rays to a point behind the retina for NEAR objects.
The lens cannot get any fatter, so near objects are blurred. DISTANT objects are sharp.

Use a converging lens to correct LONG sight.

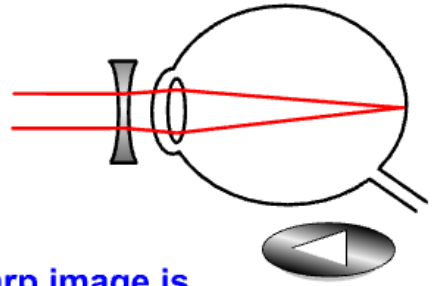


Short sight



The eye lens brings the rays to a point in front of the retina for DISTANT objects.
The lens cannot get any thinner, so distant objects are blurred. NEAR objects are sharp.

Use a diverging lens to correct SHORT sight.



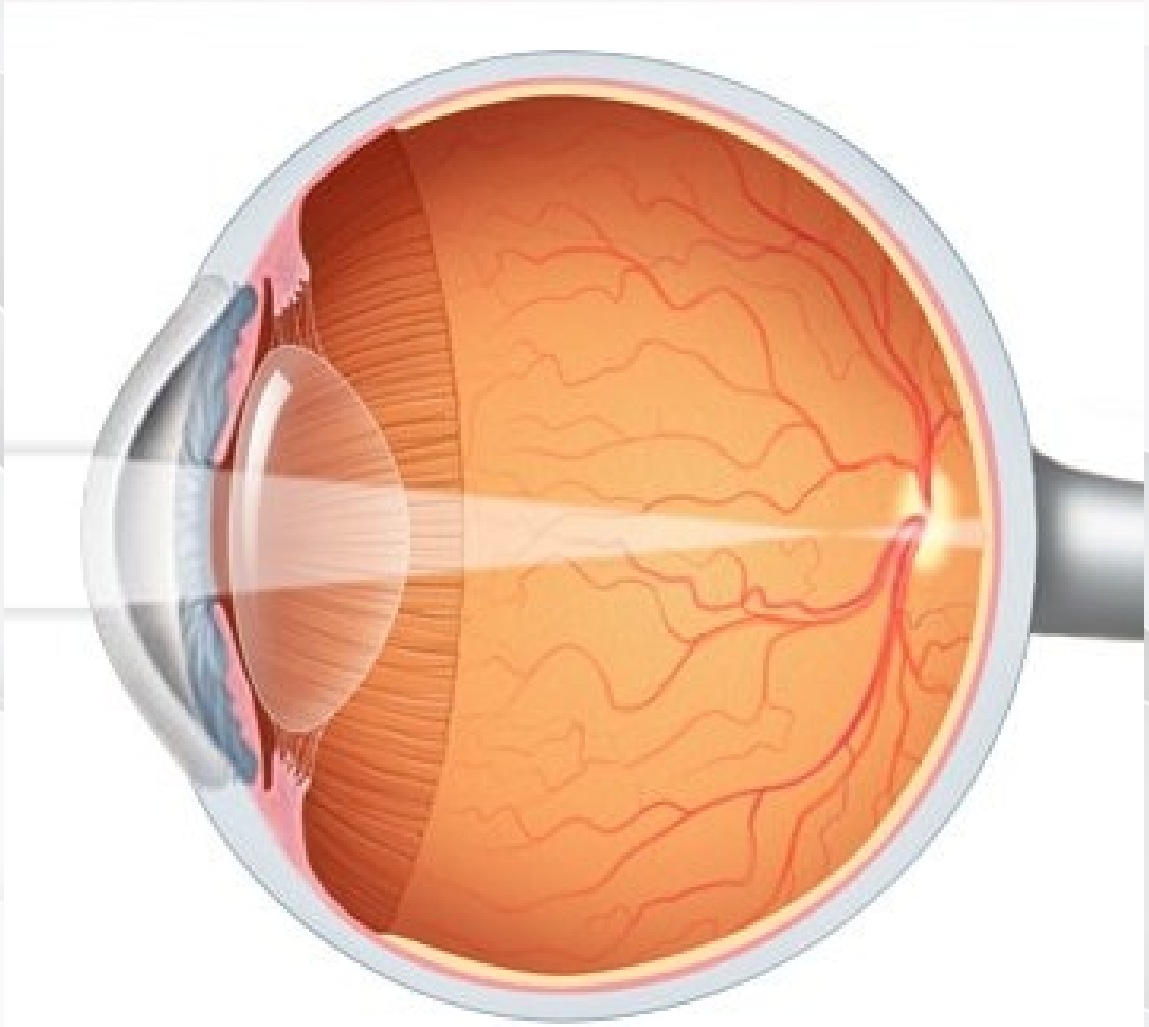
With the correct spectacles, or contact lenses, a sharp image is obtained on the retina.

SHORT-SIGHTEDNESS/ MYOPIA

https://www.nhs.uk/conditions/short-sightedness/

- HTTPS://WWW.YOUTUBE.COM/WATCH?V=2DVTGEVZBRA TIM & MOBY

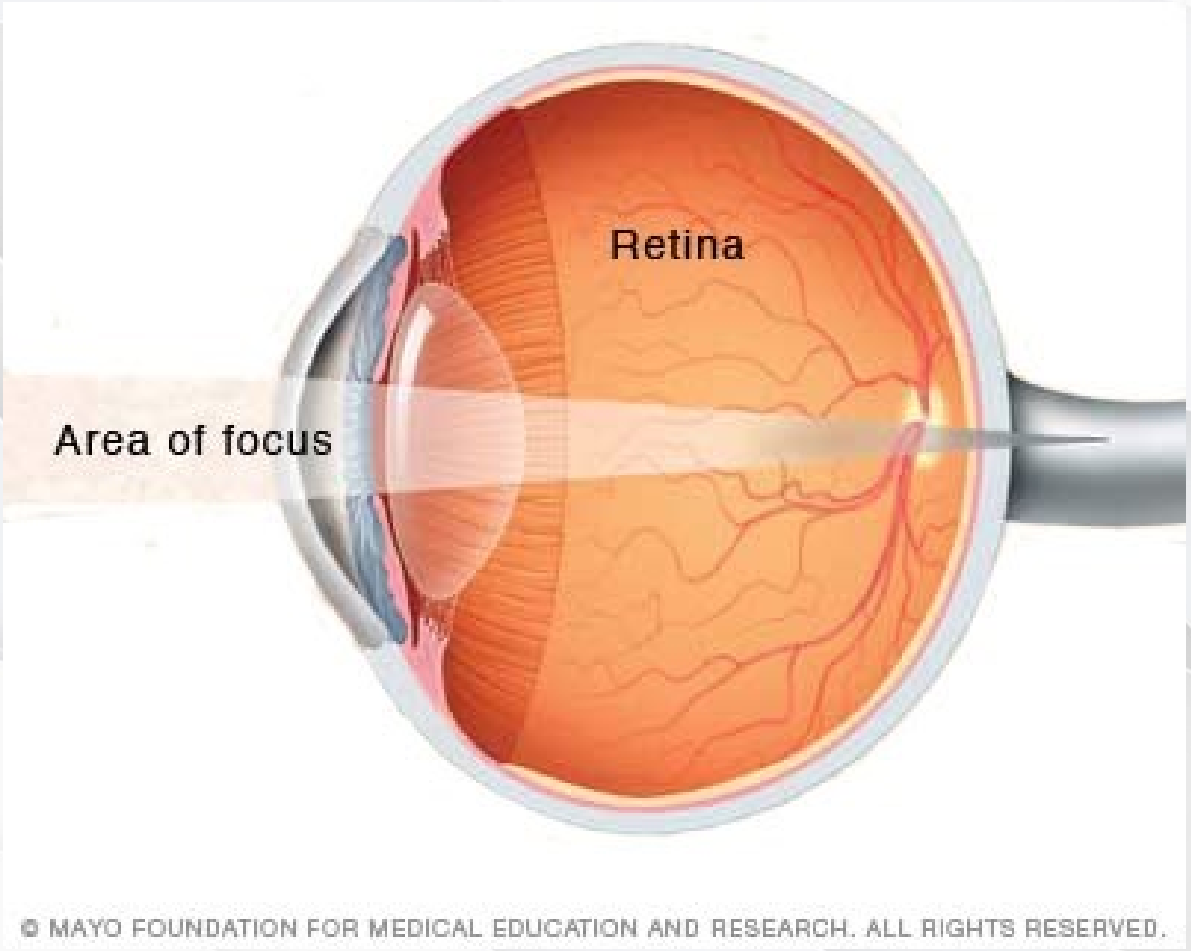
- IS **A COMMON VISION CONDITION IN WHICH YOU CAN SEE OBJECTS NEAR TO YOU CLEARLY, BUT OBJECTS FARTHER AWAY ARE BLURRY**. it occurs when the shape of your eye causes light rays to refract incorrectly, focusing images in front of your retina instead of on your retina



LONG-SIGHTEDNESS/ HYPEROPIA

- HTTPS://WWW.YOUTUBE.COM/WATCH?V=2DVTGEVZBRA

- LONG-SIGHTED **(HYPEROPIA) IS A COMMON VISION CONDITION IN WHICH YOU CAN SEE DISTANT OBJECTS CLEARLY, BUT OBJECTS NEARBY MAY BE BLURRY.**

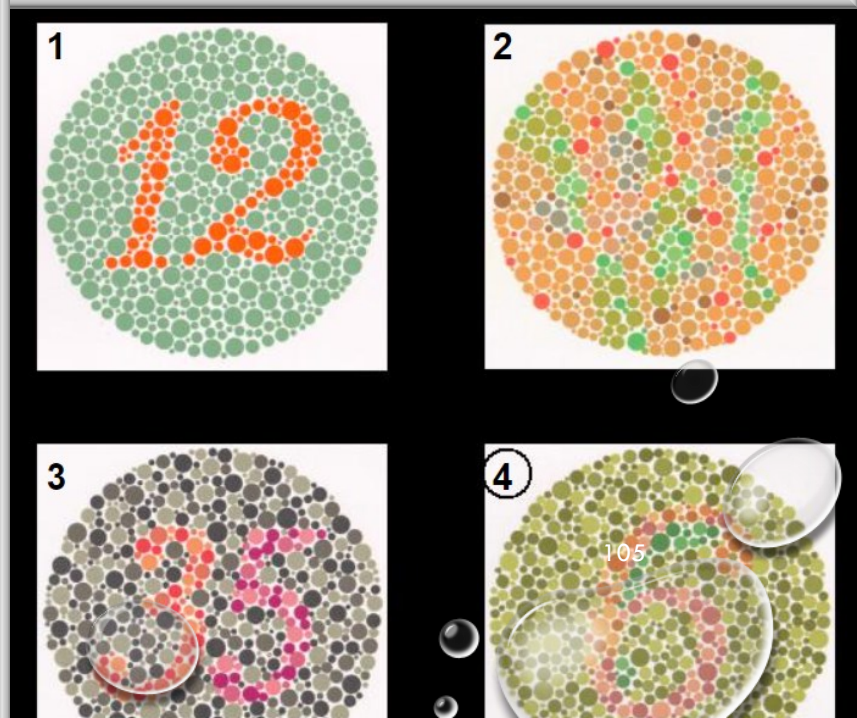


https://www.mayoclinic.org/diseases-conditions/farsightedness/symptoms-causes/syc-20372495

COLOUR DEFICIENCY

Use the Ishihara plates to see if you are colour deficient

- HTTPS://WWW.HOPKINSALLCHILDRENS.ORG/PATIENTS-FAMILIES/HEALTH-LIBRARY/HEALTHDOCNEW/WHAT-IT-S-LIKE-TO-BE-COLOR-BLIND
- HTTPS://WWW.VERYWELLHEALTH.COM/WHAT-DO-COLOR-BLIND-PEOPLE-SEE-5092522



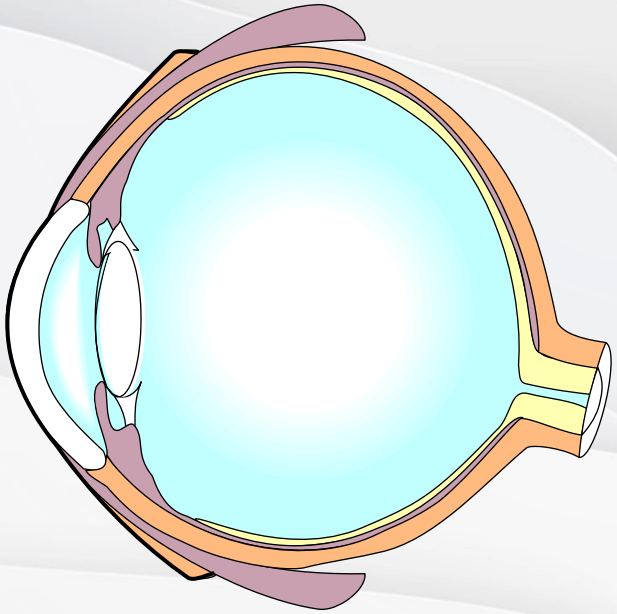
Reference https://www.colourblindawareness.org/colour-blindness/

Over a double page spread research and find out about colour blindness/deficiency

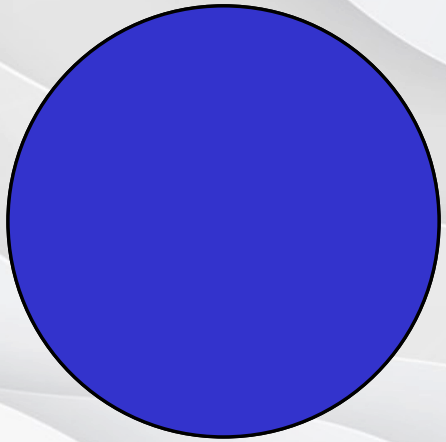
Types of colour-blindness	Causes of colour-blindness
Living with colour-blindness	Misconceptions

Extension Challenge

Use your knowledge of lenses and the eye to complete the eye ray diagrams worksheet.



15 minutes



Stretch: As we get older the lens of our eye stiffens and the ciliary muscles can become weaker. Explain the effect this would have and suggest a way to solve it.

EXIT PASS

Exit Ticket

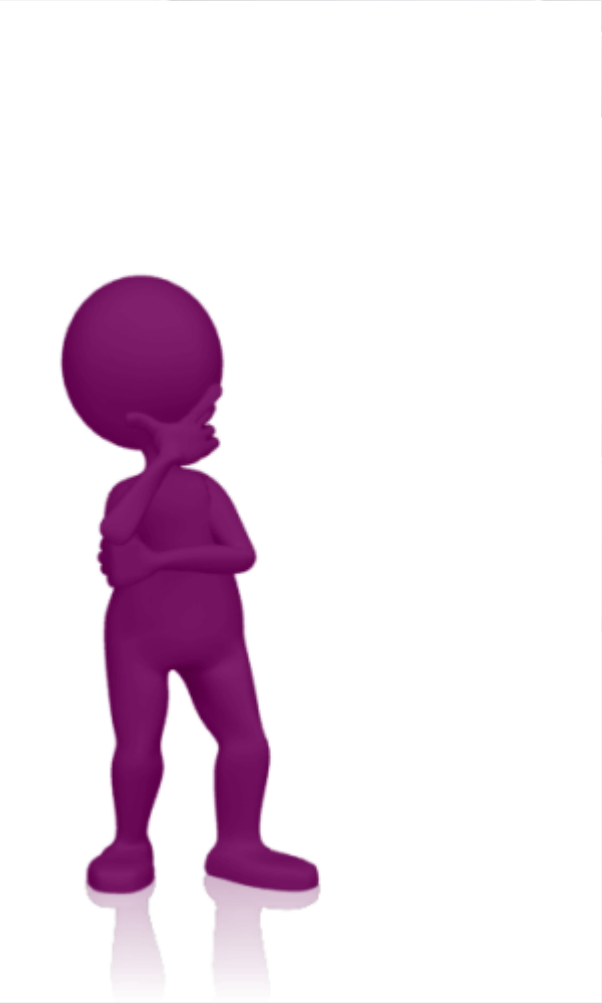
State 2 of the 3 types of eye defect and how they can be corrected

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

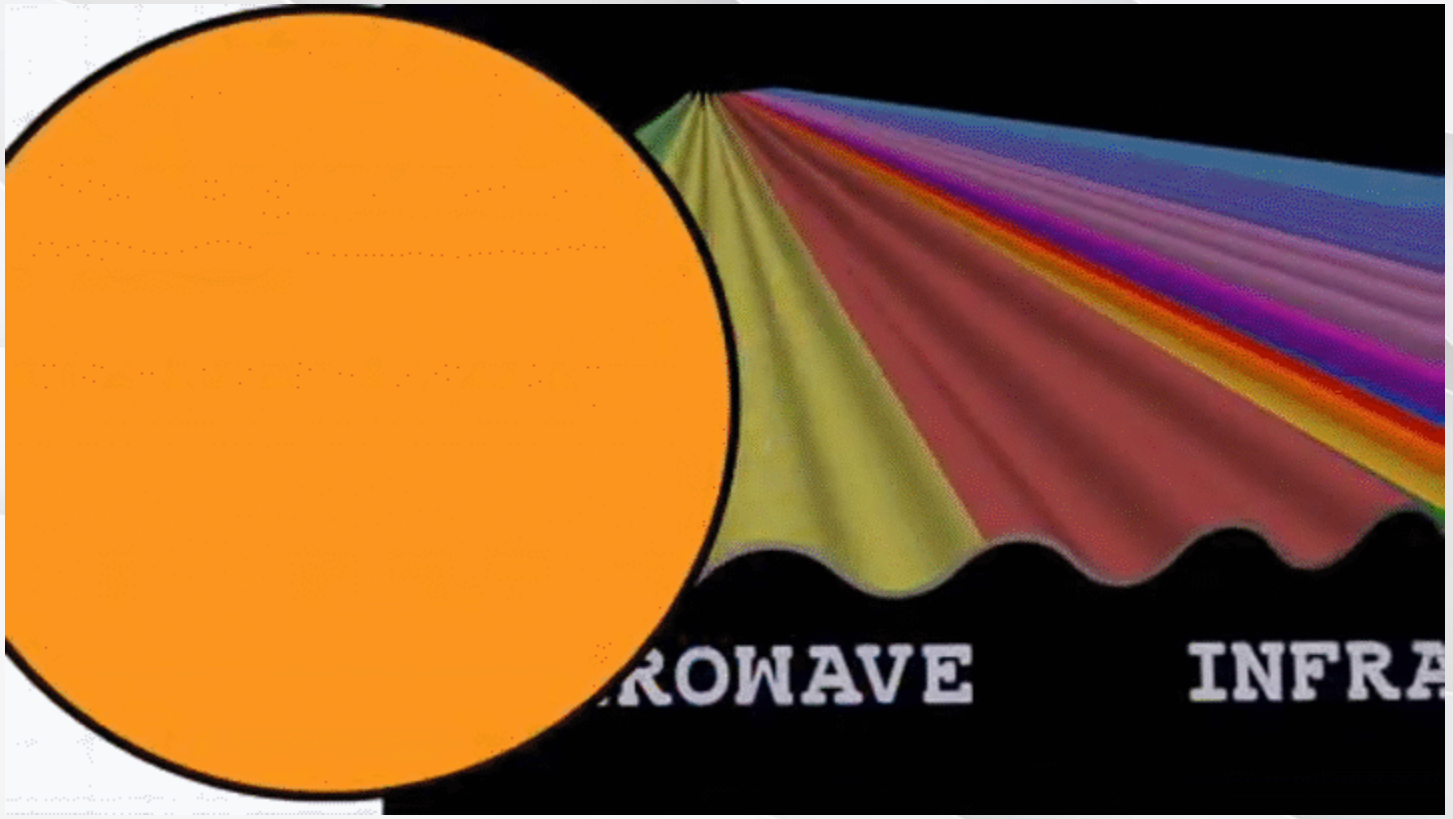
STARTER THINKERS



- 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!

THE REST OF THE BLOCK IS IN THE NEXT POWER POINT ELECTOMAGNETIC SPECTRUM

- THE ELECTROMAGNETIC SPECTRUM!



EXIT PASS

Exit Ticket

Write down 10 words from this topic and give 1 meaning