Plenary Talk Placemat

Today I have learnt that …….

The skills I used in today's lesson were…
I could also use these skills in….

Be a reflective learner.

Discuss with a partner before you share it with the class.

I would like to find out more information about….

One thing I need to remember from today's lesson is…

Before this lesson I could already…

Three key words I have learned today are…

I was successful today when I…

Plenary - complete one of the sentences below

I was successful when I ……..

A question I have about today's lesson is ……

Today I learnt ……..

The part of the lesson I enjoyed the most was……

The skills I used in today's lesson were……

One thing I need to remember from today's lesson is……..

Success Criteria

Waves

- By exploring reflections, the formation of shadows and the mixing of coloured lights, I can use my knowledge of the properties of light to show how it can be used in a creative way. SCN 2-11b
- By exploring the refraction of light when passed through different materials, lenses and prisms, I can explain how light can be used in a variety of applications. SCN 3-11a
- By exploring radiations beyond the visible, I can describe a selected application, discussing the advantages and limitations. SCN 3-11b
- By carrying out a comparison of the properties of parts of the electromagnetic spectrum beyond the visible, I can explain the use of radiation and discuss how this has impacted upon society and our quality of life. SCN 4-11b

Waves – 6 weeks

28/01/2025

1. Visible Light
2. Reflection
3. Refraction
4. Lenses
5. The eye
6. Eyesight correction
7. Colour Prism
8. Mixing Colour
9. Stroop / optical Illusions
10. Waves characteristics and beyond the visible
11. The EM Spectrum and applications
12. Infrared
13. UV
14. Risks of UV
15. X rays
16. Revision1
17. Revision 2
18. Assessment

Light & The Electromagnetic Spectrum

Visible Light

28/01/2025

Starter:

1. Name as many sources of light as you can.

Visible Light

28/01/2025

Learning Intentions:

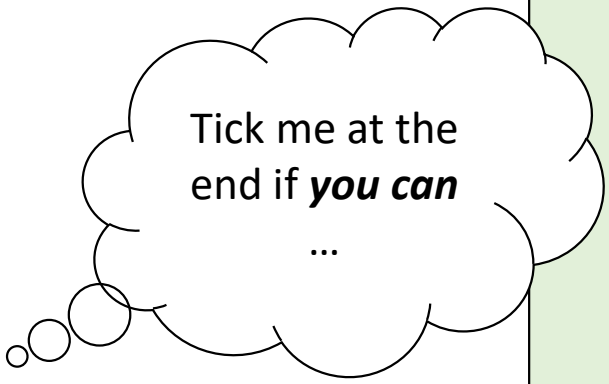
- To learn how we are able to see objects
- To state that light travels in straight lines.

Visible Light

28/01/2025

Success Criteria

- ❑I can name objects that give out light and that reflect light.
- ❑I can explain how shadows are formed.

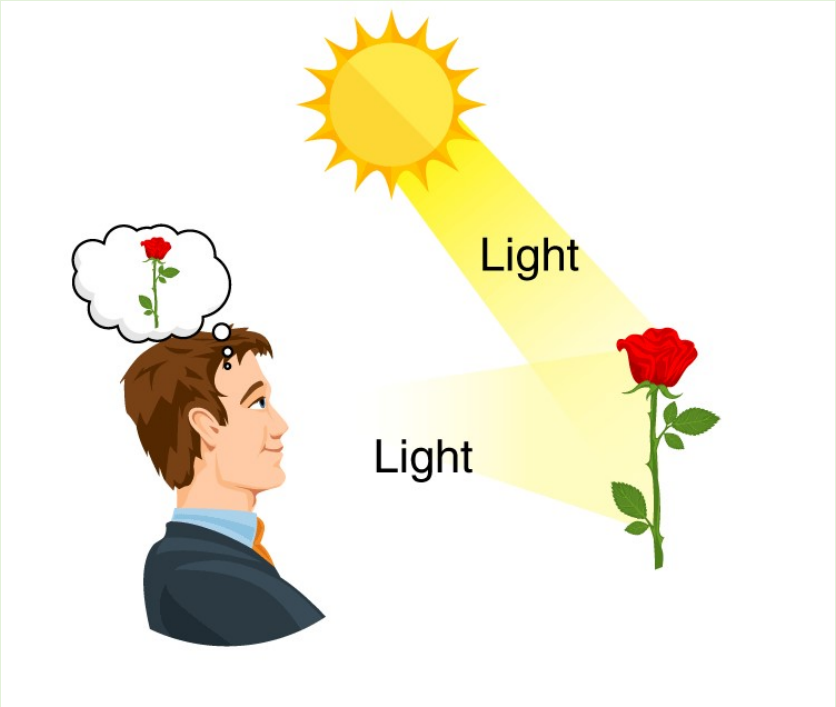


How do we see objects?

Light is often seen as narrow beams or rays and can only travel in straight lines.

If light was able to bend without assistance, then we would be able to see round corners!

We see objects because they **give out** light **(emit)** or they **reflect** light.

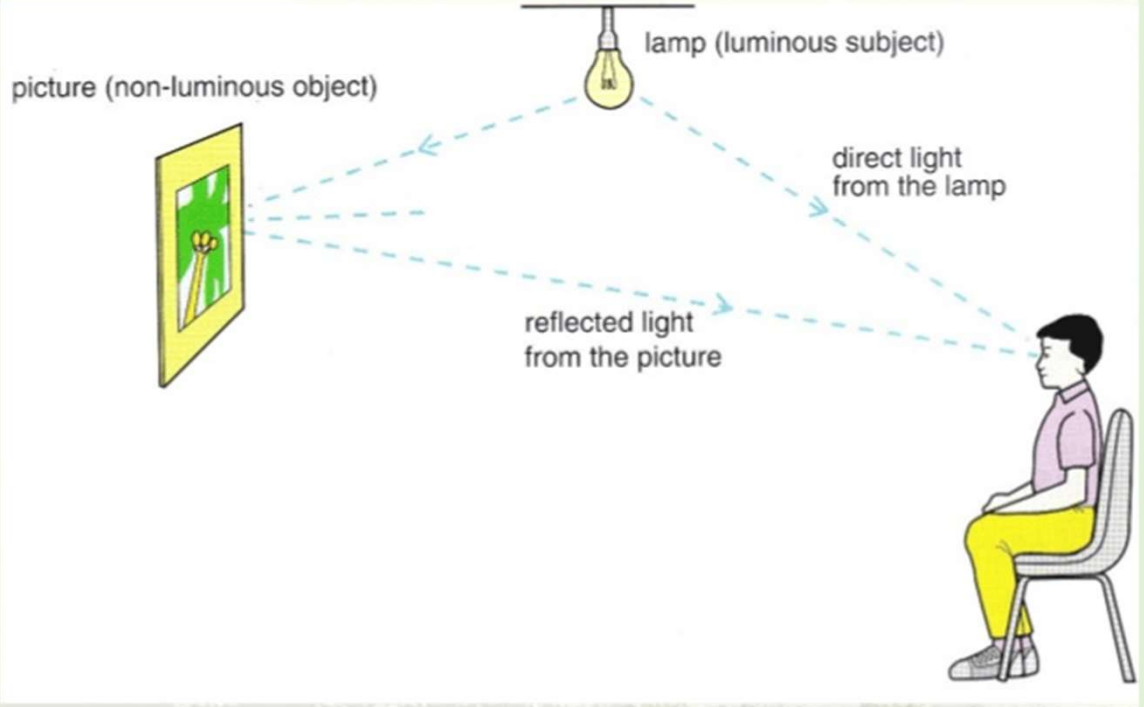


How do we see objects?

Explain why the boy can see the lamp?

The boy can see the lamp because the lamp **emits** light.

Explain why the boy can see the picture?



The boy can see the picture because the light from the lamp **reflected** off the picture then travels towards his eyes.

How do we see objects?

Light is often seen as narrow beams or rays and can only travel in straight lines.

We see objects because they give out light (emit) or they reflect light.

How do we see objects?

Page 18

In the table in your booklet write down the objects below under the correct heading – **emit light** or **reflect light**– be careful with some of them!

A light bulb

The Sun

stars

A mirror

A torch

The Moon

A candle

A book

A smartboard screen

A painting

How do we see objects?

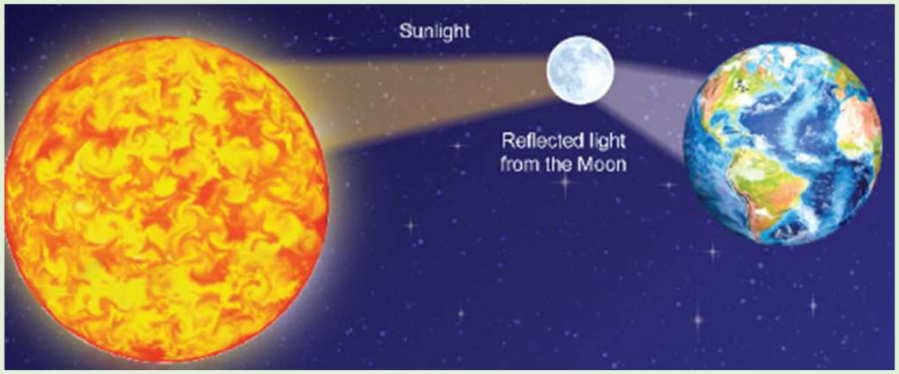
Page 18

In the table in your booklet write down the objects below under the correct heading – **emit light** or **reflect light**– be careful with some of them!

Emit Light	Reflect Light

How do we see objects?

Emit Light	Reflect Light
light bulb	mirror
Sun	book
stars	moon
torch	screen
candle	painting



Did you get the moon correct?
It reflects the light of the Sun

Travelling Light

Class Activity: Shadow Puppets

- Make a shadow puppet and leave it in a fixed position.
- Shine a light source onto your puppet

Describe what you see. What happens to the shadow when you?

1. Move the light source **further away**.
2. Move the light source **closer**.
3. Move the light source **to the right**.
4. Move the light source **to the left**.

Discuss in your groups how you think light travels. Explain your ideas in your booklet.

Travelling Light

Class Activity: Shadow Puppets

Aim: **To describe how light travels.**

Method:

- Make a shadow puppet and leave it in a fixed position.
- Shine a light source onto your puppet

Travelling Light

Results:

_____

_____

_____

Describe what you see. What happens to the shadow when you?

1. Move the light source **further away**.
2. Move the light source **closer**.
3. Move the light source **to the right**.
4. Move the light source **to the left**.

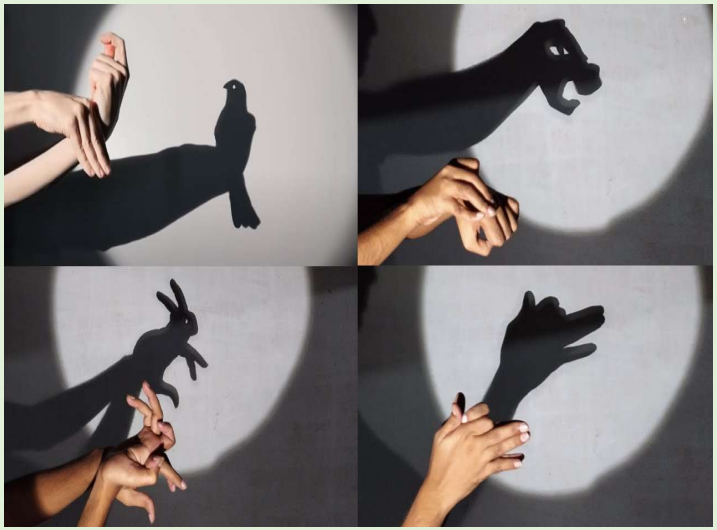
How do we see objects?

Conclusion: How does light travel?

Light travels in straight lines called rays.

Shadows form when light is blocked by an object.

Travelling Light



[Attraction Shadow Theatre Group (Britain's Got Talent)]

Visible Light

28/01/2025

Plenary: True or False

1. Light travels in **straight** lines. **True**
2. Light can **pass through** any type of material. **False**
3. We can only see objects that give out their **own** light. **False**
4. A mirror is said to **reflect** light. **True**
5. Objects blocking the path of light rays cause shadows. **True**

Success Criteria

- ❑ I can state that light travels in straight lines.
- ❑ I can state that objects either give out light or reflect it.

Tick me at the end if ***you can*** …

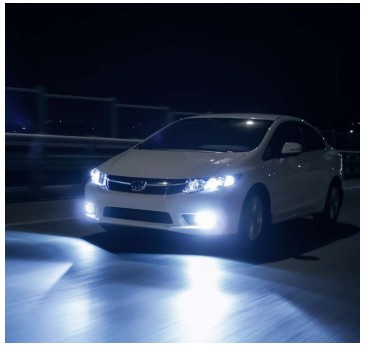
Reflection

28/01/2025

Starter:

Split these objects into two categories. Objects which give out light and objects which reflect light.



Reflection

28/01/2025

Learning Intentions:

- To state the rule of reflection.
- To describe some applications of reflection.

Reflection

28/01/2025

Success Criteria

- ❑I can explain the relationship between the angle of incidence and the angle of reflection.
- ❑I can identify the terms: incident ray, reflected ray and normal.
- ❑I can give examples of where I've seen reflected light.

Tick me at the end if ***you can*** …

Reflection

Class Discussion:

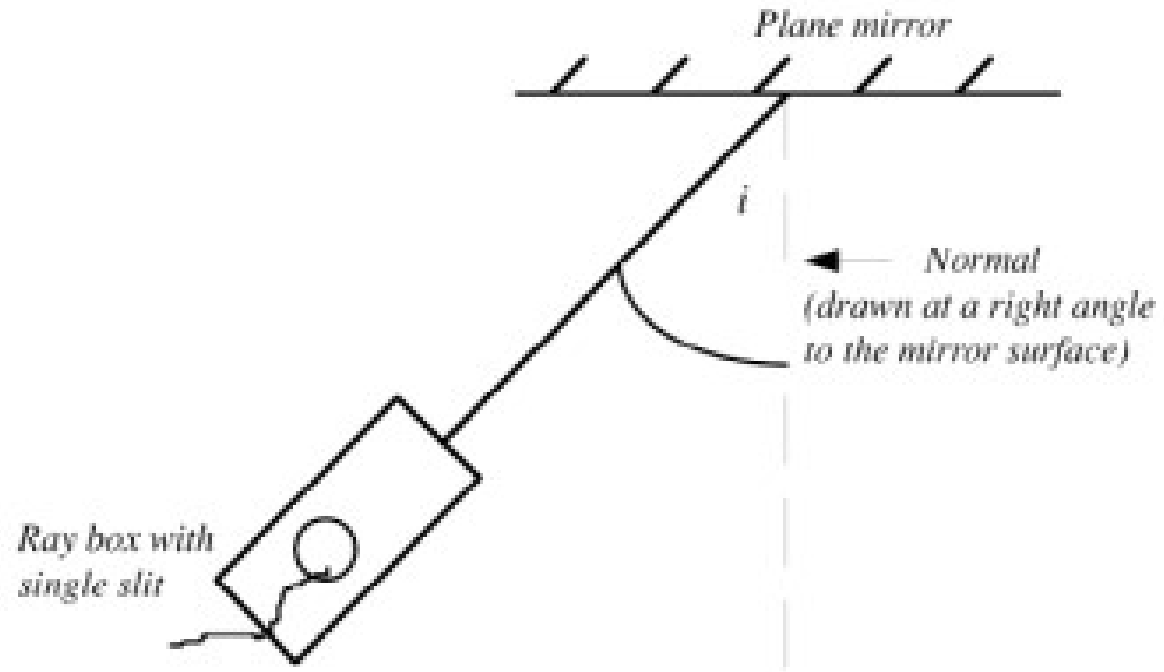
1. What does the word **reflection** mean?
2. Where have you seen light reflecting?

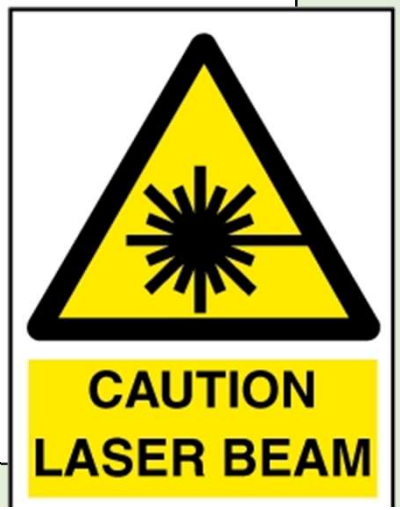
Smooth, shiny surfaces such as mirrors, polished metal reflect light.

Rule of Reflection

Aim: To investigate the relationship between the angle of incidence and angle of reflection using a plane mirror.

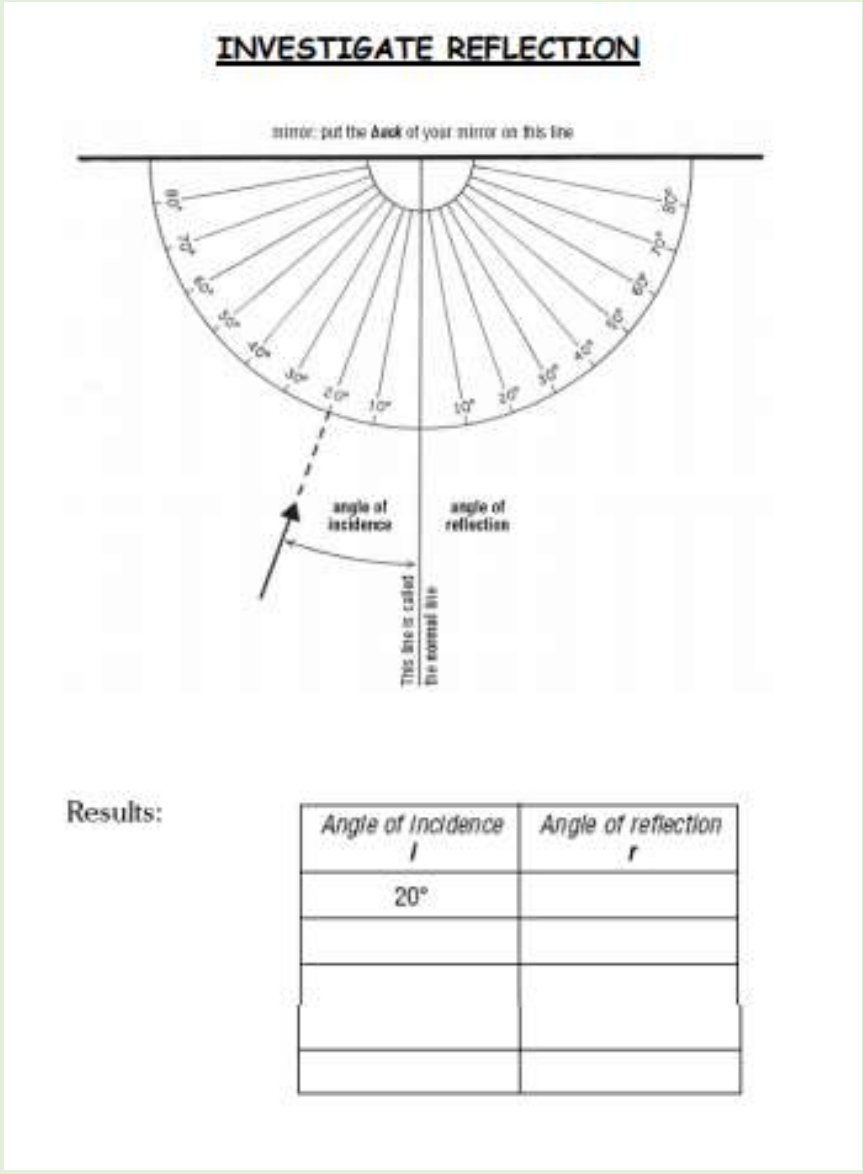
Method:





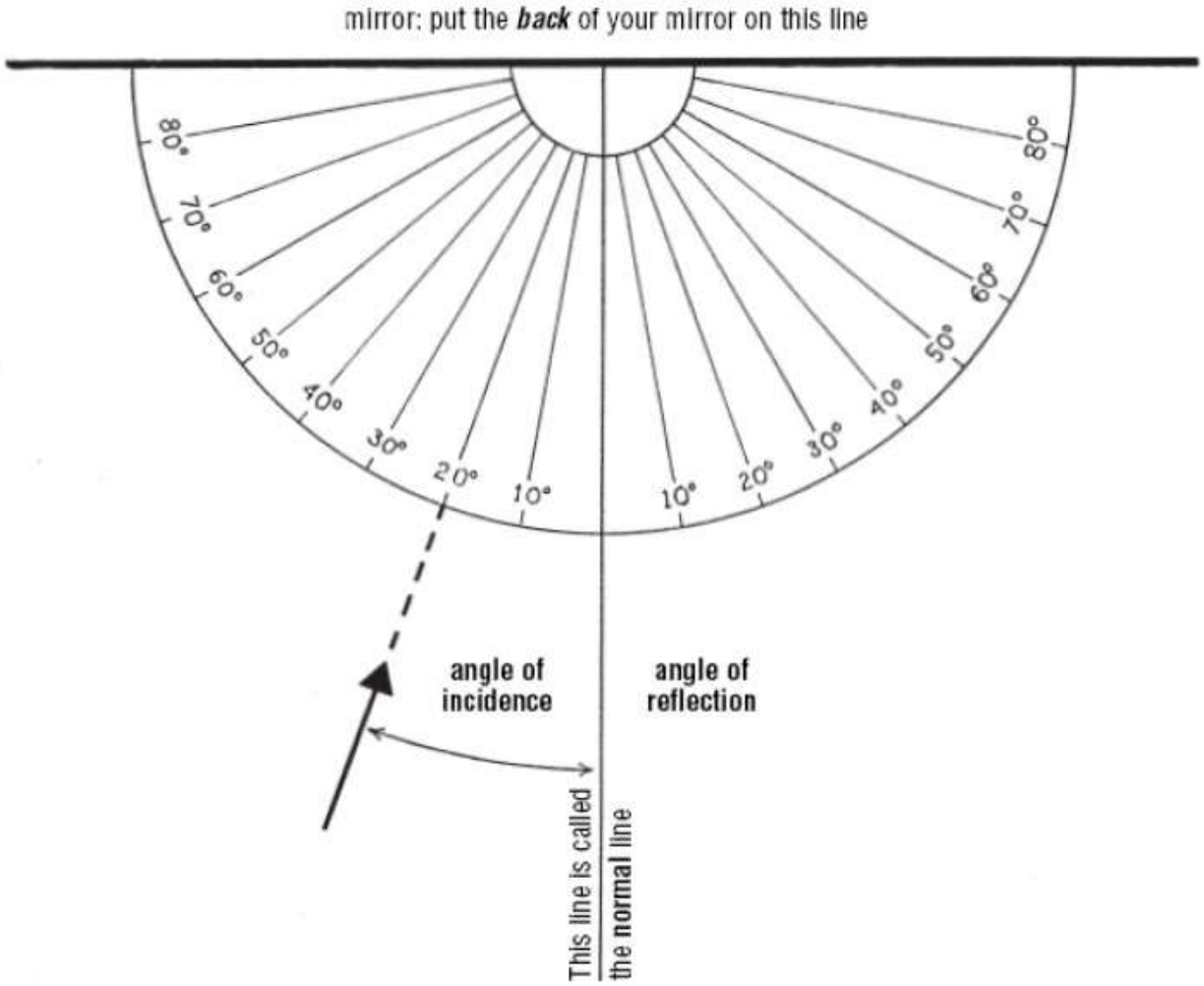
Method:

- Collect a mirror and a ray box.
- Shine a single ray of light against the mirror.
- Set the ray box to shine a single ray of light at an angle of incidence of 20˚ from the normal.
- Record the angle of reflection.
- Repeat with other angles.



Results:

Angle of Incidence *i*	Angle of reflection *r*
20°	


mirror: put the back of your mirror on this line
80°
70°
60°
50°
40°
30°
20°
10°
10°
20°
30°
40°
50°
60°
70°
80°
angle of incidence
angle of reflection
This line is called the normal line


CAUTION
LASER BEAM

Rule of Reflection

Results:

Angle of Incidence (°) I	Angle of Reflection (°) r
20˚	
30˚	
40˚	
50˚	
60˚	

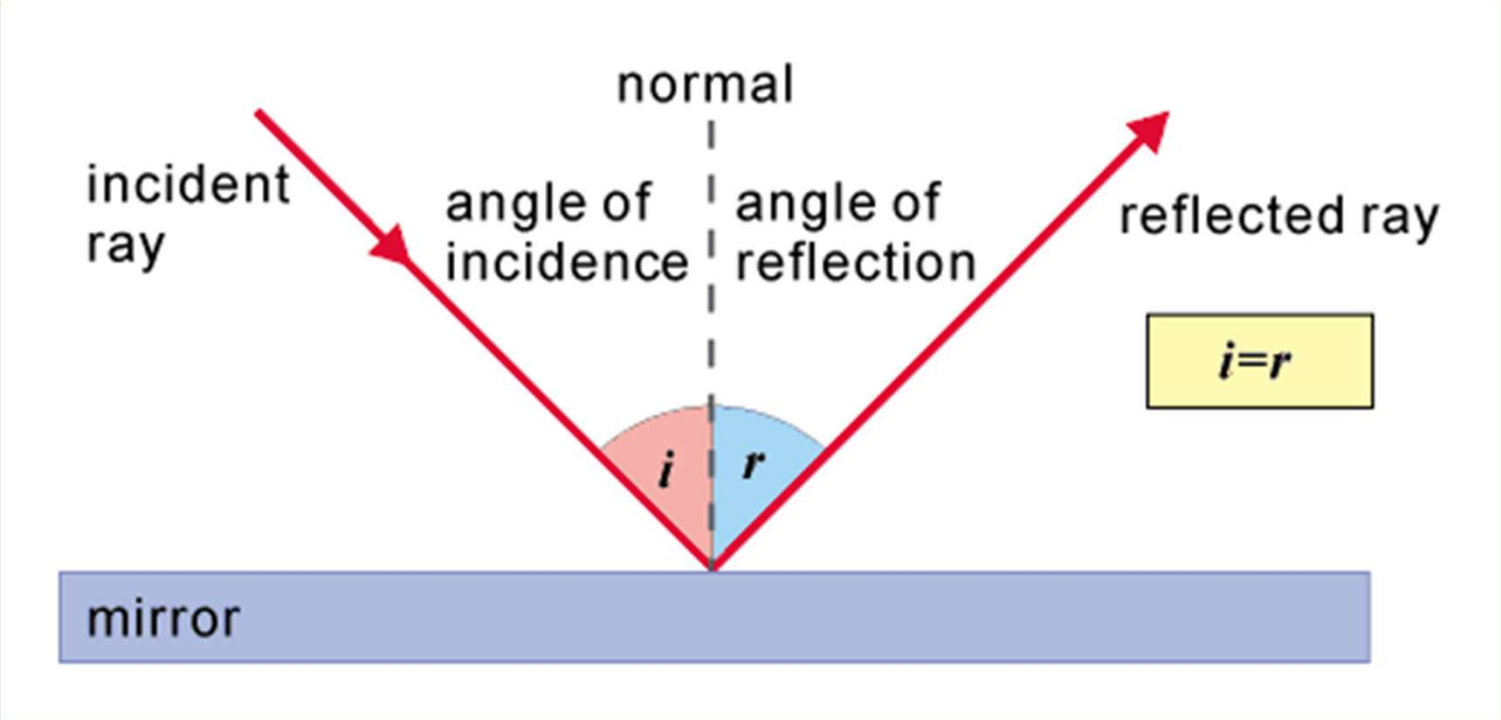
Rule of Reflection

Aim: To investigate the relationship between the **angle of incidence** and **angle of reflection** using a plane mirror.

Conclusion: Answer your aim

The **angle of incidence** is _____equal_____ to the **angle of reflection**.

Rule of Reflection



Rule of Reflection

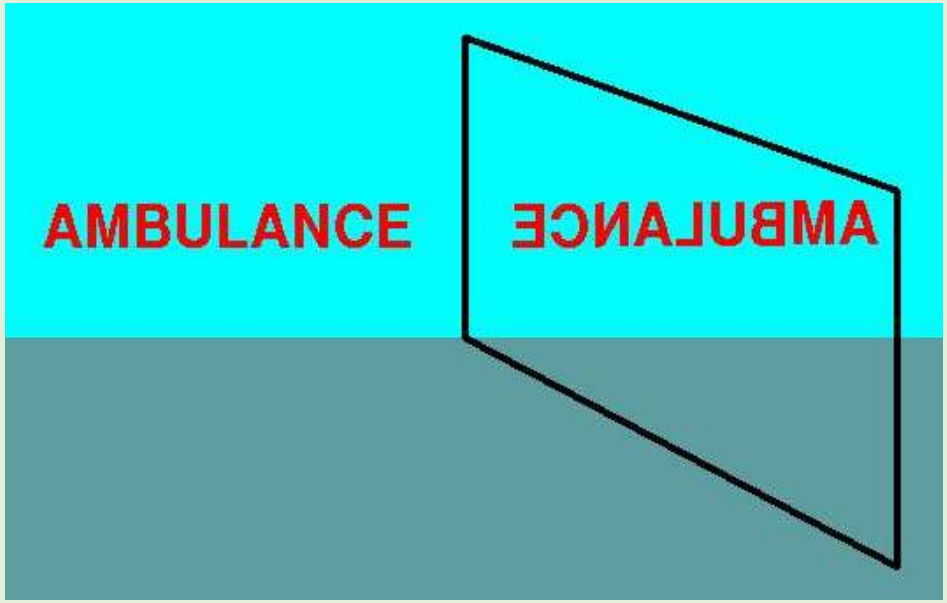
When light is reflected, the angle is always measured between the _____light ray_____and the _____normal_____.

The **normal** is a reference line which is at _____90°_____to the surface of the block.

Rule of Reflection

Class question:

Why does an ambulance have the word **ambulance** written backwards (inverted) on the bonnet?



Extension Task:
Write a word or message on a piece of paper which is inverted.
Swap messages with your partner and read it with the mirror. Did you read it correctly?

Using Reflection

Class Question:

What other objects use reflection in a useful way?

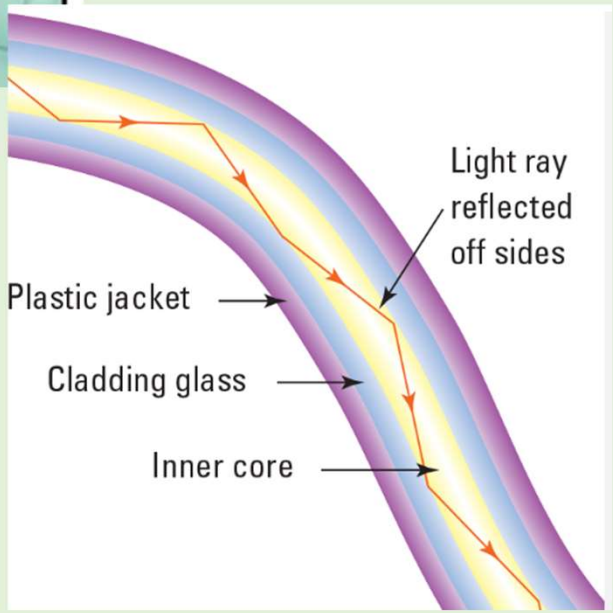
Make a list in your booklet.

The following object using reflection in a useful way:

Using Reflection

A common use is a makeup mirror.

Using Reflection



It is also used in **endoscopes**.

Light is sent inside the patient and an image of their insides reflects back inside the tube and appears on a screen. The doctor can see inside the patient.

Using Reflection

Curved mirror
Solar cooker
Headlight
Torch
Fibre optics

Rule of Reflection

Extension task: Questions to challenge your thinking:

1. Why do you think mirrors are often used in telescopes?

2. If you were to design a room that uses the least amount of electric lighting during the day, how would you use the concept of reflection to your advantage?

3. Can you think of any animals or creatures that use reflection or light emission in nature? (Hint: Think about deep-sea creatures or insects that glow in the dark.)

Using Reflection

And for fun ….Pepper’s Ghost

This trick using a half mirror can make you see the impossible!

Video

Reflection

28/01/2025

Plenary:

Why is our own reflection in the mirror different from what others see?

Success Criteria

- ❑I can state the rule of reflection.
- ❑I can describe some applications of reflection.

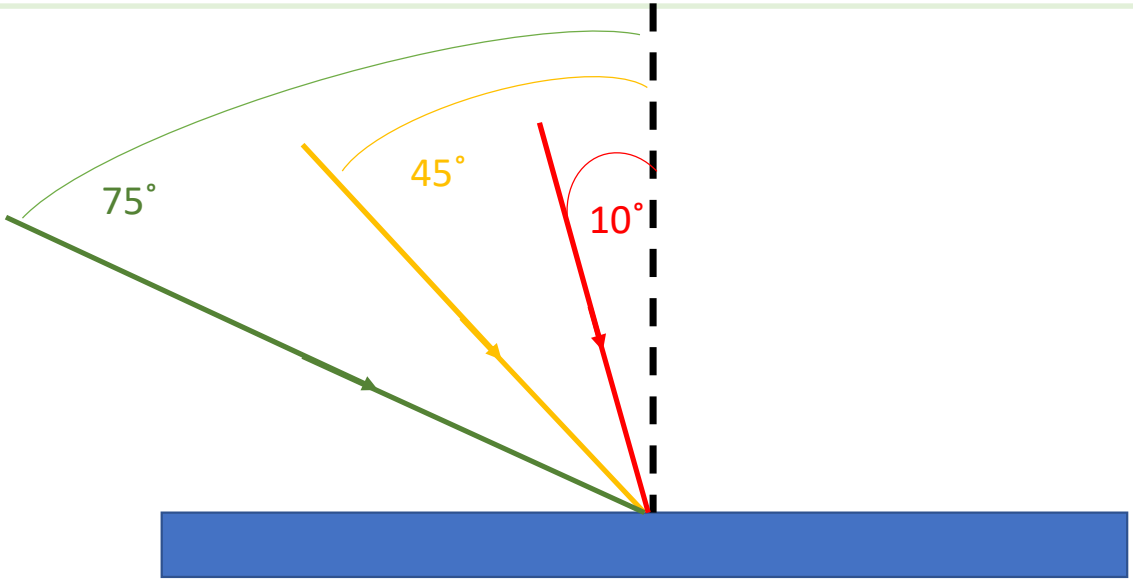
Tick me at the end if ***you can*** …

Refraction

28/01/2025

Starter:

1. State the rule of reflection
2. A pupil investigating the rule of reflection arranges a ray box with a ray of light incident on a plane mirror. The diagram shows the angles of incidence light. What are the expected values for the matching angles of reflection?



Angle of reflection:

Green =

Yellow =

Red =

Refraction

28/01/2025

Learning Intentions:

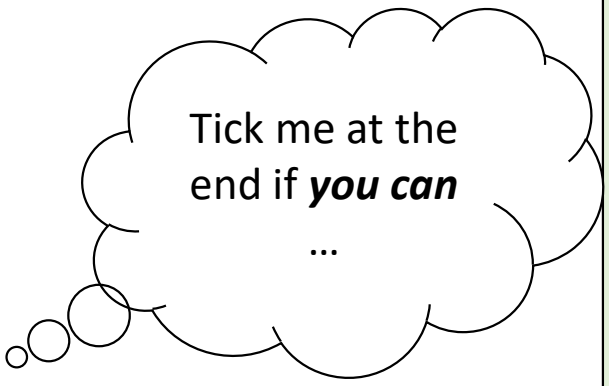
- To state that refraction is when light changes speed when travelling from one material to another.
- To state that refraction can cause light to change direction.

Refraction

28/01/2025

Success Criteria

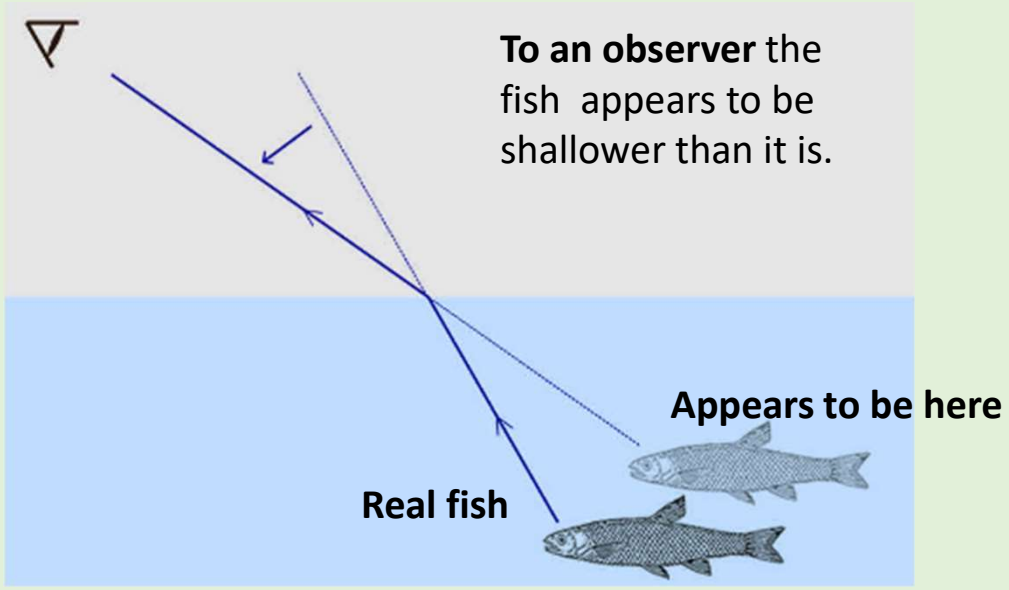
- ❑To explain what happens to light when it passes through different materials.
- ❑To explain what happens to light when it passes through different shapes.



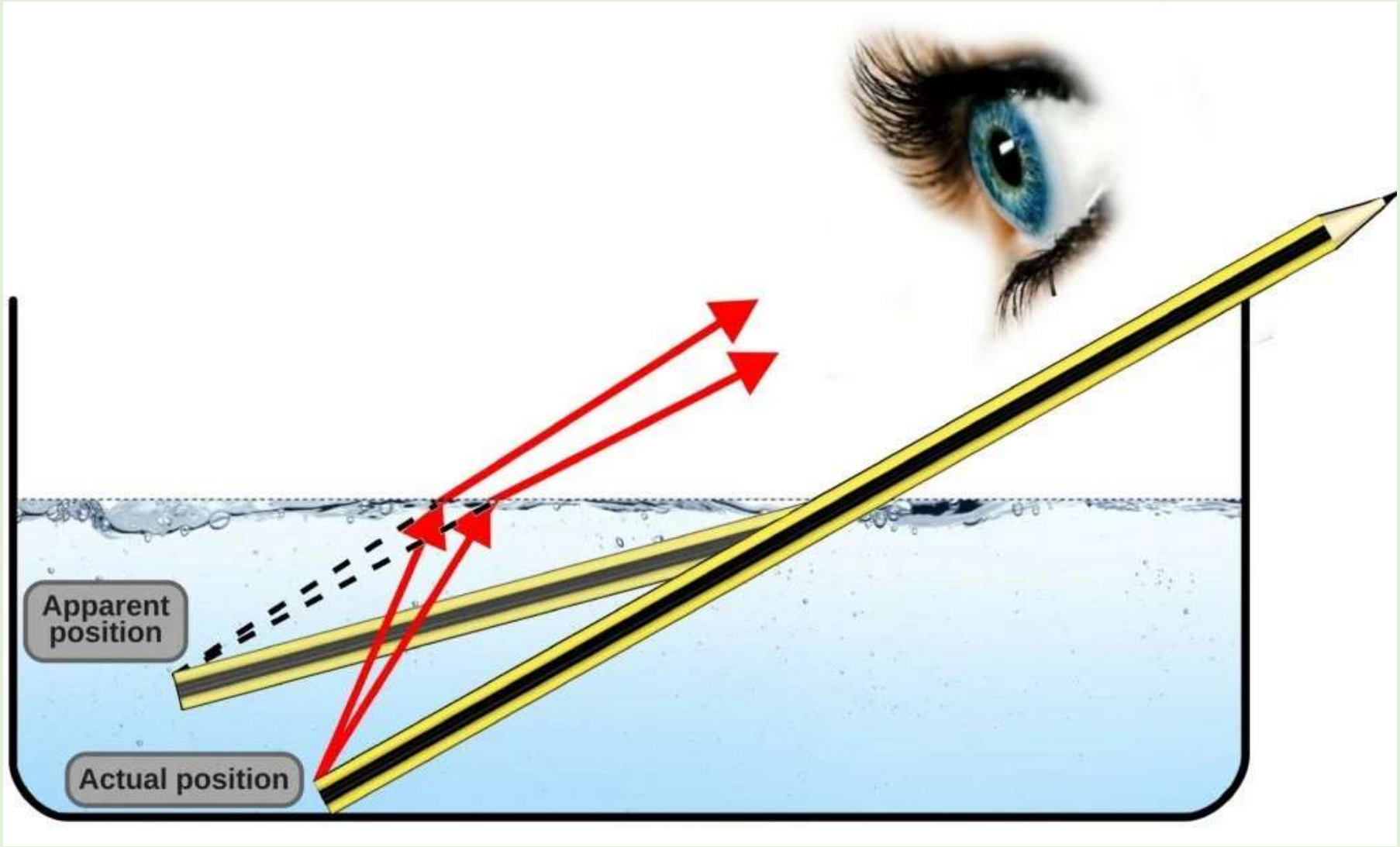
Refraction

Refraction can often be seen in every-day life.

Refraction can make light **bend**



The light from the part of the pencil in the water, and the light from the fish both must pass from water to air to reach our eyes.


Apparent position
Actual position

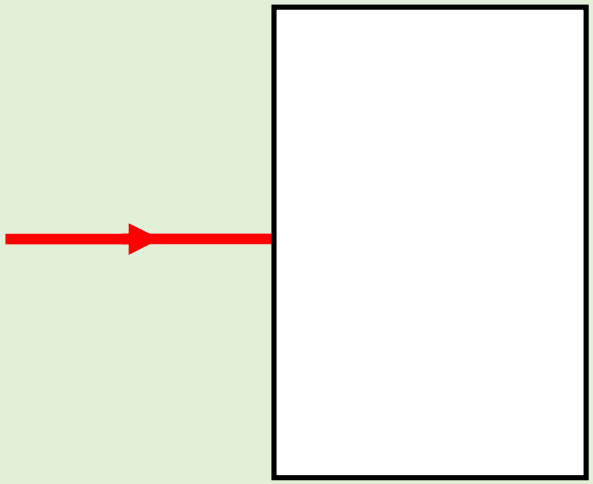
Refraction

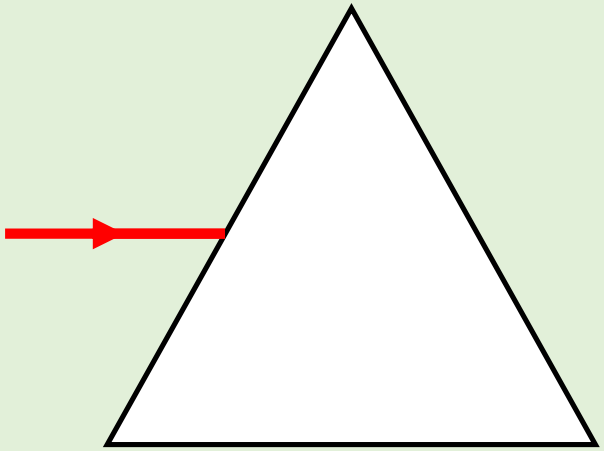
Refraction is where light changes speed when it moves from one material to another.

This often causes the light to bend and change direction.

Refraction Experiment

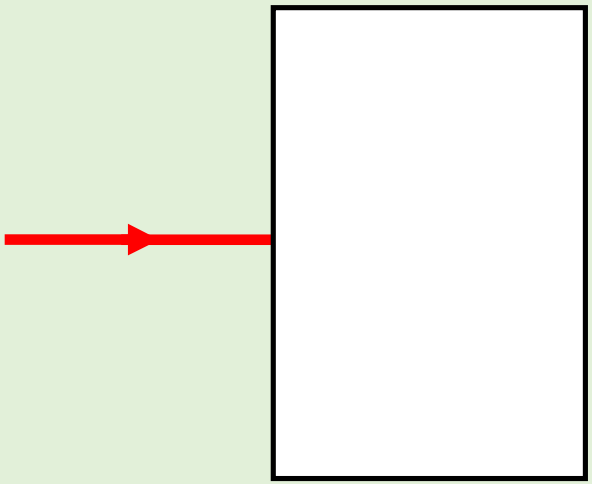
Aim: To investigate how light changes direction in two different shaped plastic blocks; a **rectangular block** and a **triangular block**.





Refraction

Method: Use a **ruler** when you draw rays of light.



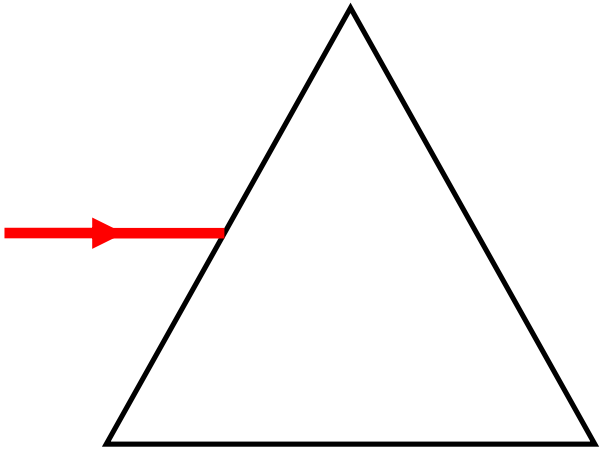
1. Draw around the block.
2. Draw a line to represent the incoming ray. This is called the incident ray.
3. Shine the laser through the glass block and mark where the beam of light exits the block.
4. Draw the ray of light as it leaves the glass block. This is the refractive ray.
5. Connect the rays together.
6. At the point of entry to the block, label the angle of incidence i and the angle of refraction r.

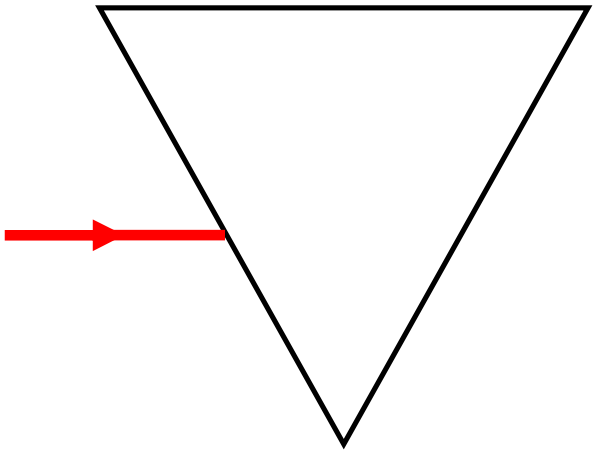
Refraction

Results:

Refraction

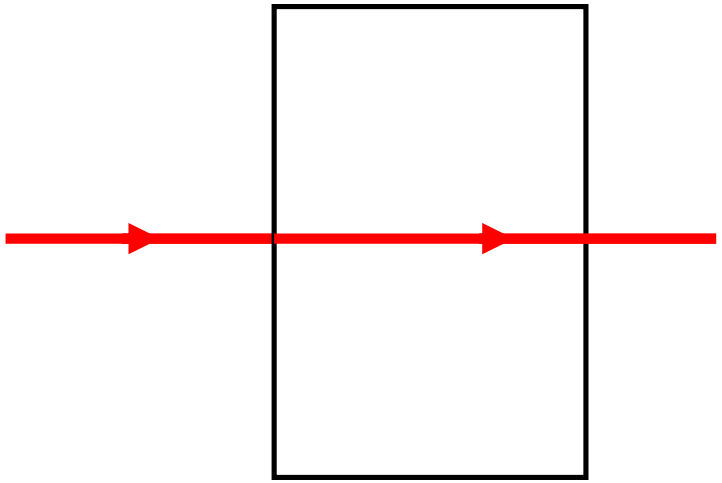
Results:

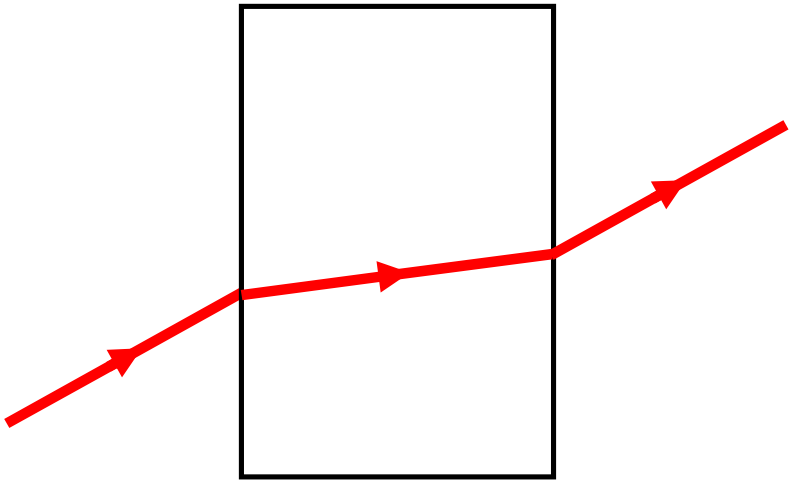




Refraction

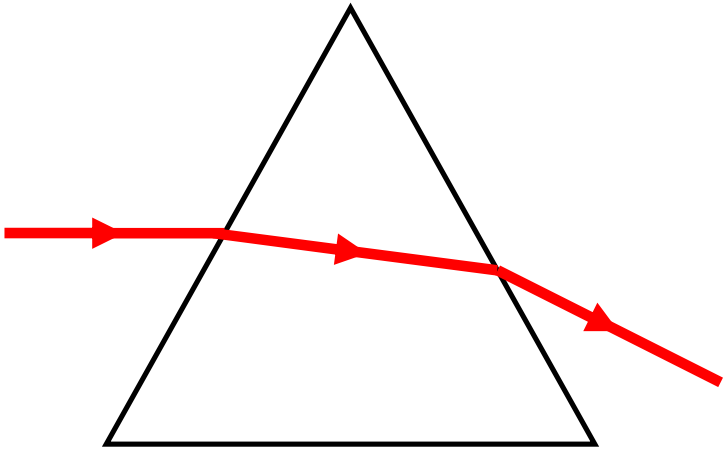
Results:

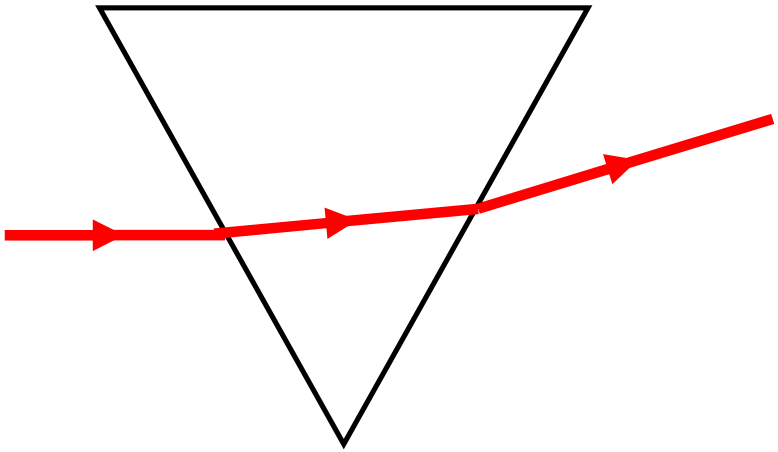




Refraction

Results:





Refraction

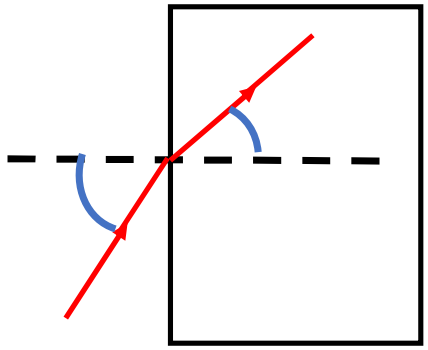
Conclusion:

Aim: To investigate how light changes direction in two different shaped plastic blocks; a **rectangular block** and a **triangular block**.

Refraction

Extension Task:

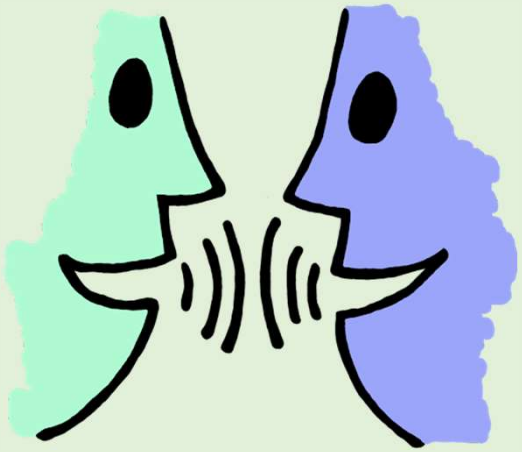
Using a protractor, measure the angle of incidence and the angle of refraction in diagrams 2, 3 and 4.



Aim: To investigate how light changes direction in two different shaped plastic blocks; a **rectangular block** and a **triangular block**.

Refraction

Refraction of light | Physics - Bitesize Science– 1:53



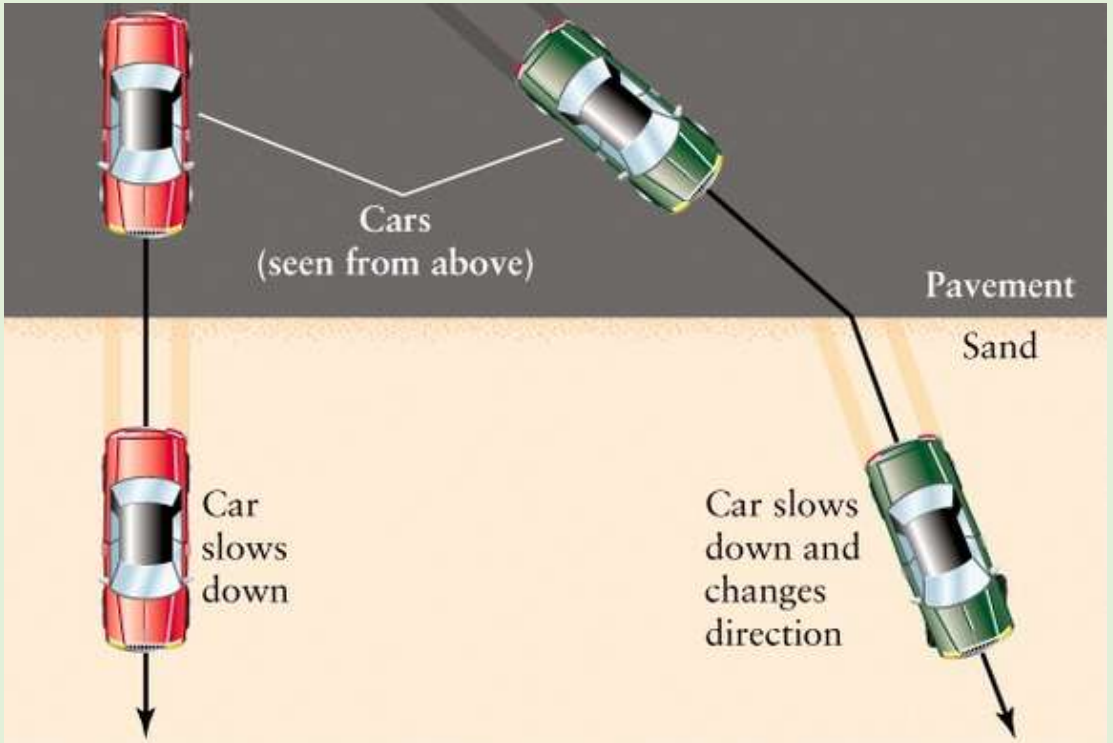
Be prepared to share what you learned with the class!

Refraction

28/01/2025

Plenary:

Explain how this picture of a car driving from the pavement onto the sand is like light traveling from air into plastic.



Success Criteria

- ❑ To state that refraction is when light changes speed when travelling from one material to another.
- ❑ To state that refraction can cause light to change direction.

Tick me at the end if ***you can*** ...

Lenses

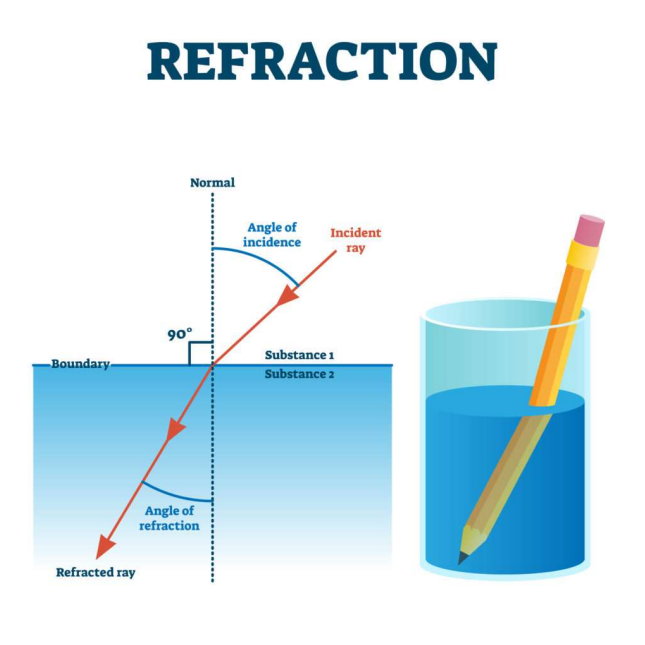
28/01/2025

Page 26

Starter:

1. State what is meant by “refraction of a wave”? (What is the “definition of refraction”?)

2. A pupil states that the direction of a wave always changes when it refracts. Is this statement true or false? Give a reason for your answer.



Lenses

28/01/2025

Learning Intentions:

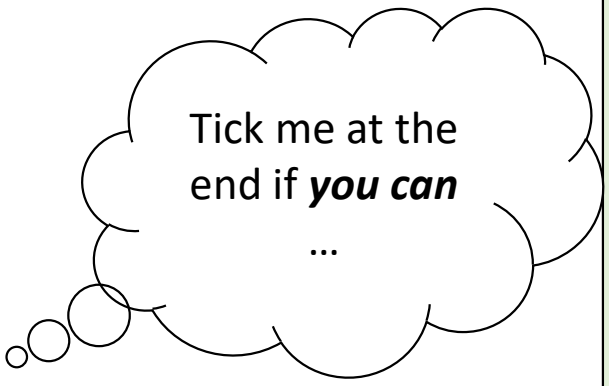
- To investigate the refraction of light through convex and concave lenses.
- To identify applications of refraction, such as lenses to correct long and short sight.

Lenses

28/01/2025

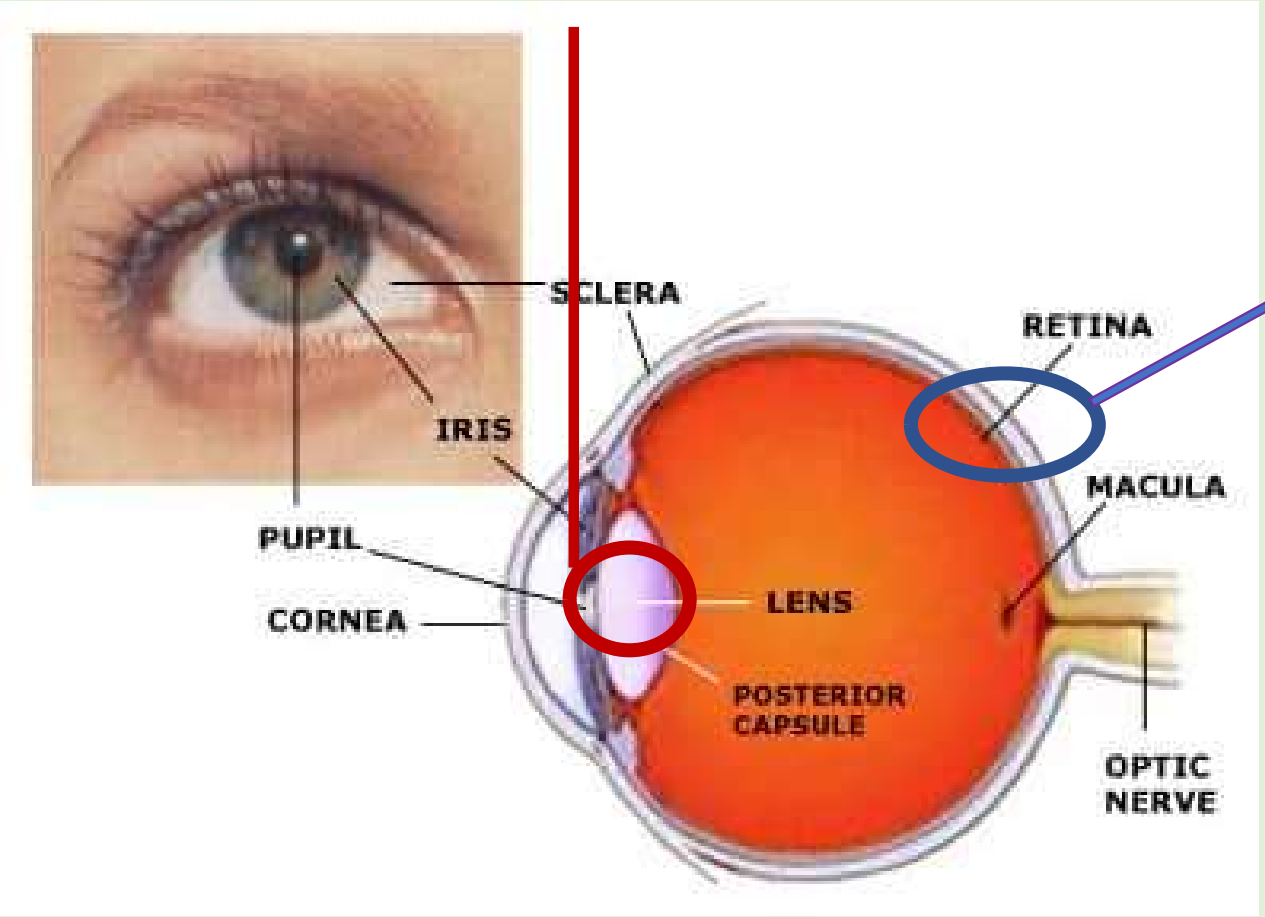
Success Criteria

- ❑To describe what happens when light travels through convex and concave lenses.
- ❑To draw ray diagrams to show the effect of thick and thin lenses on light rays.



Lenses

Each of your eyes has a lens.



The lens in your eye bends light onto your retina so that an image forms there. You've got a tiny movie screen inside your eyes!

Lenses

Lenses deliberately bend light to correct for common **eyesight defects.**

Short sight

Can’t see distant things clearly

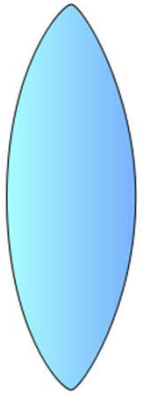
Long sight

Can’t see close things clearly

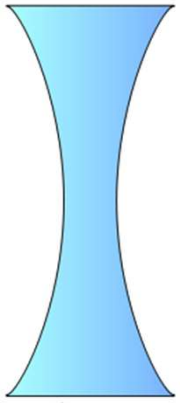
These defects are **very** common.
Many people need to wear glasses.

Lenses

Lenses bend light. They come in two basic shapes -



Convex *or* **converging** lens
(thicker in the middle than at the edges…)

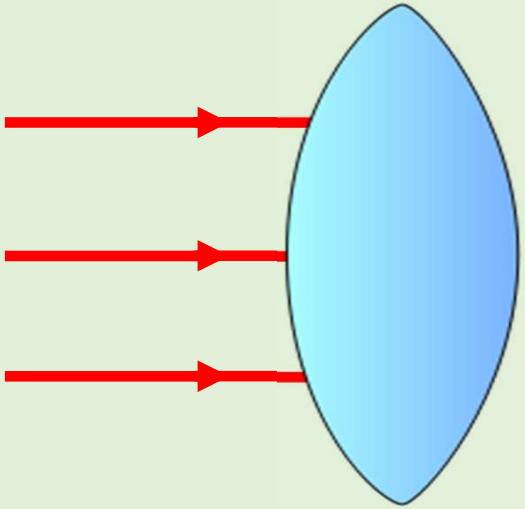


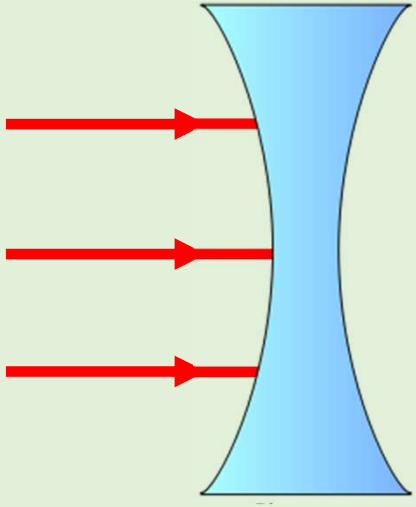
Concave *or* **diverging** lens
(thinner in the middle than at the edges…)

(“Caves go in the way…”)

Lenses

Aim: To investigate how light refracts as it passes through different convex and concave lenses.

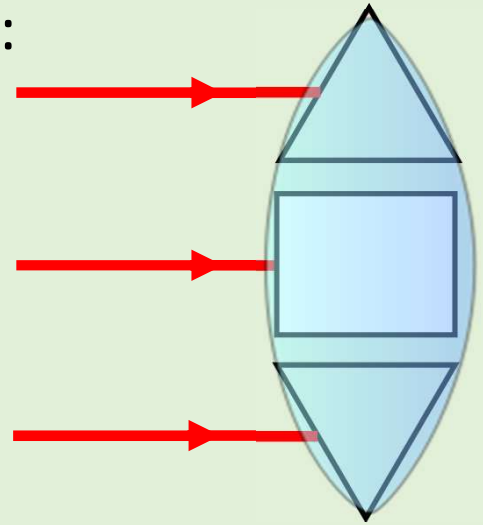




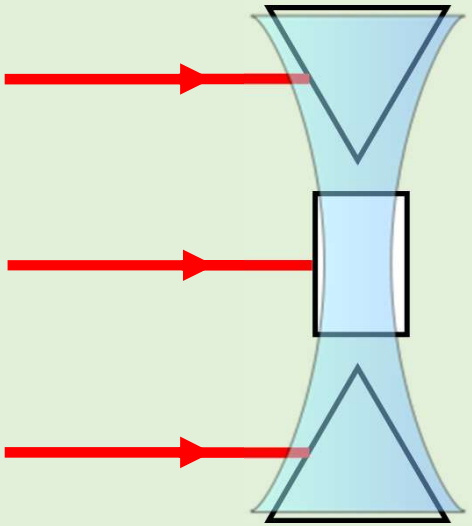
Lenses

Predict what is going to happen…
Think about the following, based on what you have already seen ...

A **<u>convex</u>** lens can be thought of as:



A **<u>concave</u>** lens can be thought of as:

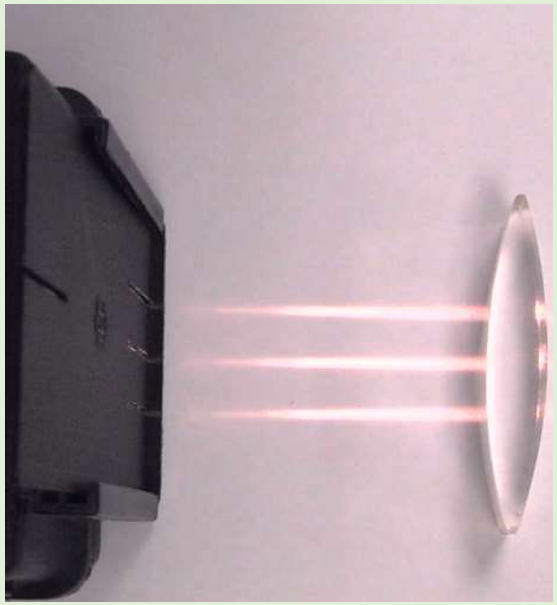


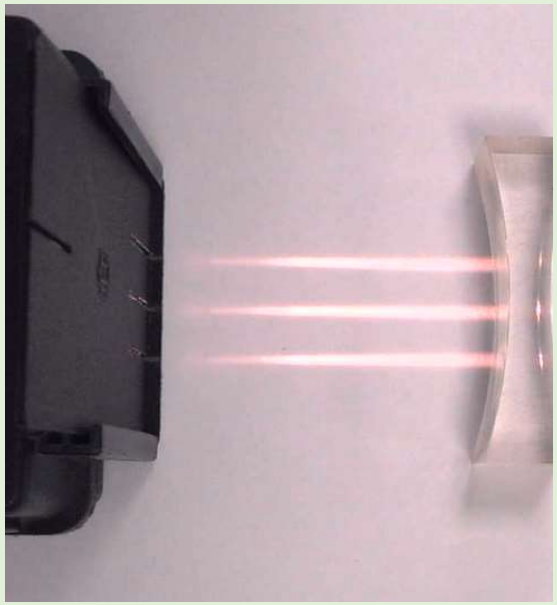
Carry out the experiment– were you correct?

Lenses

Method:

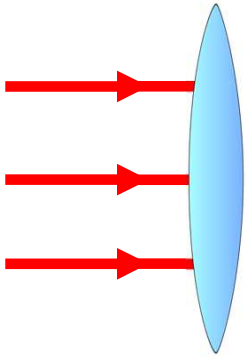
1. Using the ray box shine three rays of parallel light into each lens.
2. Draw around the lens and mark the path of the rays of light on both sides of the lens.
3. Repeat for each lens.



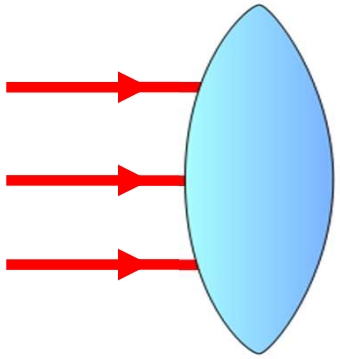


Lenses

Results:



Thin convex lens



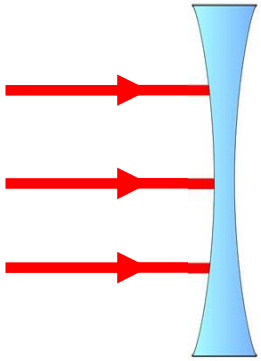
Thick convex lens

1. How does a convex lens affect the path of the light rays?

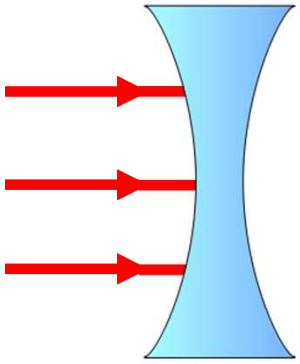
2. How does the thickness of the lenses affect the path of the light rays?

Lenses

Results:



Thin concave lens



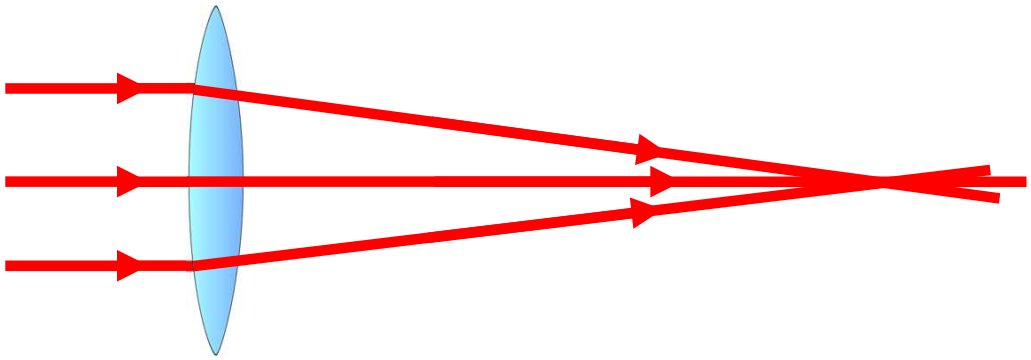
Thick concave lens

1. How does a concave lens affect the path of the light rays?

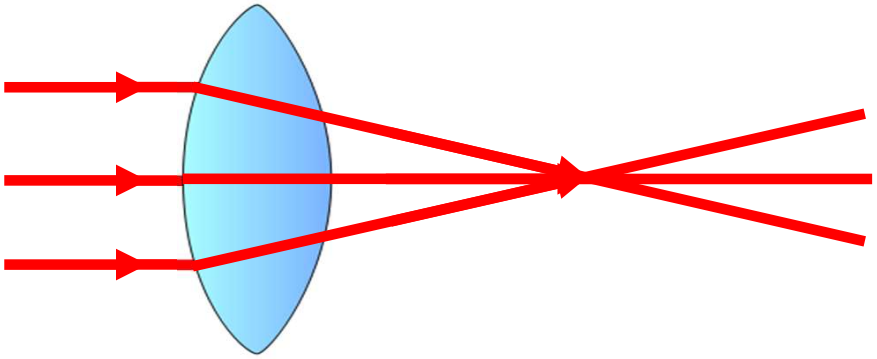
2. How does the thickness of the lenses affect the path of the light rays?

Lenses

Results:



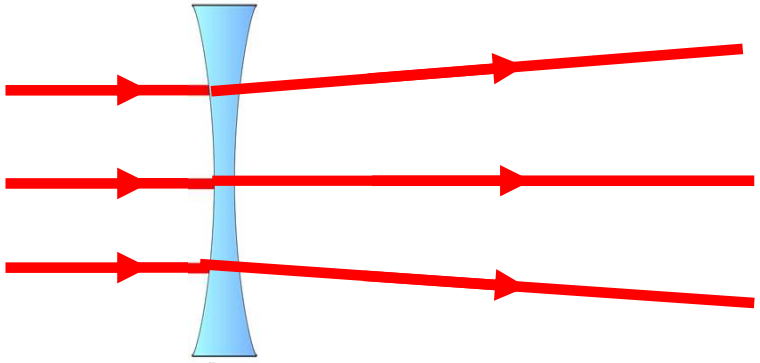
Thin convex lens



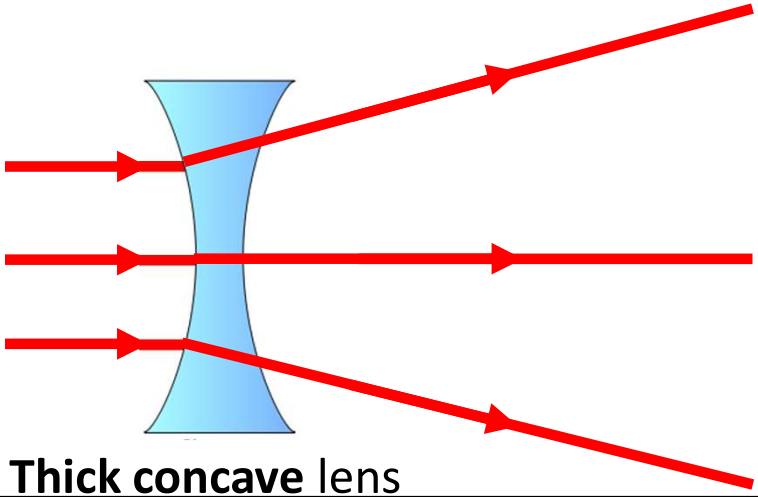
Thick convex lens

Lenses

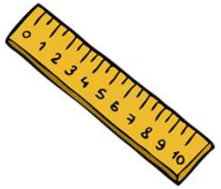
Results:



Thin concave lens



Thick concave lens



Lenses

Conclusion:

Aim: To investigate how light refracts as it passes through different convex and concave lenses.

Lenses

Convex lenses bring the rays together to a focal point.

Concave lenses make the light spread out.

Lenses

The more **curved** a lens is the _greater_ the effect on the light rays.
The thicker convex lens brings the rays to a focus _closer_ to the lens.

Lenses

28/01/2025

Plenary:

Name **5** devices which use lenses.

Tick me at the end if ***you can*** …

Success Criteria

- ❑ To investigate the refraction of light through convex and concave lenses

The Eye

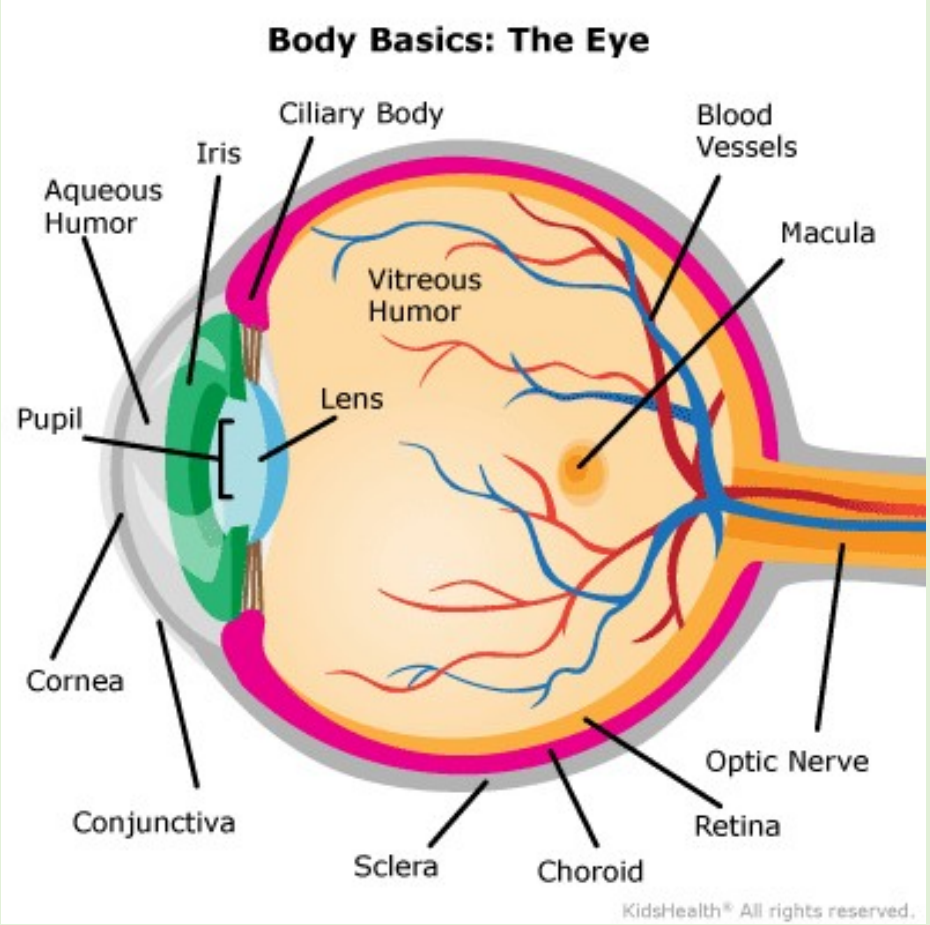
28/01/2025

Page 29

Starter:

1. What property of light causes light to bend when it moves from one material to another?

2. Name and draw the two basic lens shapes.



The Eye

28/01/2025

Learning Intentions:

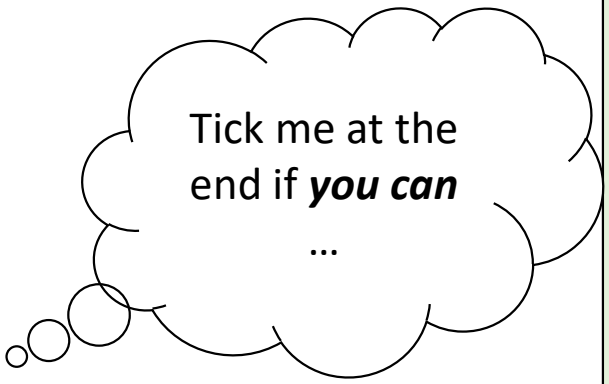
- To explain how the eye works.

The Eye

28/01/2025

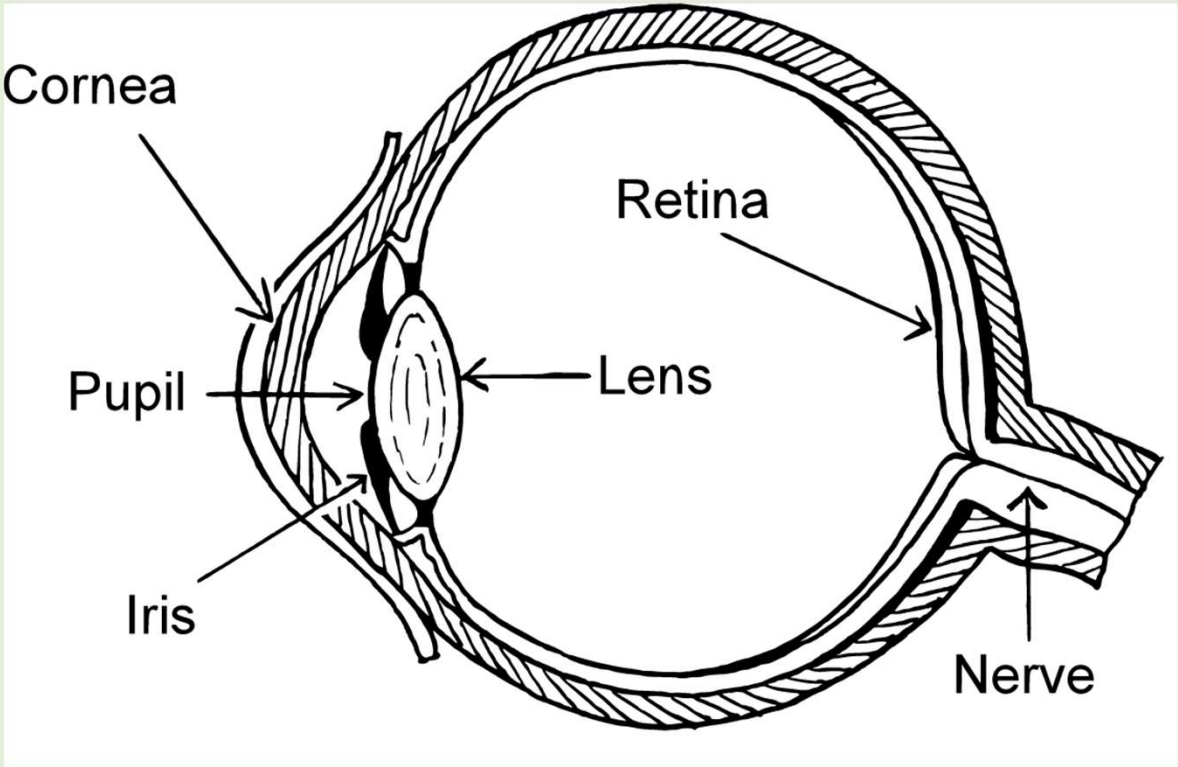
Success Criteria

- ❑I can state the names and functions for parts of the eye.
- ❑I can explain the job of the lens.

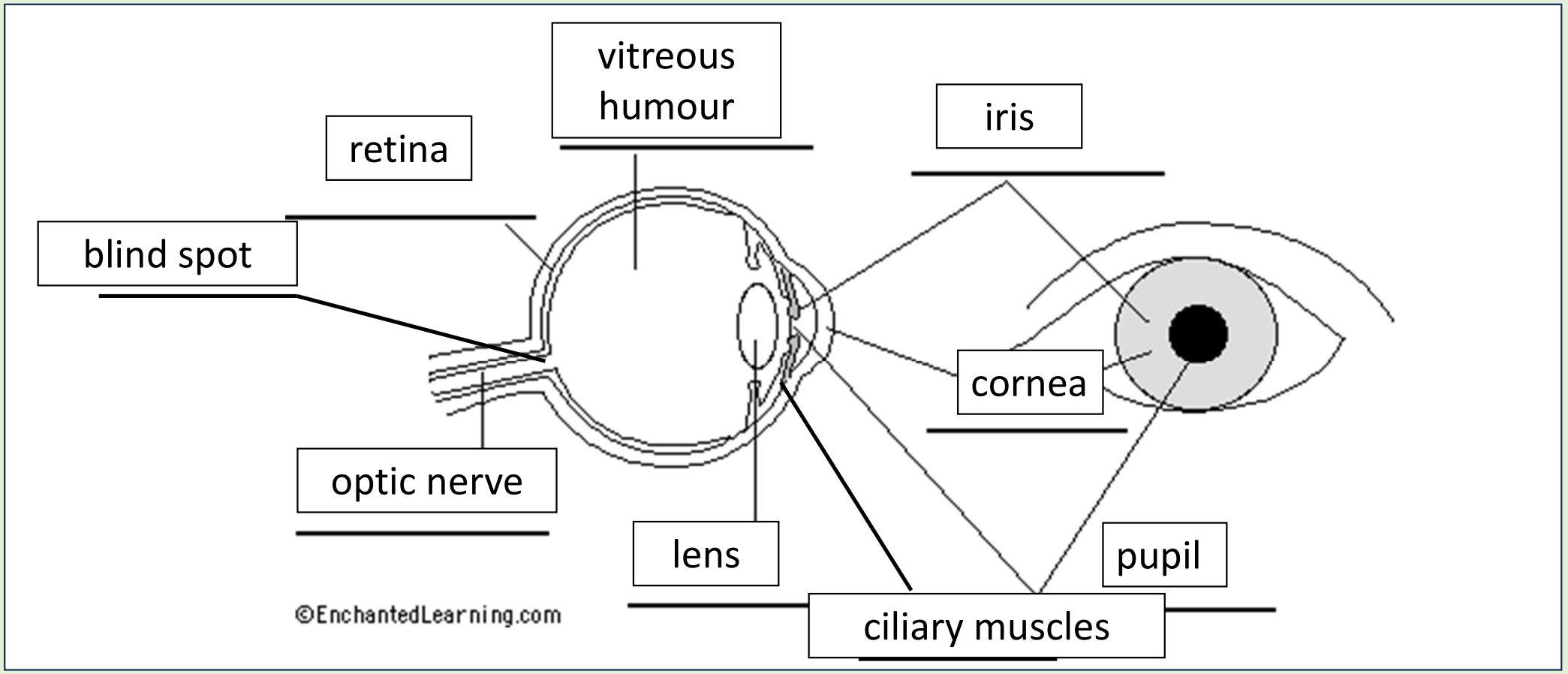


The Eye

In order to find out how we see, we need to find out what our eye looks like.



The Eye


vitreous humour
retina
iris
blind spot
cornea
optic nerve
lens
pupil
ciliary muscles
©EnchantedLearning.com

The Eye

[What's inside an eyeball? | Eyeball Dissection | We The Curious](#) – 3.27

Listen out for these words whilst watching the video…

Pupil
Iris
Lens
Retina

Cornea
Blind spot
Optic nerve
Ciliary Muscles
Vitreous humour

The Eye

Parts		Function
My try	Correct	
		A hole which lets light through.
		Coloured part of the eye and controls the size of the pupil.
		Shape can be changed to focus the light.
		Receptor cells which convert light into electrical impulses.
		Transparent layer at the front of the eye which helps focus the light.
		A place on the retina where there are no receptor cells.
		Sends electrical impulses to the brain.
		Changes the lens shape to focus the light on the retina.
		A gel like substance which helps maintain the round shape of the eye.

The Eye

Put these words in the parts column under ‘My Try’. Match them to the correct function.

Pupil	Optic nerve	Ciliary muscles	Retina
Iris	Blind spot	Vitreous humour	Pupil
Cornea			

Parts		Function
My try	Correct	
		A hole which lets light through.
		Coloured part of the eye and controls the size of the pupil.
		Shape can be changed to focus the light.
		Receptor cells which convert light into electrical impulses.
		Transparent layer at the front of the eye which helps focus the light.
		A place on the retina where there are no receptor cells.
		Sends electrical impulses to the brain.
		Changes the lens shape to focus the light on the retina.
		A gel like substance which helps maintain the round shape of the eye.

Card sort also available

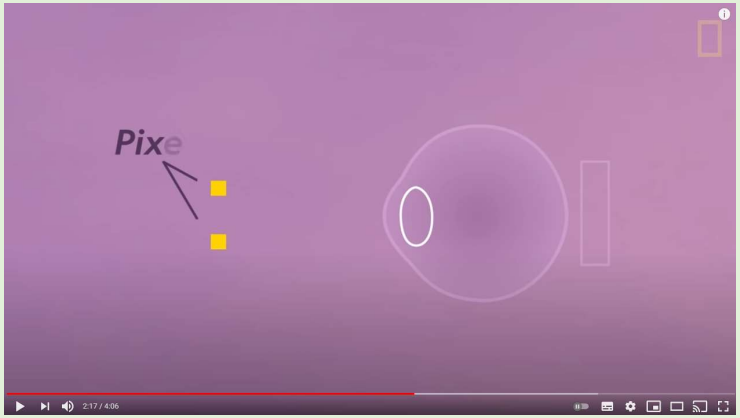
The Eye

Parts		Function
My try	**Correct**	
	Pupil	A hole which lets light through.
	Iris	Coloured part of the eye and controls the size of the pupil.
	Lens	Shape can be changed to focus the light.
	Retina	Receptor cells which convert light into electrical impulses.
	Cornea	Transparent layer at the front of the eye which helps focus the light.
	Blind spot	A place on the retina where there are no receptor cells.
	Optic nerve	Sends electrical impulses to the brain.
	Ciliary Muscles	Changes the lens shape to focus the light on the retina.
	Vitreous humour	A gel like substance which helps maintain the round shape of the eye.

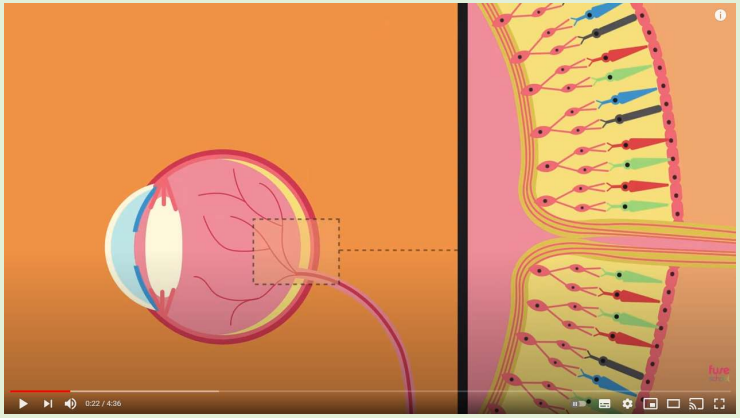
How does the human eye work?

[How does the human eye work? – 2:46]

[How Your Eyes Make Sense of the World | Decoder-4:06]

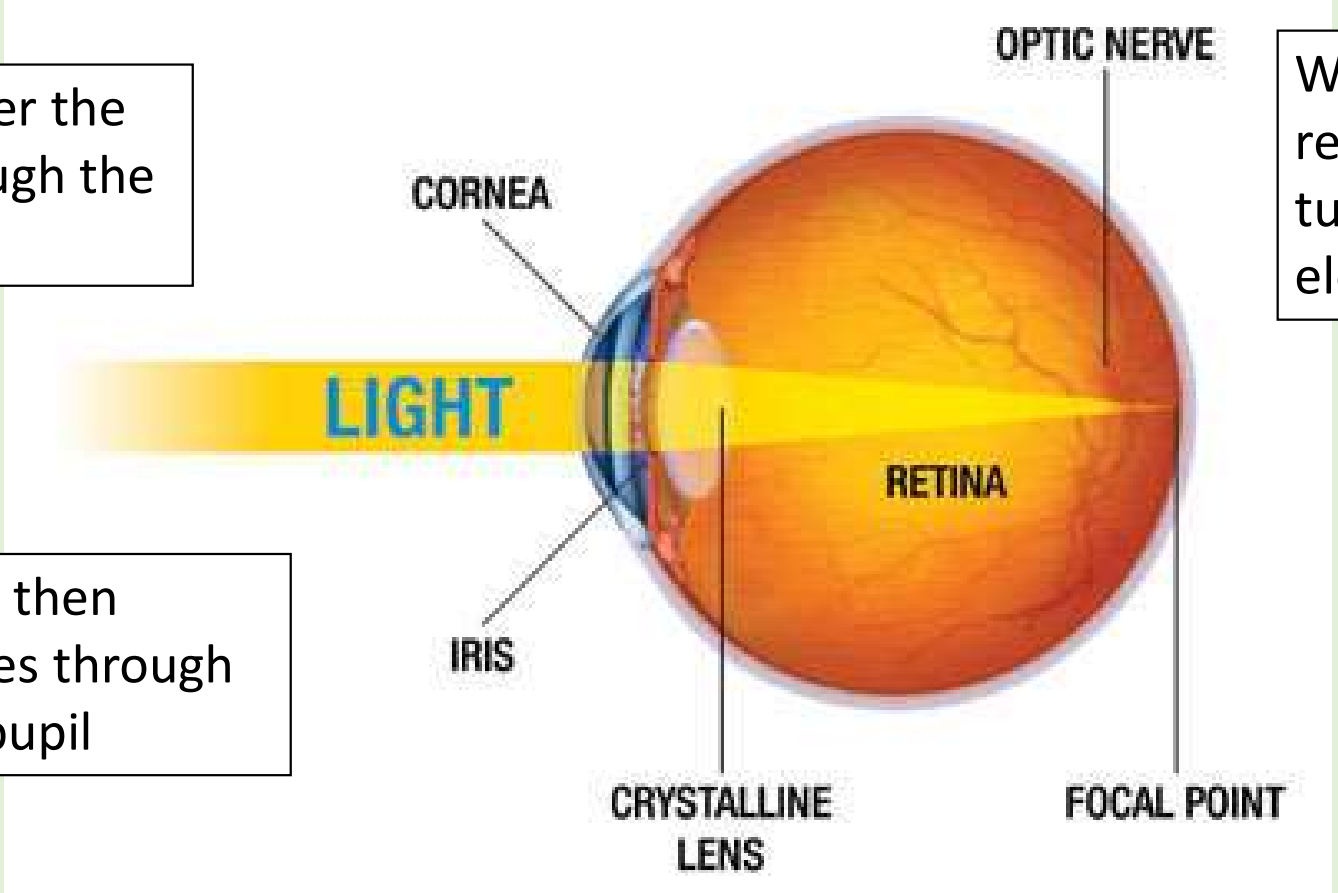


[The Eye | Physiology | Biology | FuseSchool – 4:36]



[Operation Ouch - The Eye Lense | Body Facts – 4:01]

Light enter the eye through the cornea



When light hits the retina, special cells turn the light into electrical signals

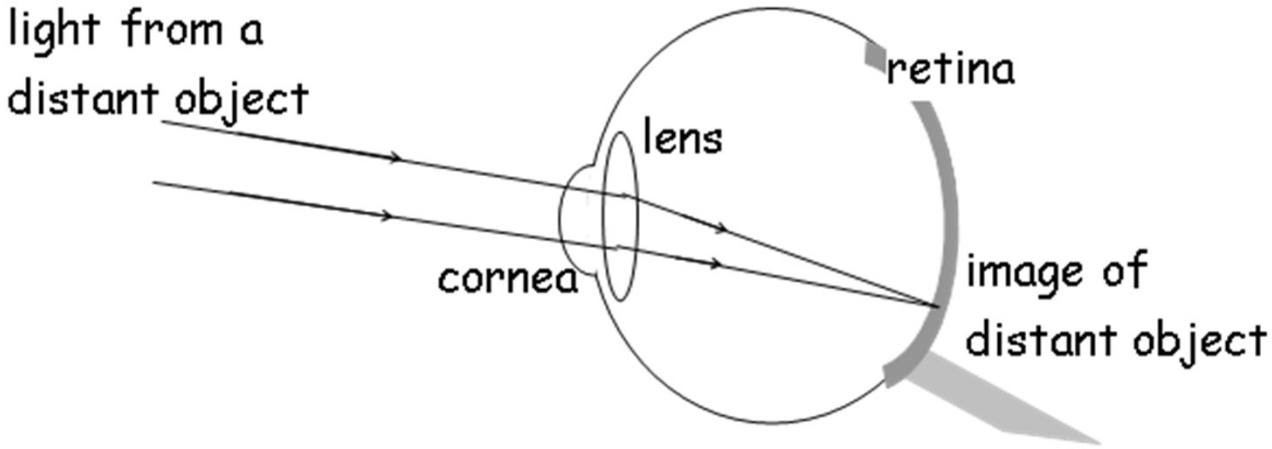
Light then passes through the pupil

These electrical signals travel from the retina through the optic nerve to the brain. Then the brain turns the signals into the images you see.

The lens focuses the light on to the retina

How do we see?

Light from an object will enter the eye. This light is focused by the _____ and _____. An image is produced on the _____ at the back of the eye. Special cells detect the light and send a signal to the _____.



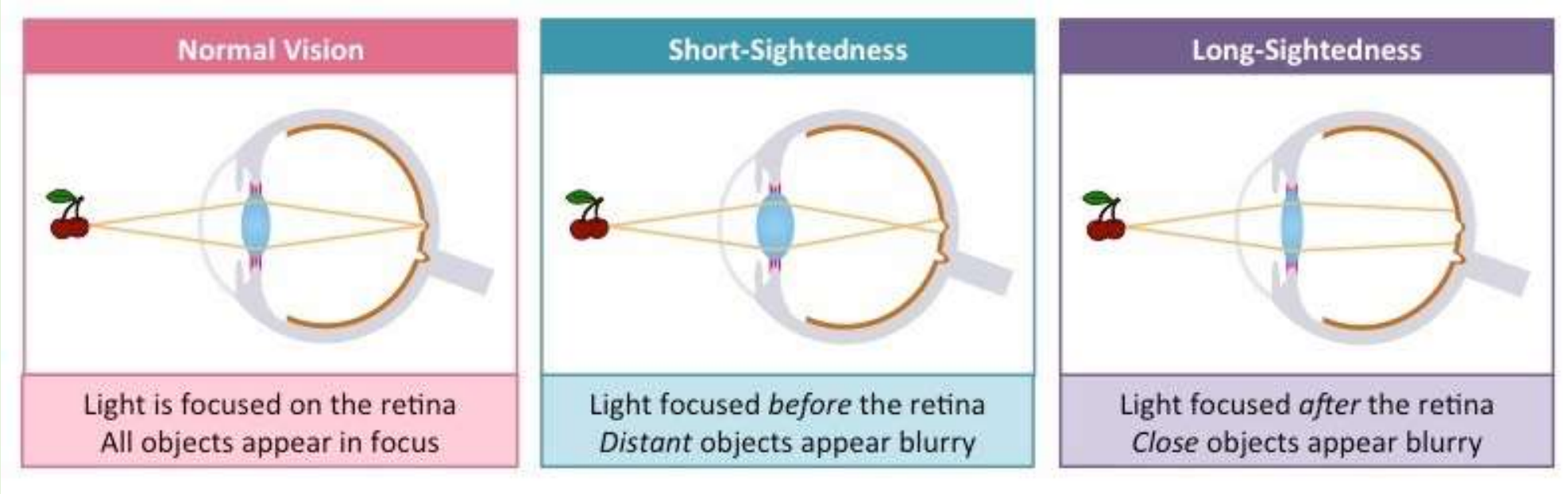
Word bank:

brain
cornea
retina
lens

Long and Short Sight

People may suffer from short or long – sightedness defects if the eye is the wrong shape or the muscles do not adjust the lens enough.

Both long and short sight can be corrected using **lenses**.



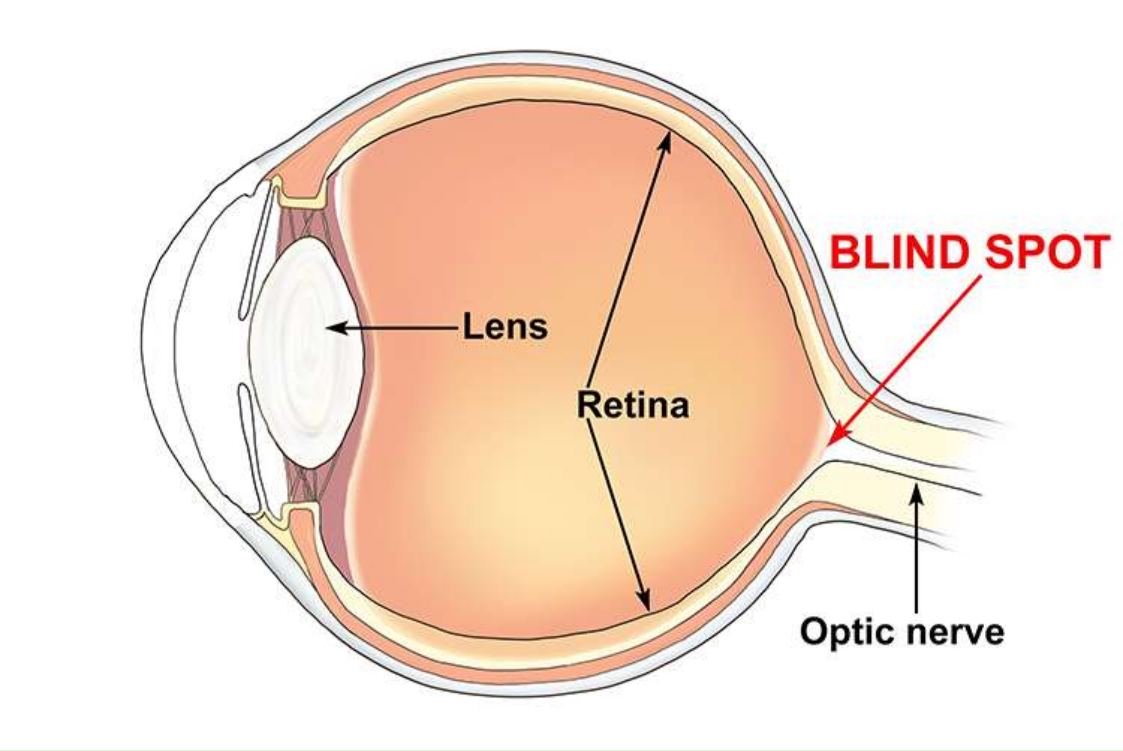
What is the blind spot?

Extension Task

The blind spot is the area on the retina without receptors that respond to light. Any image that falls on this region will NOT be seen.

It is in this region that the optic nerve exits the eye on its way to the brain.

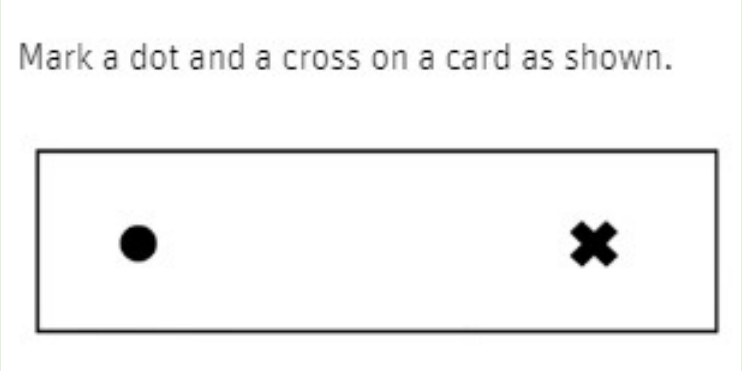
You are not normally aware of it, but you can show it's there with a simple test….



Finding The Blind Spot

Try the activity as your teacher reads out the instructions

- 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?

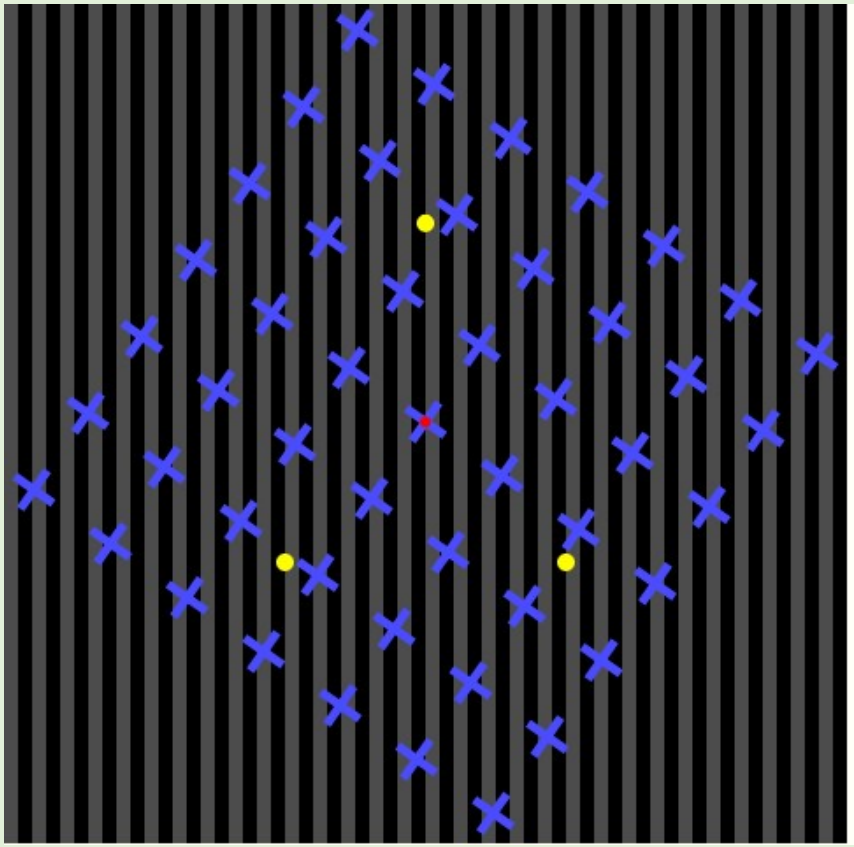
Motion Induced Blindness

Use the link to the website to watch the demo.

https://michaelbach.de/ot/mot-mib/index.html

Follow the instructions….

What did you learn?

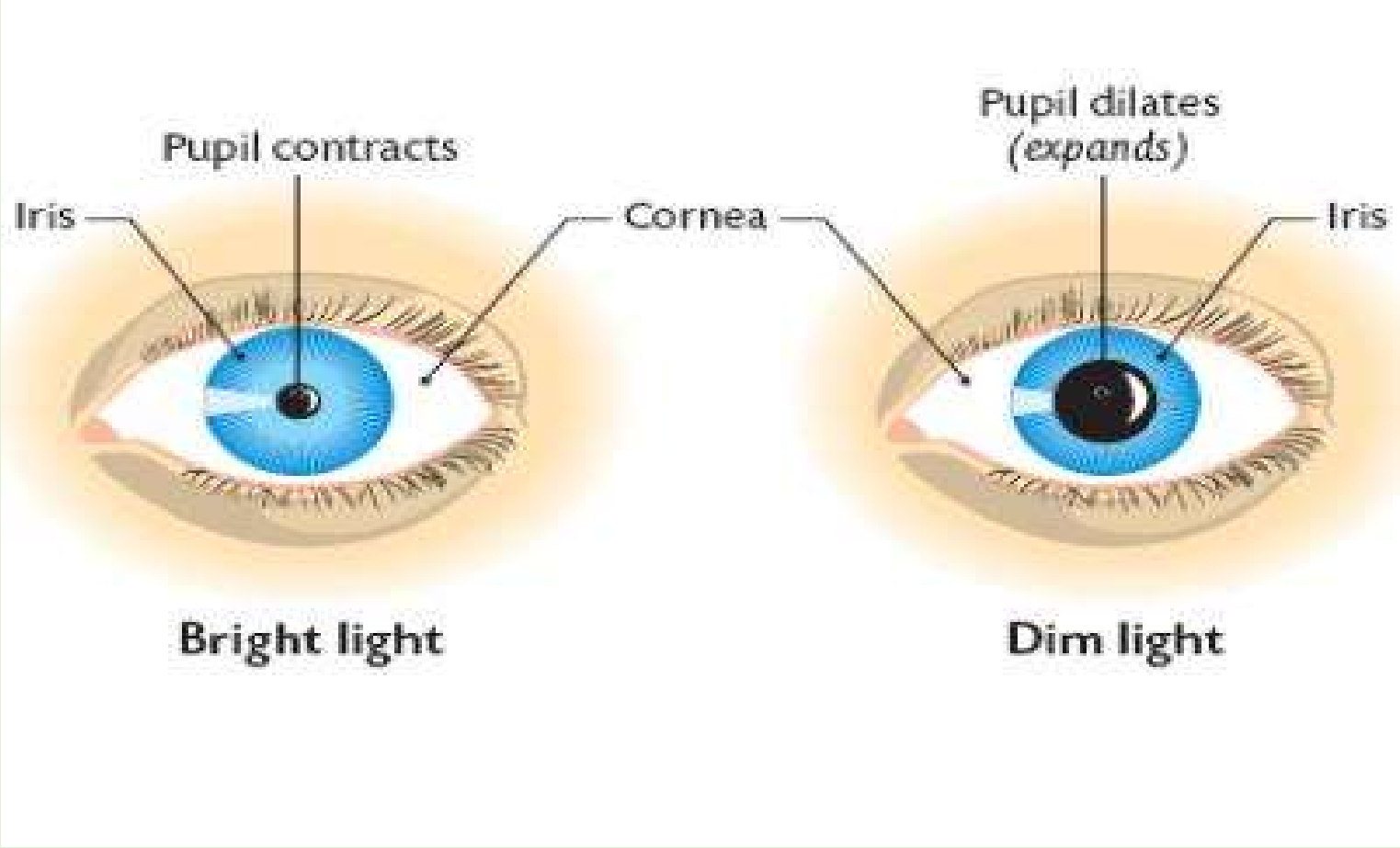


How the Pupil Reacts to Light

Extension Task:

- You must work with a partner to do this.
- Sit facing your partner.
- Your teacher will turn off the room lights. You will need a few seconds for your eyes to adjust to the dim light.
- When your teacher says, look directly into the eyes of your partner.
- When the lights go on, what do you notice?

How the Pupil Reacts to Light



Eye Dissection

Your teacher will demonstrate an eye dissection

What did you learn from the eye dissection?

Instructions Here: https://www.exploratorium.edu/learning_studio/cow_eye/doit.html

Eye Dissection

Cow's Eye Dissection I Exploratorium – 8:05

Eye Dissection

Page 32

What did you learn from the eye dissection?

The Eye

28/01/2025

Plenary:

1. Why do you think we don't notice that we have a blind spot in each eye?

2. When we say someone has "blue eyes", what part of the eye are we talking about?

Success Criteria

- ❑I can explain what the 'blind spot' is.
- ❑I can describe how the pupil reacts to light.

Tick me at the end if ***you can*** …

Colour

28/01/2025

Starter:

1. What part of the eye is responsible for turning light into electrical impulses?
2. What part of the eye is responsible for controlling the size of the pupil?
3. What name is given to the area of the retina where the optic nerve leaves for the brain?

Colour

28/01/2025

Learning Intentions:

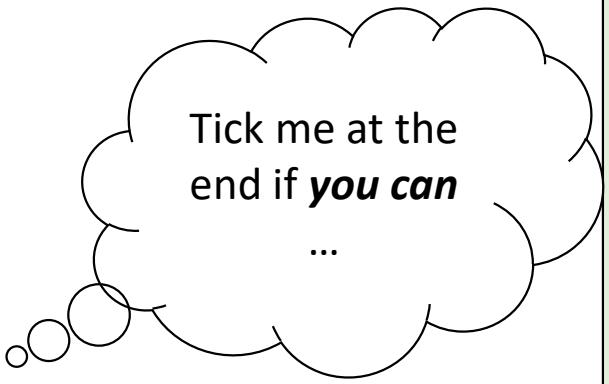
- To learn that a visible spectrum is formed when light travels through a prism.

Colour

28/01/2025

Success Criteria

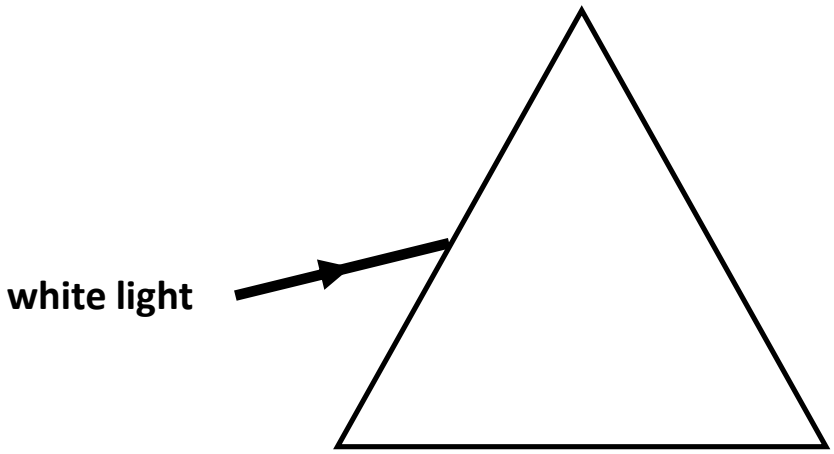
- ❑I can describe what happens when white light travels through a prism.
- ❑I can state the colours of the visible spectrum.



Triangular Prism

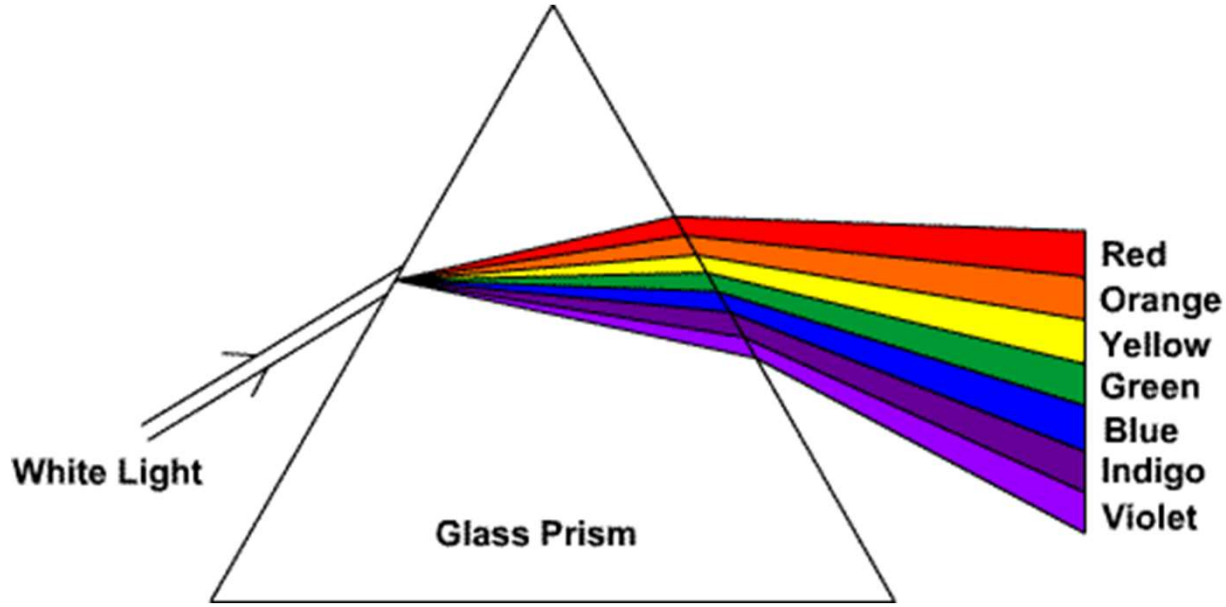
Aim: To investigate what happens when white light travels through a triangular prism.

Method and Results:



Triangular Prism

Method and Results:



Triangular Prism

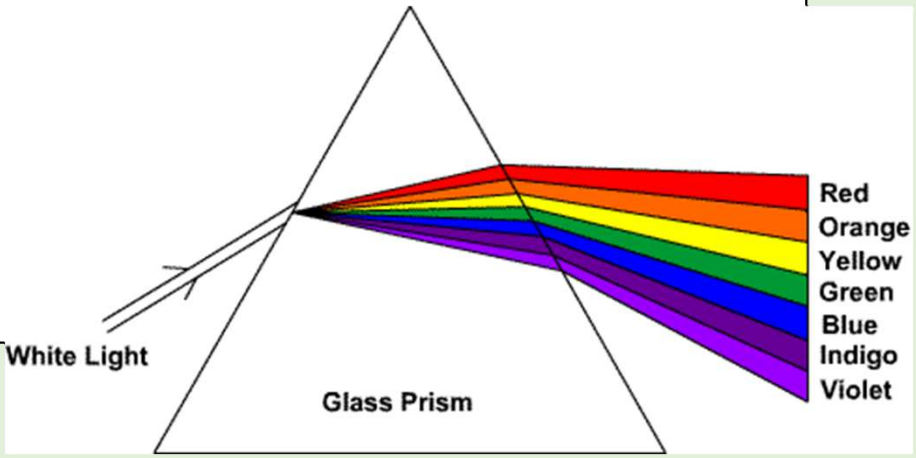
Conclusions:

1. What happens to the direction of the beam of light?

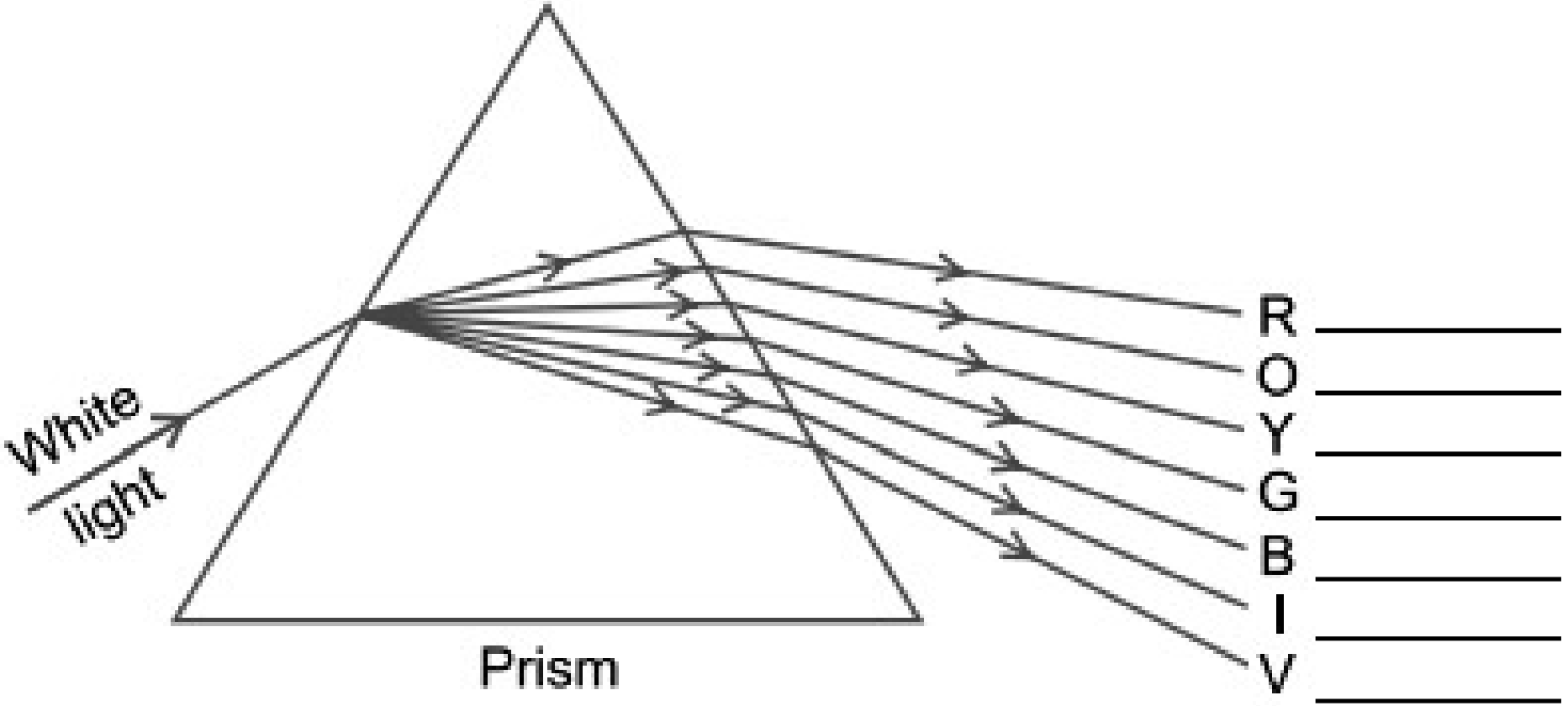
2. What name is given to this change of direction?

3. What happens to the colour of the beam of white light?

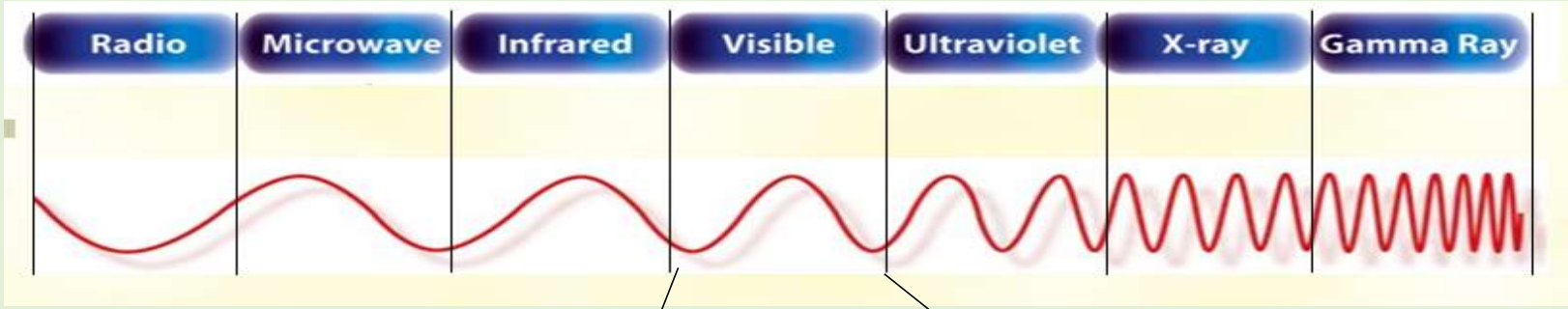
4. Is white light only one colour, or many?



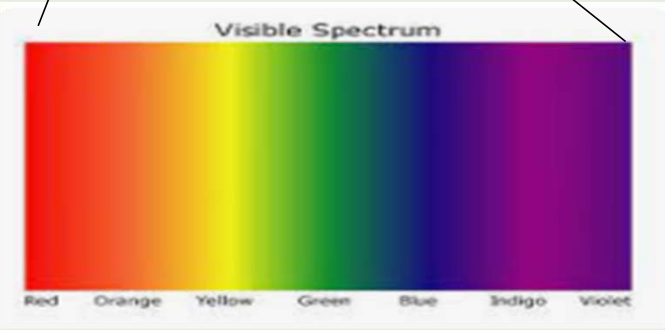
Triangular Prism



Spectrum Of Visible Light



Visible light is not just one colour, it is a range of colours. Visible light has its own **spectrum.**



Longest wavelength

Shortest wavelength

Spectrum Of Visible Light

White light contains all the colours of the visible spectrum.

Red refracts/bends least and violet refracts/bends the most.

Spectrum Of Visible Light

Red	**R**
Orange	**O**
Yellow	**Y**
Green	**G**
Blue	**B**
Indigo	**I**
Violet	**V**

Remember the colours of the spectrum using the phrase:

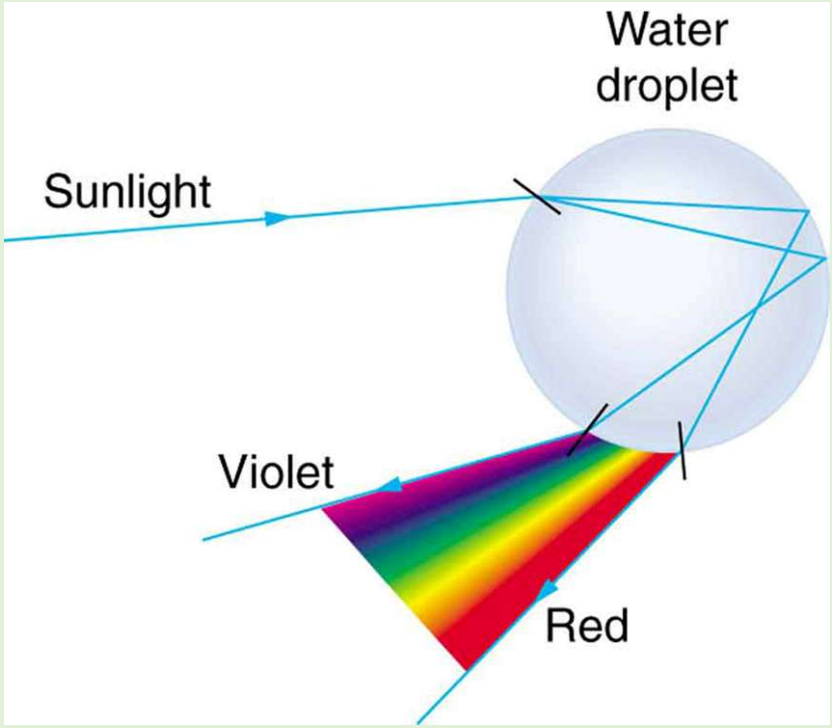
Richard **O**f **Y**ork **G**ave **B**attle **I**n **V**ain

Another helpful method is the abbreviation:

ROY G BIV

Make up your own mnemonic to remember the colours of the visible spectrum.

Water droplets act as prisms to make a rainbow.



Your teacher will let you watch an advert that uses the song “I can sing a rainbow”.
http://www.youtube.com/watch?v=WNeOW4Kvs-Q
Listen carefully to the song to spot any scientific mistakes you hear in the song.

Colours

28/01/2025

Plenary:

1. What kind of weather conditions are needed for a very distinct reflection like this?

2. Why do you think those conditions are needed to see a distinct reflection in water?

Success Criteria

❑I can state that a visible spectrum is formed when light travels through a prism.

❑I can state the colours of the visible spectrum.

Tick me at the end if ***you can*** …

Mixing Coloured Light

28/01/2025

Starter:

1. What happens to white light when it passes through a prism?
2. List the colours of the visible spectrum in order starting with the longest wavelength - **red**.

Mixing Coloured Light

28/01/2025

Learning Intentions:

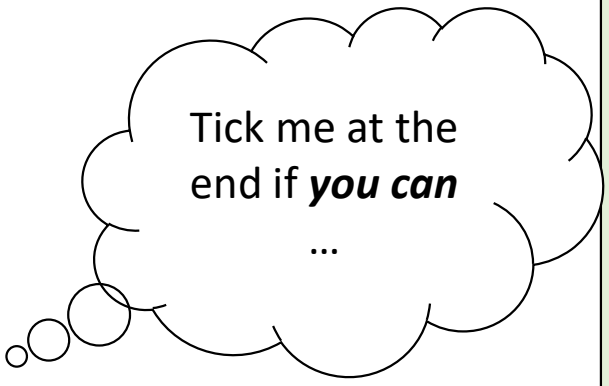
- To learn how mixing colours can produce white light and other colours.

Mixing Coloured Light

28/01/2025

Success Criteria

- To name the primary and secondary colours of light
- To learn what colour blindness is.



Mixing Coloured Light

If we can make a spectrum by dispersing white light, can we create white light by mixing up a full spectrum?

Activity:

Colour mixing demonstration.

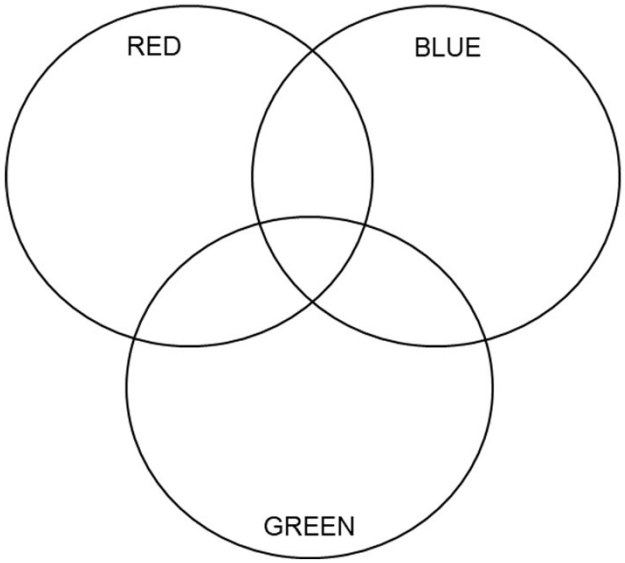
Mixing Coloured Light

Aim: To investigate what happens when coloured light is mixed.

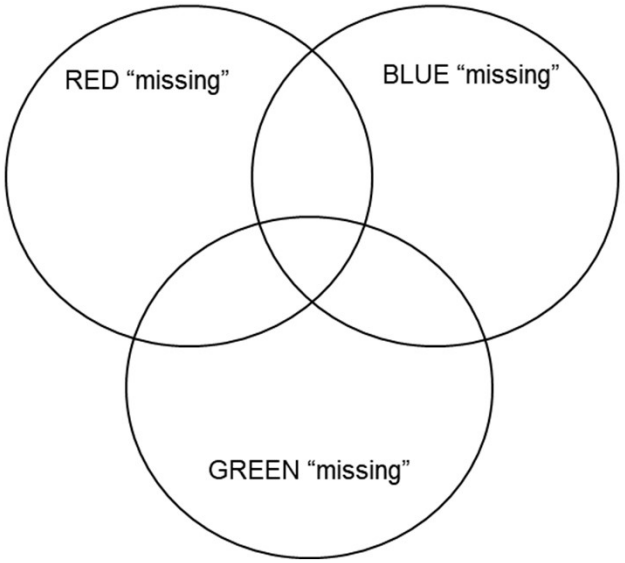
Mixing Coloured Light

Results:

COLOUR ADDITION

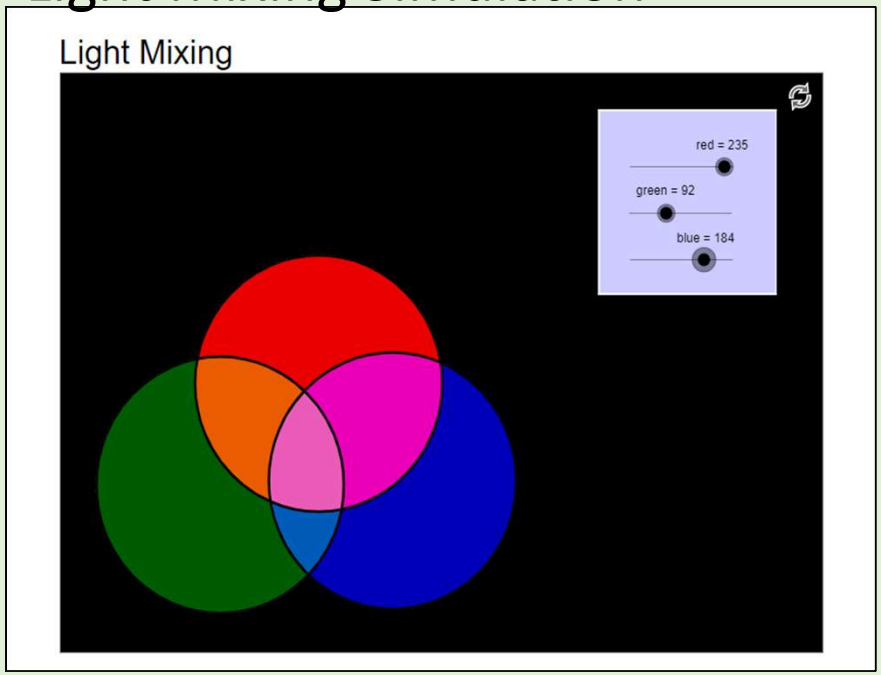


COLOUR SUBTRACTION

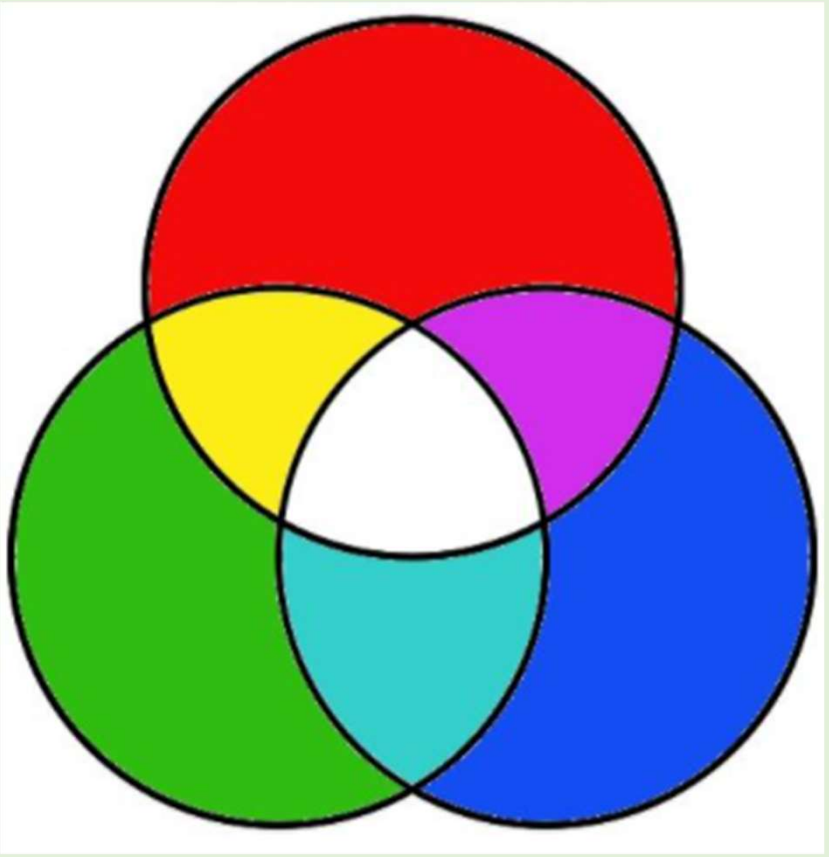


Mixing Coloured Light

Light Mixing Simulation



https://ophysics.com/l1.html



Mixing Coloured Light

Conclusion:

The primary colours of light are red, blue and green

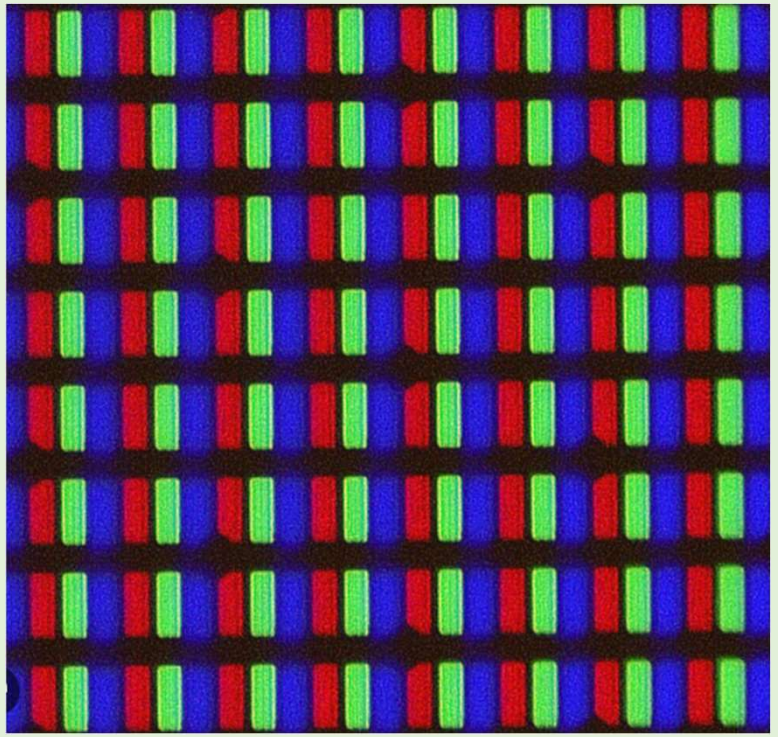
The secondary colours of light are yellow, cyan and magenta

white light can be made by adding together equal parts of red, green and blue light.

Mixing Coloured Light

The picture show an extreme close-up of a mobile phone screen.

From a normal distance this looks white



1. How many colours are needed to get the full colour picture you get on a phone?

2. What happens on the phone screen to make up all the different colours the screen can produce?

Colour Blindness

There are almost three million colour blind people in the UK - that is enough to fill Wembley stadium more than 30 times.

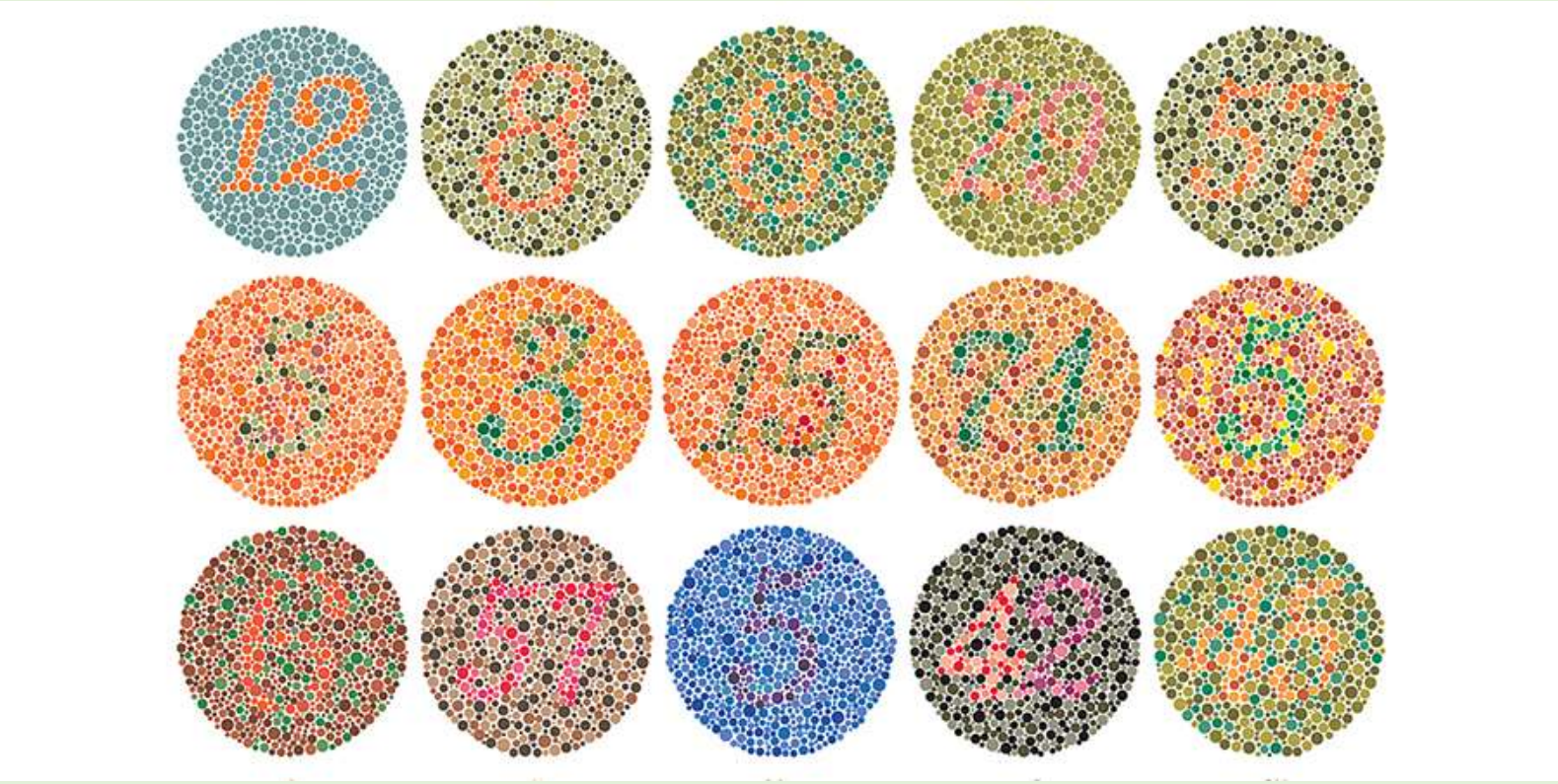
The NHS describes colour vision deficiency as when someone finds it difficult to identify and distinguish between certain colours.

Autumn can be frustrating when the reds and greens just look like rusty brown

For people who are colour blind, it can be difficult to differentiate between ripe and unripe foods

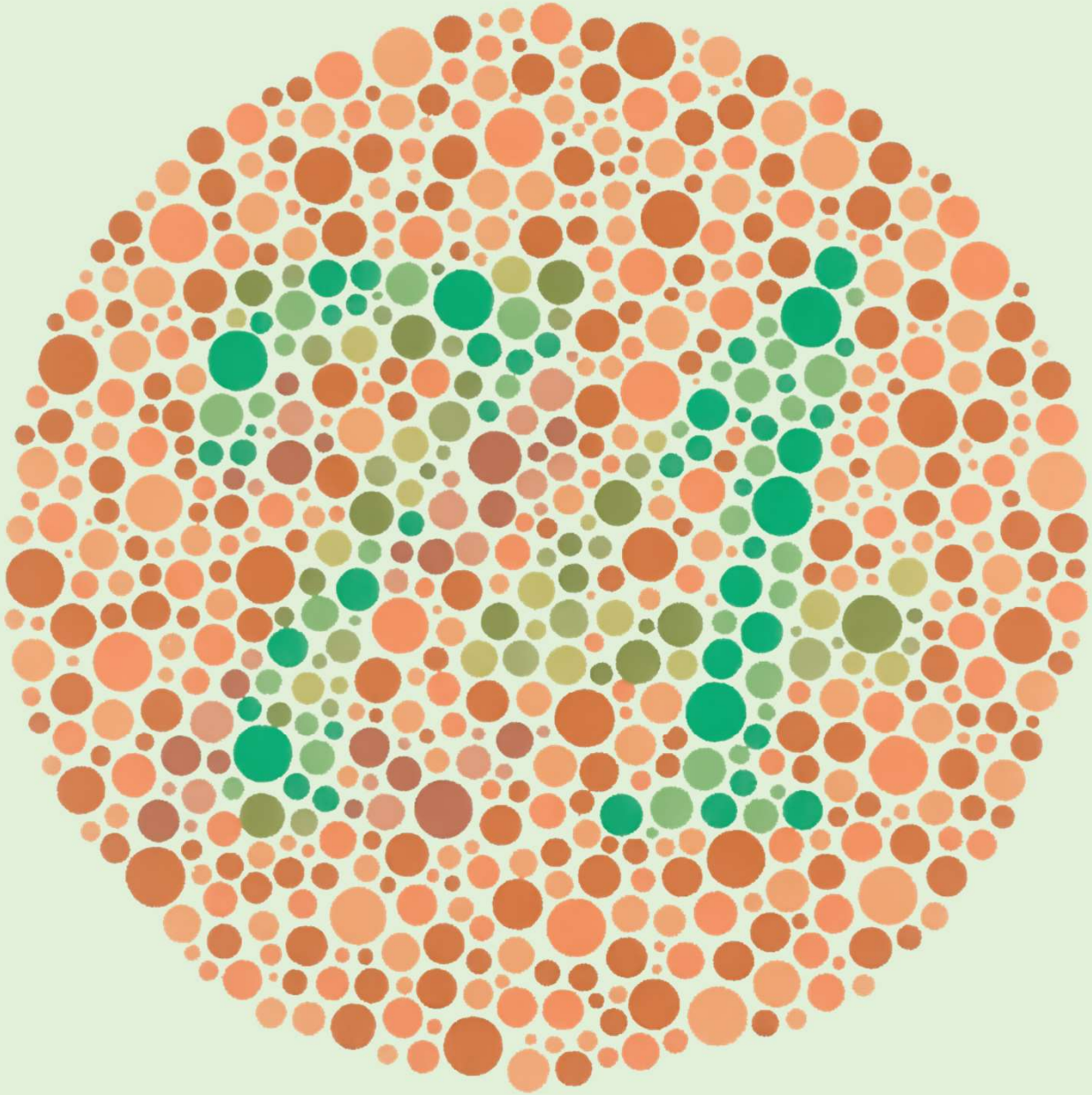
For people who are colour blind, it can be difficult to differentiate between kits that are close in colour

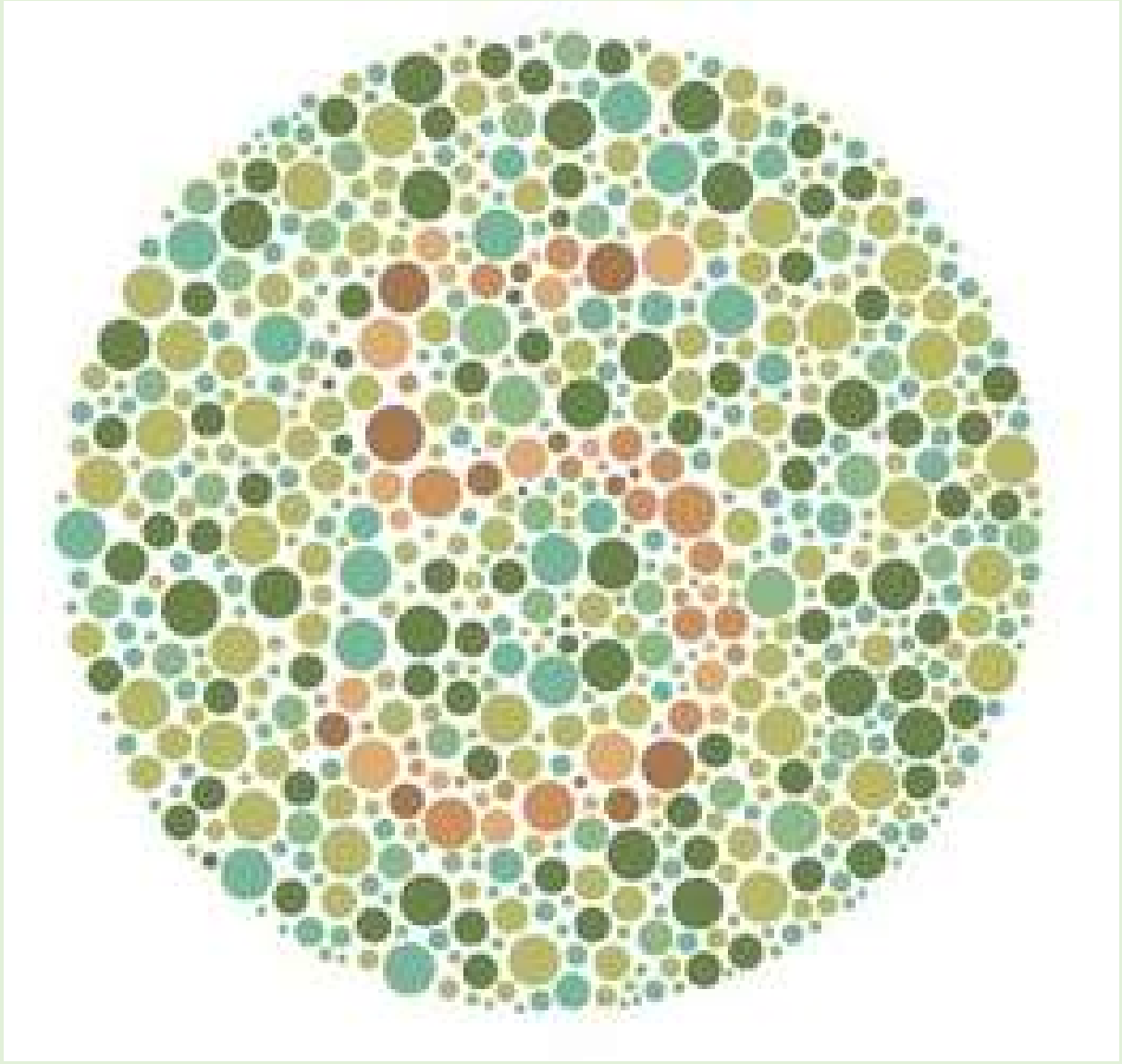
In a colour vision deficiency test you are asked to identify the number or symbol inside the circle.

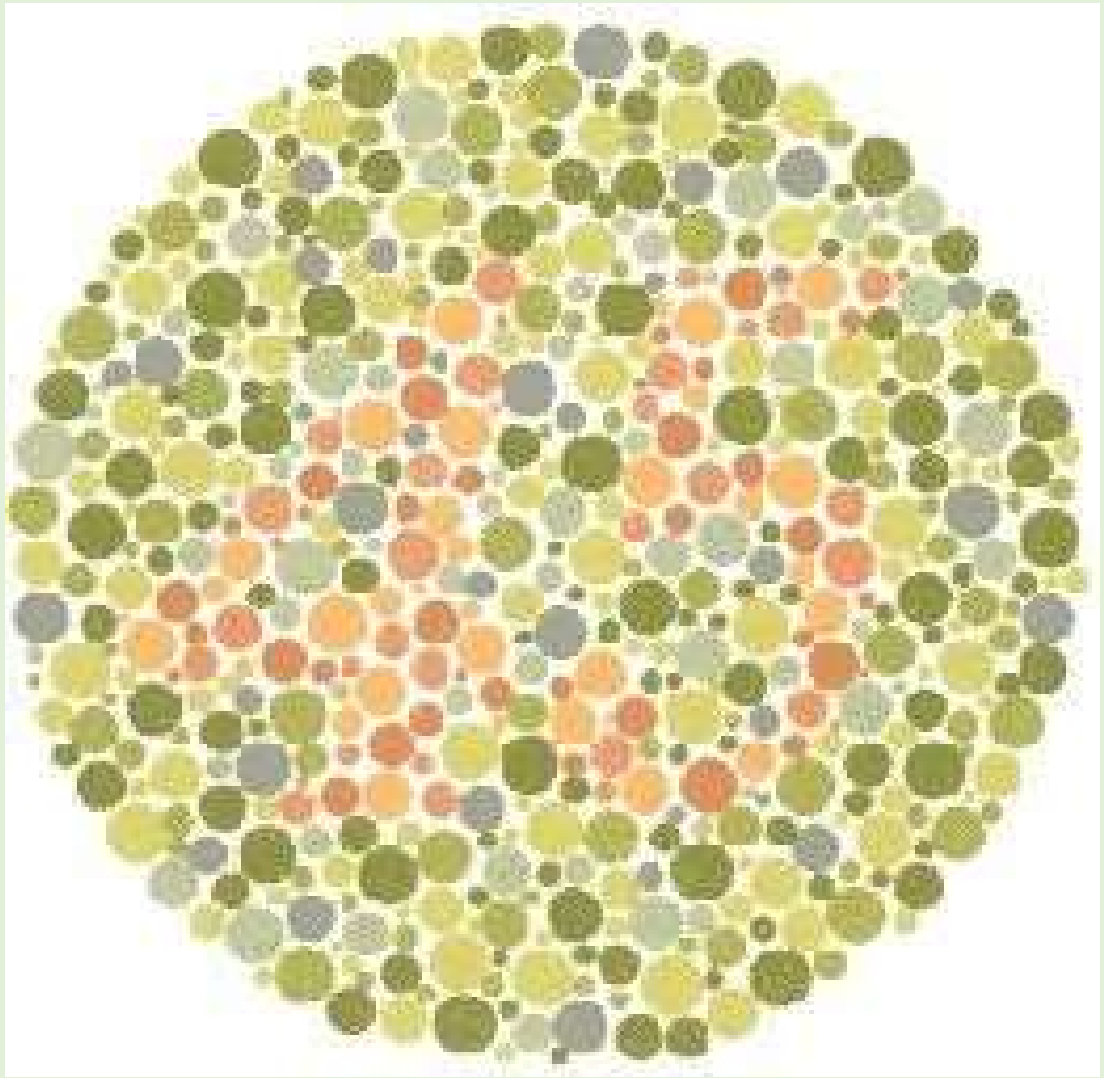


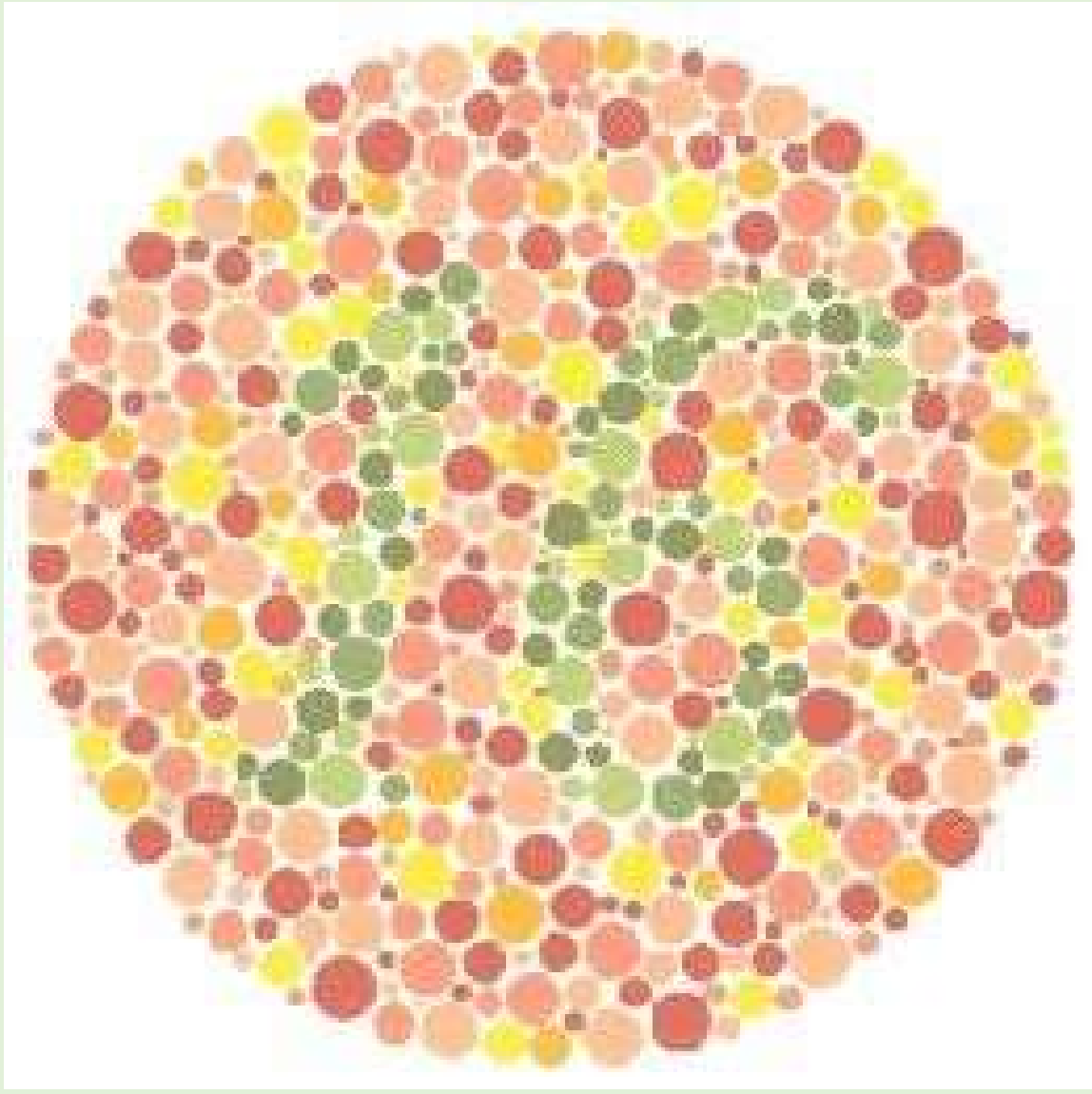
There are many tests available to measure colour vision defects but the most common is the Ishihara Plate test

Let’s try a few……









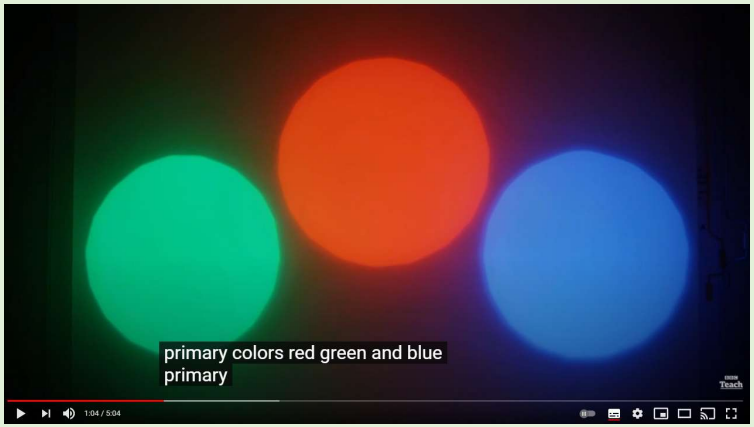
Colour Blindness

Watch this video about the reasons for colour blindness.

- Colour blindness is when someone finds it difficult to identify and distinguish between certain colours.
- It is caused by faults in the colour receptive cones in the retina of the eye.

Mixing Coloured Light

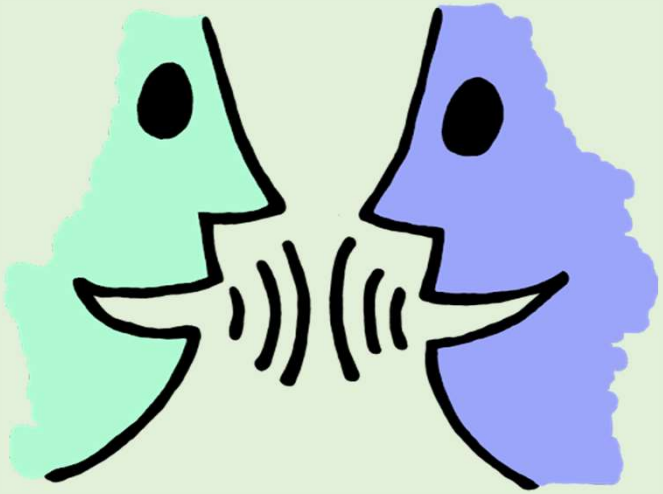
How do light waves make colour? | Physics - Wave World – 5:04



Page 36

Write down 3 pieces of information from the video.

Be prepared to share what you learned with the class!



Extension Newton's Colour Wheel

Instructions: https://www.fizzicseducation.com.au/150-science-experiments/light-sound-experiments/newton-colour-wheel/

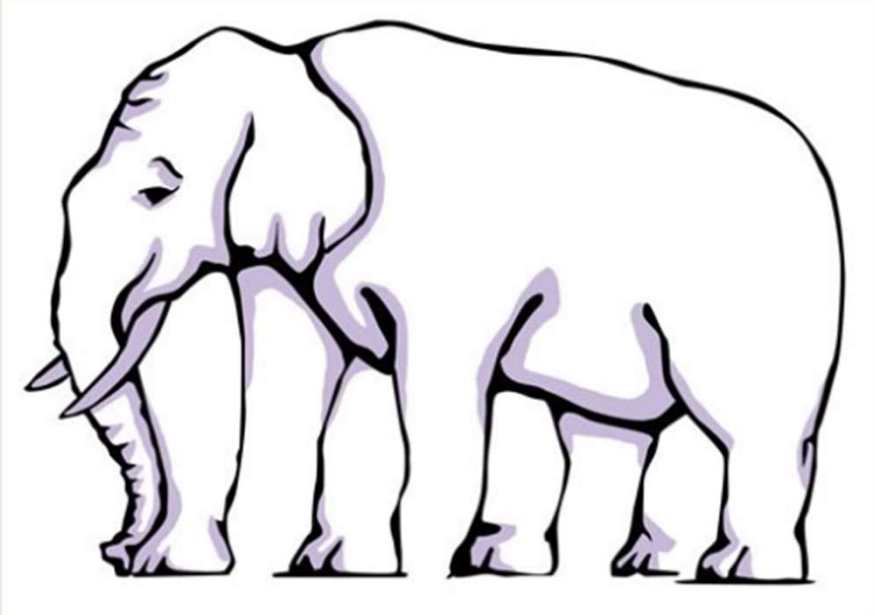
Mixing Coloured Light

28/01/2025

Plenary:

This is a well-known optical illusion.

Is it because your **eyes** are fooled that the trick works?



Success Criteria

- ❑To learn how mixing colours can produce white light and other colours
- ❑To learn what colour blindness is.

Tick me at the end if ***you can*** …

Extension

The Stroop Test

28/01/2025

Starter:

1. Name the three primary colours of light?

2. How is white light produced?

The Stroop Test

28/01/2025

Learning Intentions:

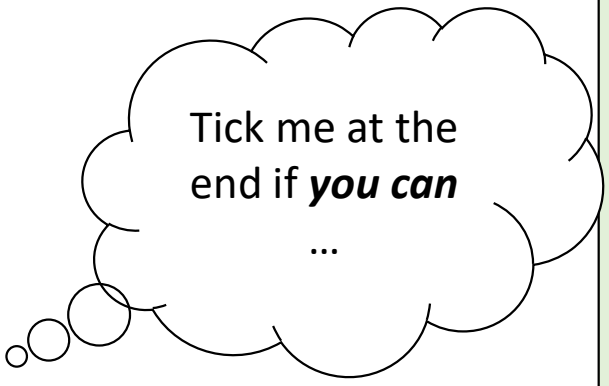
- To learn how coloured light affects the appearance of different coloured objects.

The Stroop Test

28/01/2025

Success Criteria

- I can describe how coloured light affects the appearance of different coloured objects.
- I can plan and carry out a scientific investigation
- I can calculate an average



The Stroop Test

Aim: To name the colour of the ink the words are printed in, while ignoring the actual word meaning.

Example: RED GREEN BLUE

BLUE RED GREEN

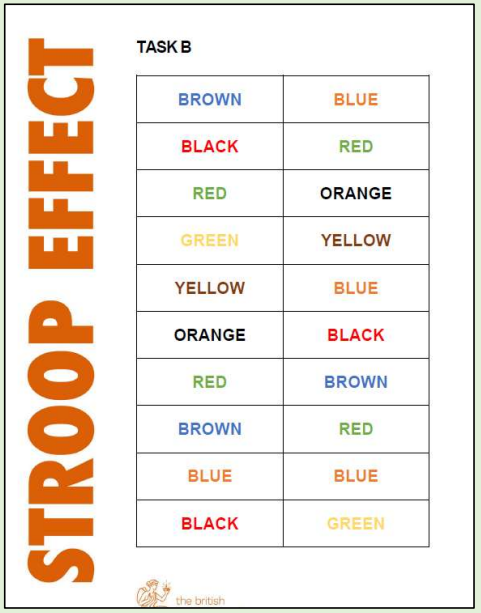
The Stroop Test

Method: Working in pairs

1. Collect two cards – TASK A and TASK B
2. The task is to name the colour of the ink the words are written in as fast as possible.
3. Complete two cards, TASK A then TASK B
4. Your partner will check that the correct response has been given and record the time in seconds on a stopwatch.
5. Swap roles and complete the activity again.

Results (group):

Name	Task A time (seconds):	Task B time (seconds):



The Stroop Test

Results (group):

Name	Task A time (seconds):	Task B time (seconds):

The Stroop Test

Page 37

Results (class):

Average time for task A:

Average time for task B:

Name	Task A time (seconds):	Task A time (seconds):

The Stroop Test

Conclusion: What task was easier / quicker to complete? Why?

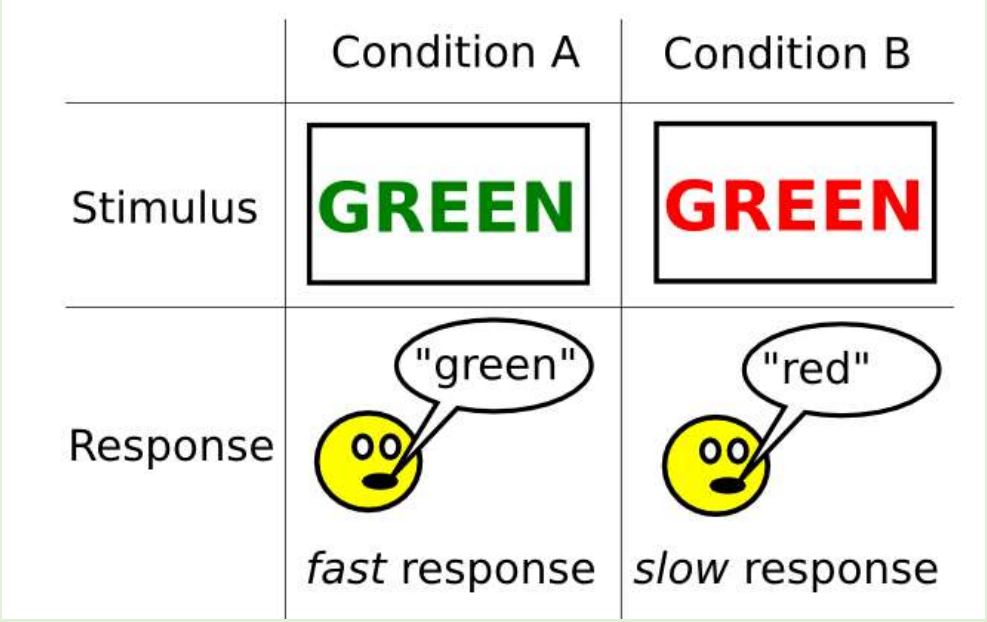
Evaluation:

Think about: Are there any groups of people it would not work with? What could we investigate further?

The Stroop Test

Discussion:

Speed of Processing Theory: the interference occurs because words are read faster than colours are named.
Selective Attention Theory: the interference occurs because naming colours requires more attention than reading words.



The Stroop Effect occurs because reading has become an automatic process for most of us. Even though we have been instructed to just name the colour of the ink, we cannot switch off reading the word. Therefore in task B we read first and then identify the colour, as they conflict this causes cognitive interference, taking extra time.

The Stroop Test

Plenary: Name the shape

Success Criteria

- To learn how coloured light affects the appearance of different coloured objects.

Tick me at the end if ***you can*** …

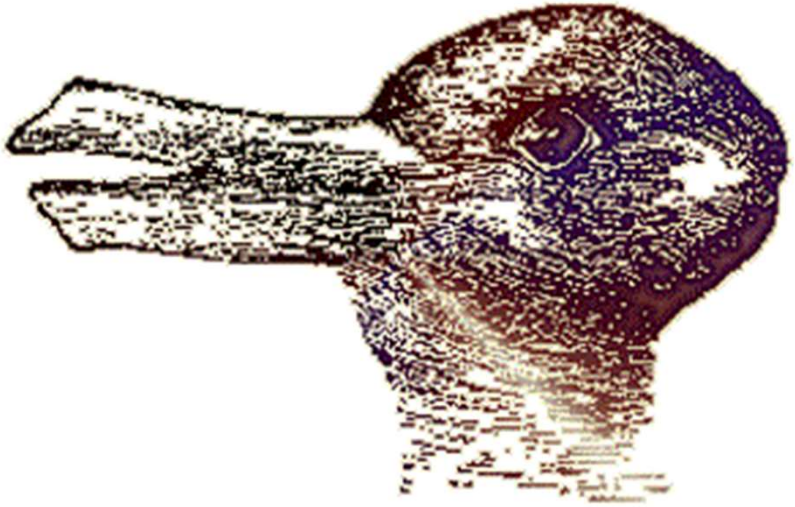
Extension

Optical Illusions

28/01/2025

Starter:

How many animals do you see in the image?



Optical Illusions

28/01/2025

Learning Intentions:

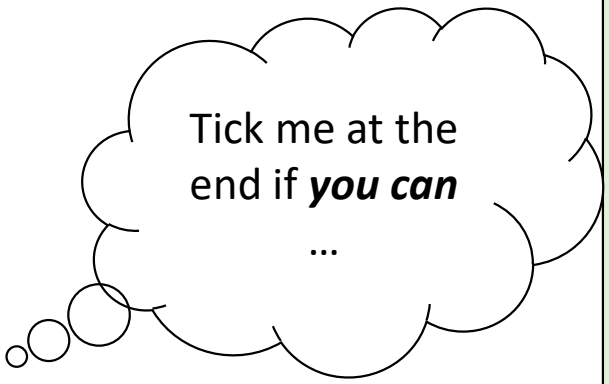
- To explain that our brain can be tricked by optical illusions.

Optical Illusions

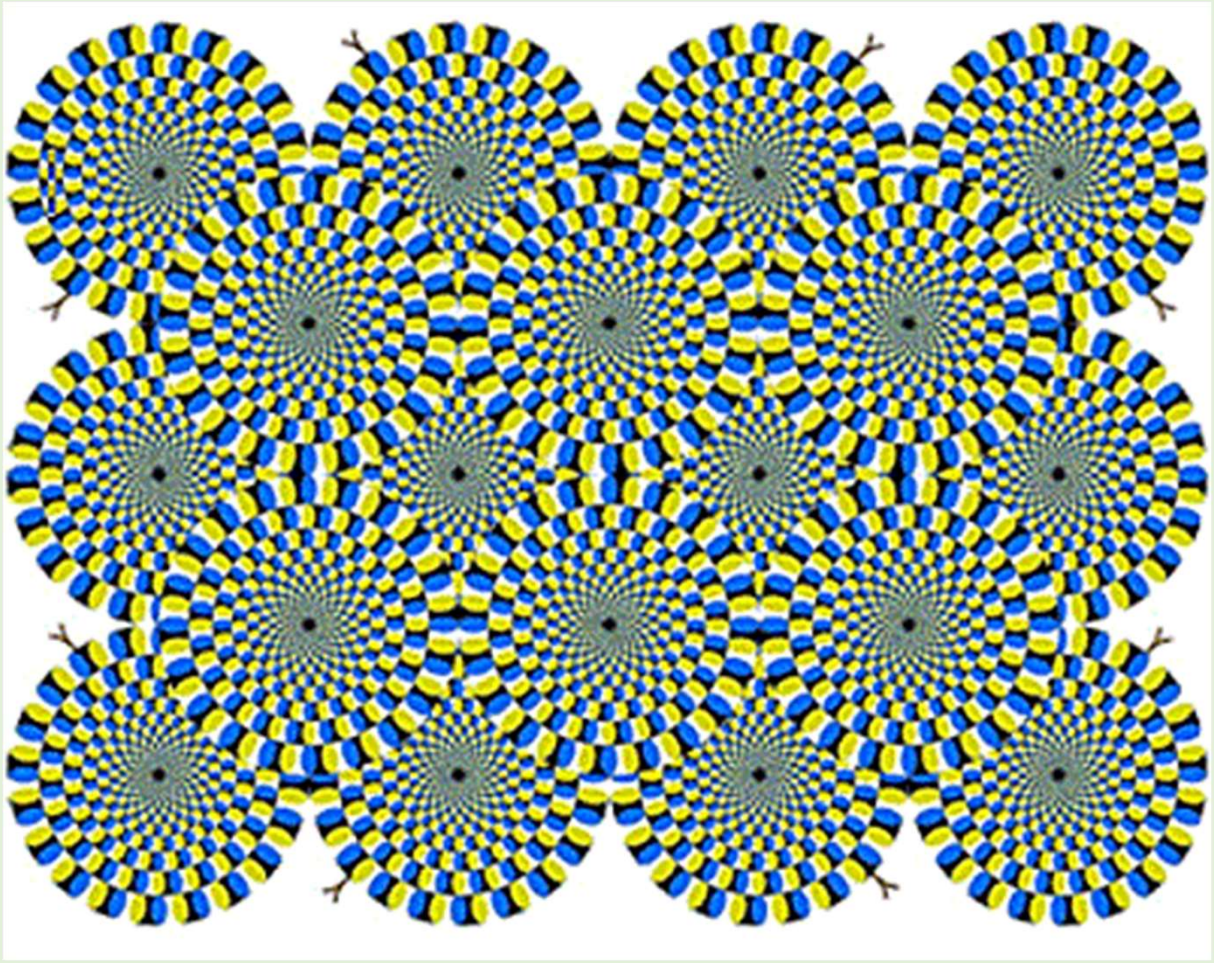
28/01/2025

Success Criteria

❑I can explain that our brain can be tricked by optical illusions.

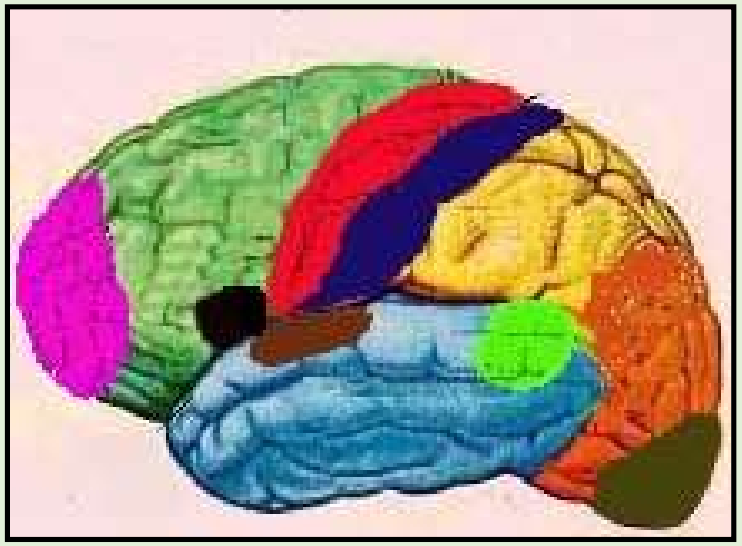


Seeing is believing……



…..or, is it?

Perception is the process by which the brain analyses and makes sense of incoming sensory information.



The brain uses tricks to interpret data quickly:

- Past experience
- Gathering tricks

Optical Illusions

- Your teacher will show you some optical illusions where the eyes are deceived by something that is not what it seems.
- \\acad-kik-file\shared files\Curriculum Areas\Science\S1 S2 SCIENCE\S2 COURSE\NEW S2 COURSE\Science of Entertainment\5 The Eye\Optical Illusions

Dragons

http://www.urdjuret.com/Optical/Illusions.html

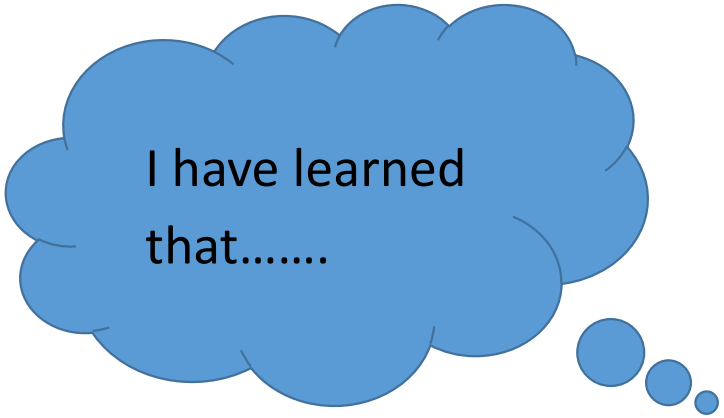
Dragons – Instructions

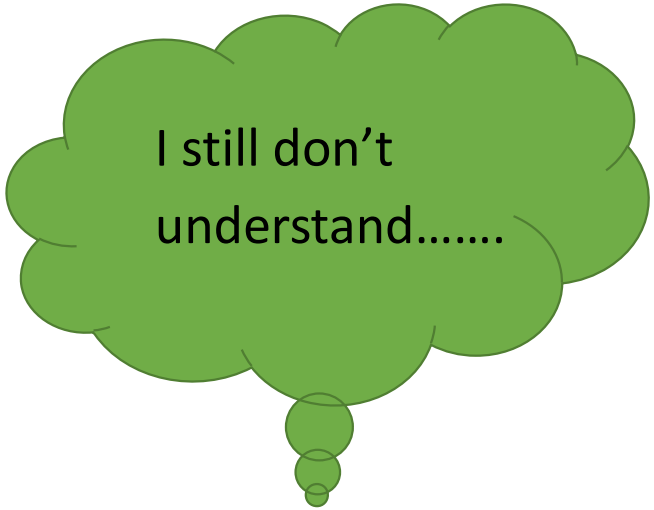
- Try to make a video of your dragon!

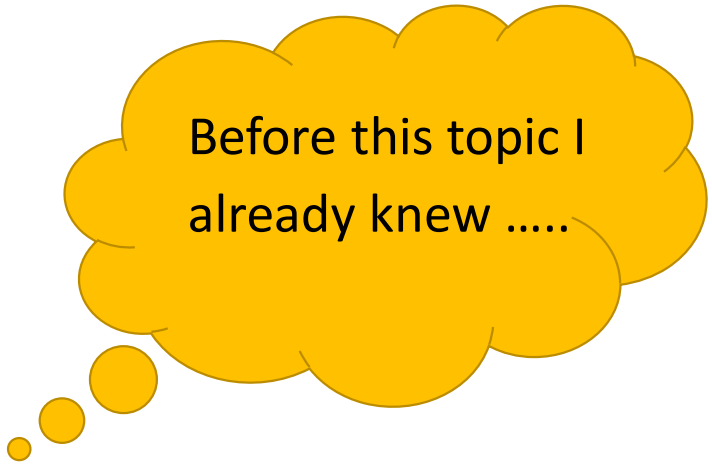
Optical Illusions

28/01/2025

Plenary: For the whole topic of light…

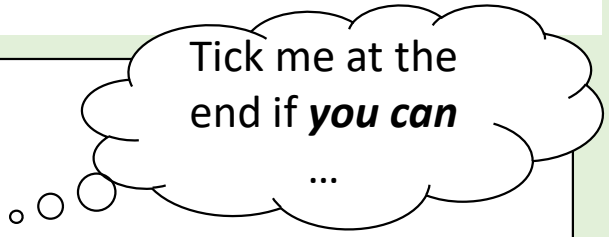






Success Criteria

❑ To explain that our brain can be tricked by optical illusions.



Plenary Talk Placemat

Today I have learnt that …….

The skills I used in today's lesson were…
I could also use these skills in….

Be a reflective learner.

Discuss with a partner before you share it with the class.

I would like to find out more information about….

One thing I need to remember from today's lesson is…

Before this lesson I could already…

Three key words I have learned today are…

I was successful today when I…

- How Do We See? | Operation Ouch | Science for Kids (21:26)

Waves

28/01/2025

Starter:

1. Sketch a wave you might see at the seaside.

2. What words can you use to describe it?

Learning Intentions:

- State that light is a wave that transfers energy.
- Learn how wavelength is related to the energy the waves carry.

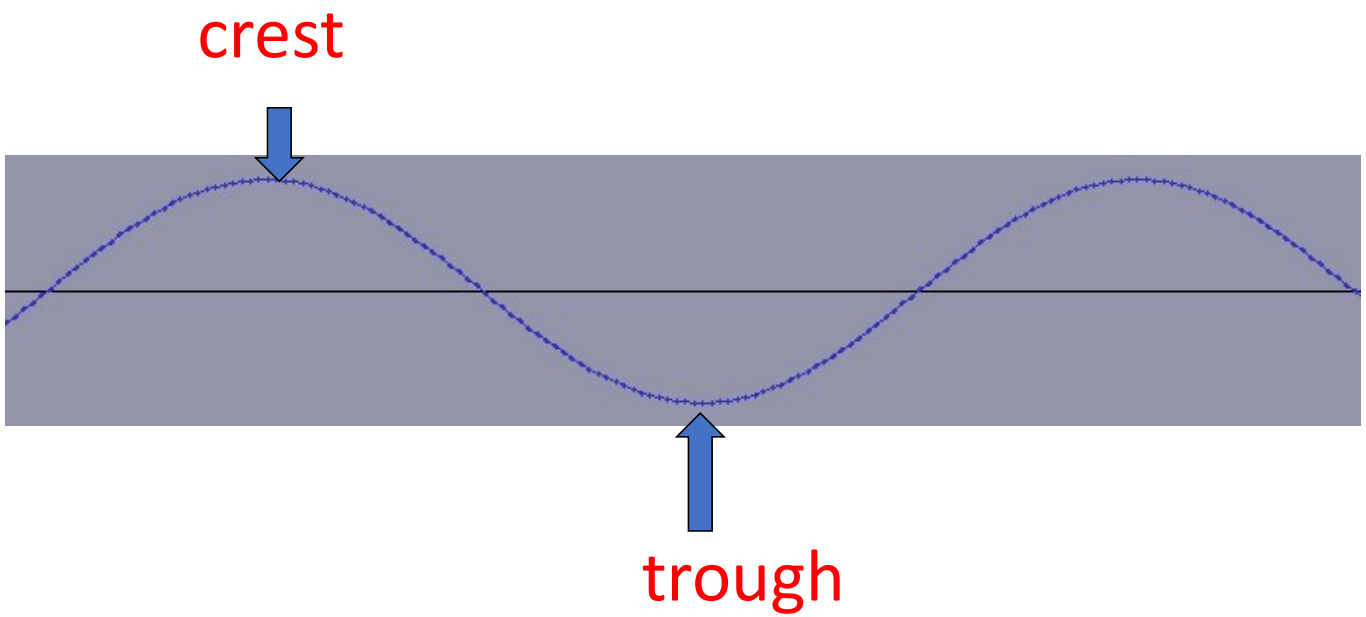
Success Criteria

- ❑I can identify the wavelength of a wave.
- ❑I can state that shorter wavelengths of EM Waves carry more energy.
- ❑I can state that light is part of the electromagnetic spectrum.

Tick me at the end if ***you can*** …

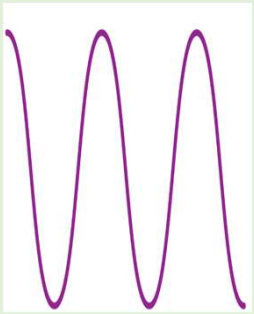
Waves

Light is an example of a _____wave_____. Just like waves in the sea, they have two parts.

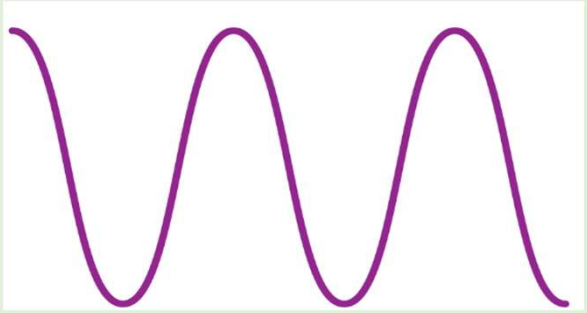


Waves

Waves can be bunched up



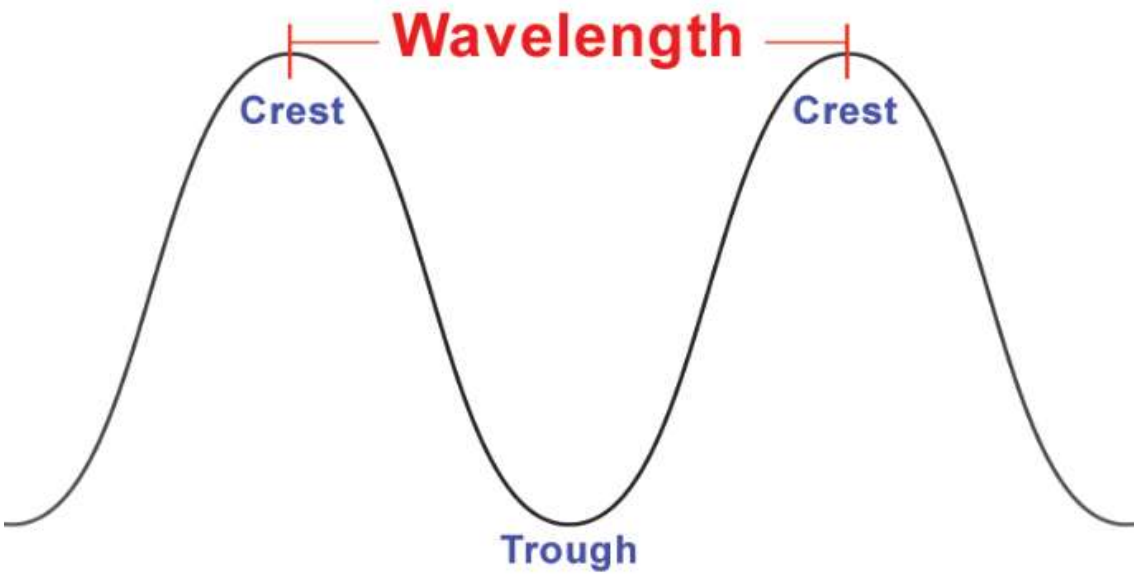
Or stretched out



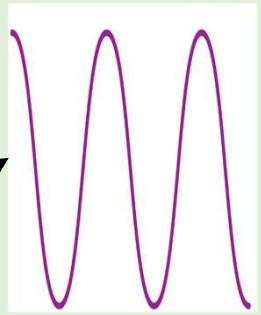
Wavelength

A wavelength is the _____ of ONE wave, in metres.

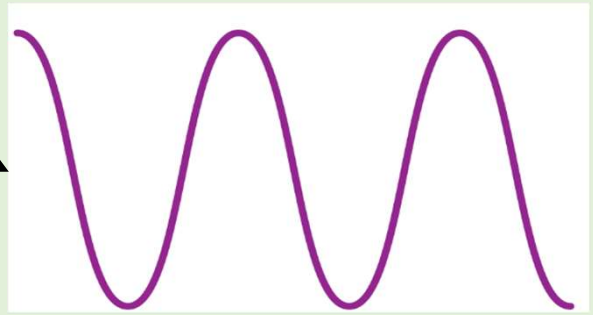
length



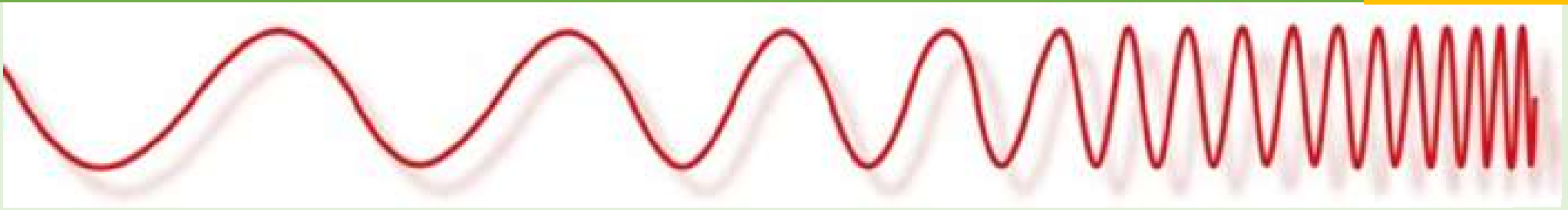
Wavelength



The top wave has a shorter (smaller) **wavelength** than the bottom wave.



Wavelength



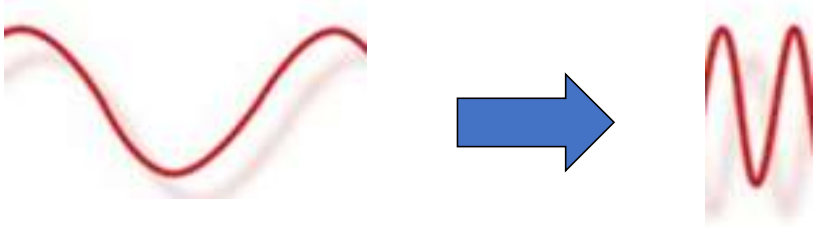
Class questions:

1. As you move from left to right, what is it about the wave that changes?

   The wavelength

2. In what way does it change?

   It gets shorter

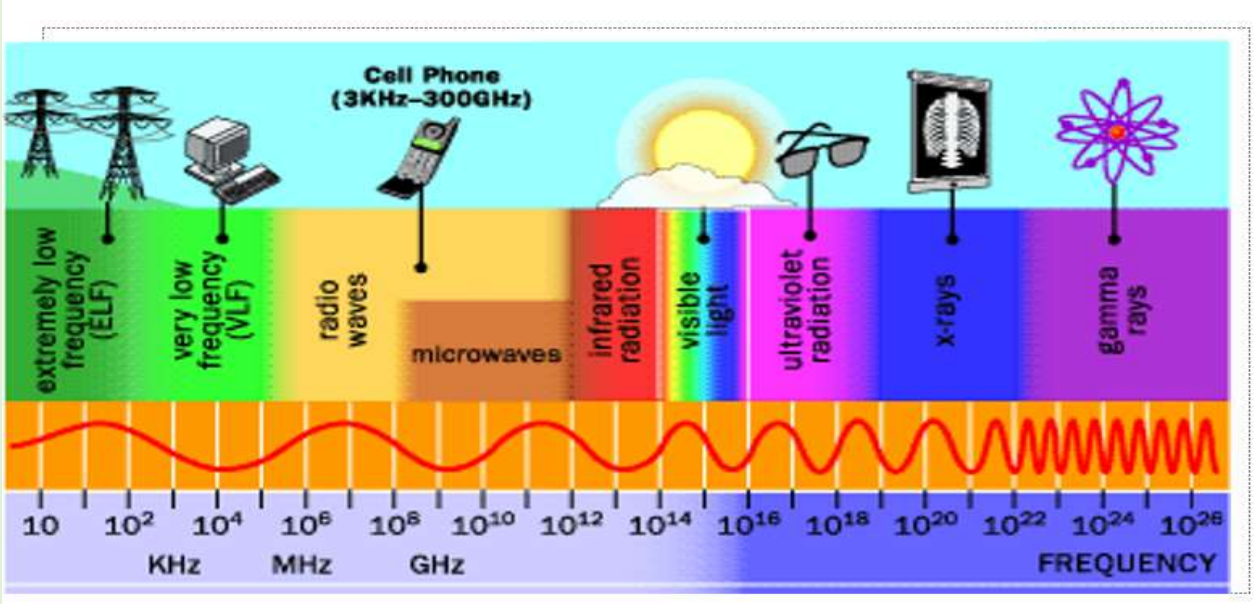


Light is a Wave

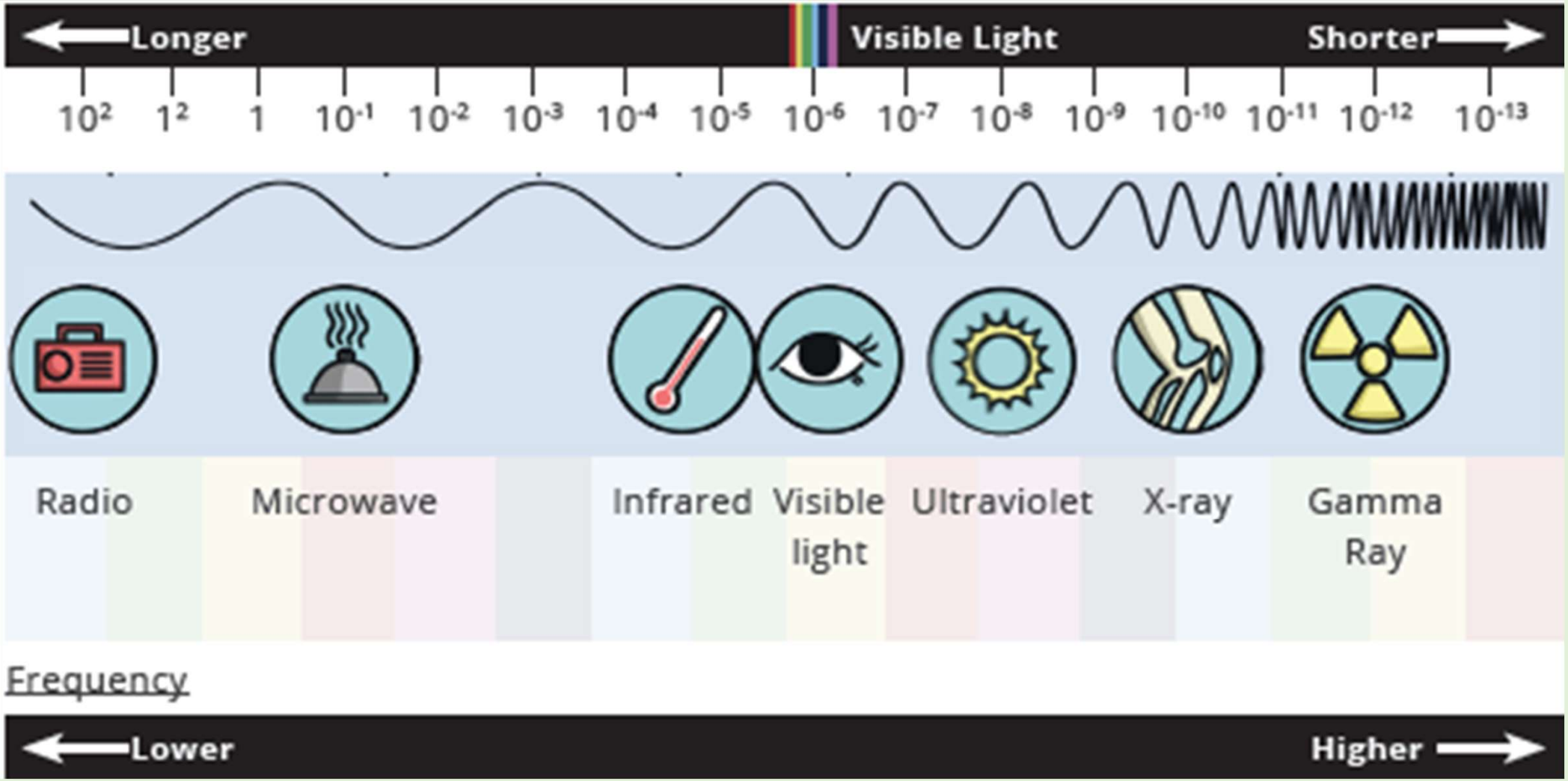
Light is part of a _____ of waves called the **electromagnetic spectrum**. This is shortened to the _____ _____.

family

EM spectrum



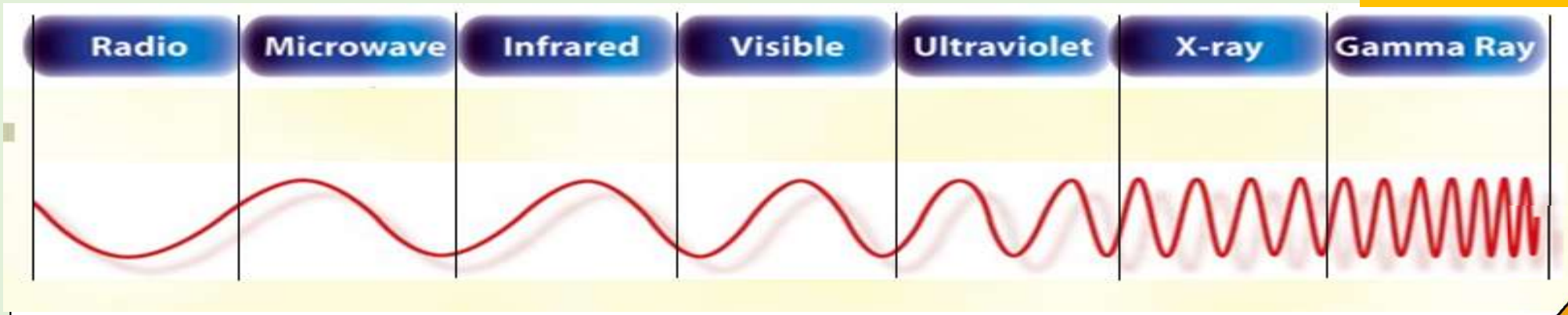
Watch the Video


Longer
Visible Light
Shorter
10^{2} 1^{2} 1 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} 10^{-9} 10^{-10} 10^{-11} 10^{-12} 10^{-13}
Radio
Microwave
Infrared
Visible light
Ultraviolet
X-ray
Gamma Ray
Frequency
Lower
Higher

Family of Waves

The different types of electromagnetic waves have a lot in common. Each different type of electromagnetic wave has different properties because they have different wavelengths.

The EM Spectrum



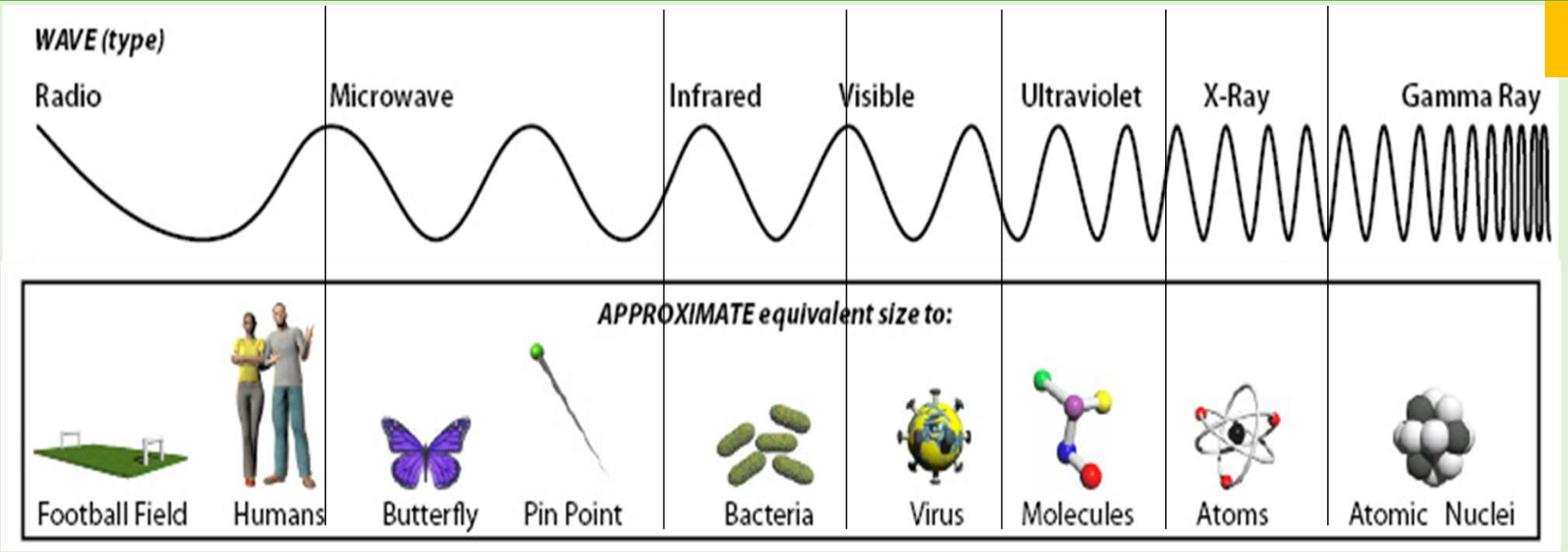
increasing energy and potential damage →

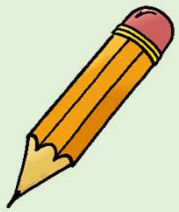
As you go from left to right, the _____ of the waves gets greater. As you move from radio waves to gamma rays, the risk of _____ to living things gets bigger.

energy

damage

Wavelength Scale

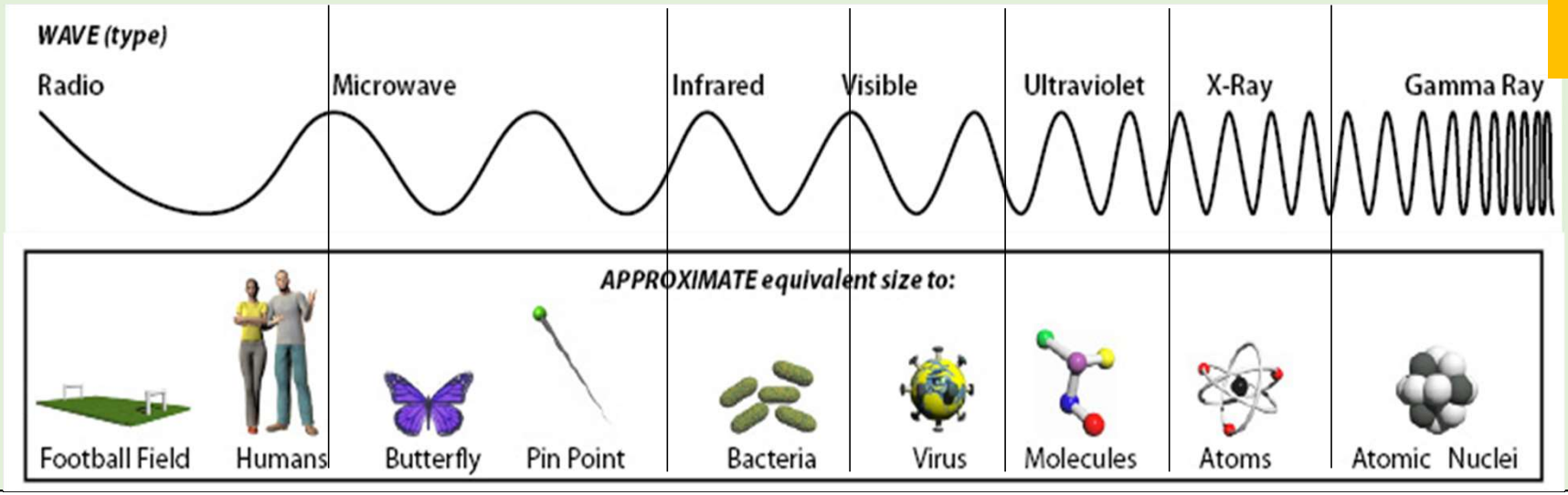




Which waves have wavelengths of the size described…

1. between the size of a football field to the size of a person
2. about the size of atoms
3. between the size of a butterfly and the size of a pin point?

Wavelength Scale



Extension questions

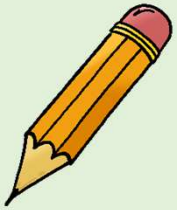
4. Which wave is close in size to a grain in sand? _____

5. What wave is like the width of a hair? _____

6. Which waves are smaller than an ant? _____

7. Are radio waves bigger or smaller than a basketball? _____

Wavelength Scale



Waves

28/01/2025

Plenary:

True or False?

1. The wavelength of a wave is how tall it is
2. The electromagnetic spectrum has many different wavelengths
3. The shorter the wavelength of a wave gets, the more energy the wave has

Tick me at the end if ***you can*** …

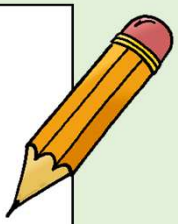
Success Criteria

- ❑ I can explain why we can't see right through most things
- ❑ I can state that light and X-rays are waves
- ❑ I can explain what "wavelength" means
- ❑ I can explain why X-rays can pass through things.

The EM Spectrum

28/01/2025

Starter:



1. The electromagnetic spectrum is a family of _____.
2. Wavelength is the _____ between two crests.
3. Gamma rays have a shorter _____ than radio waves.

The EM Spectrum

28/01/2025

Learning Intentions:

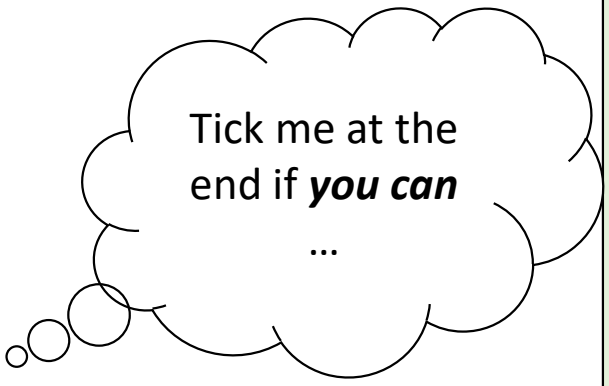
- To state a use for each part of the electromagnetic spectrum.

The EM Spectrum

28/01/2025

Success Criteria

- ❑ I can state a use for each part of the electromagnetic spectrum.



The EM Spectrum - Summary Table

The next few slides describe how the E.M spectrum is used in everyday life.

Complete the table in your booklet as you go through to show the uses of different parts of the E.M spectrum.

Uses for the EM Spectrum

28/01/2025

Wave Name	Applications
radio	
microwave	
infrared	
visible light	
ultraviolet	
X-rays	
gamma ray	

Radio

For radio

For T.V

Microwave

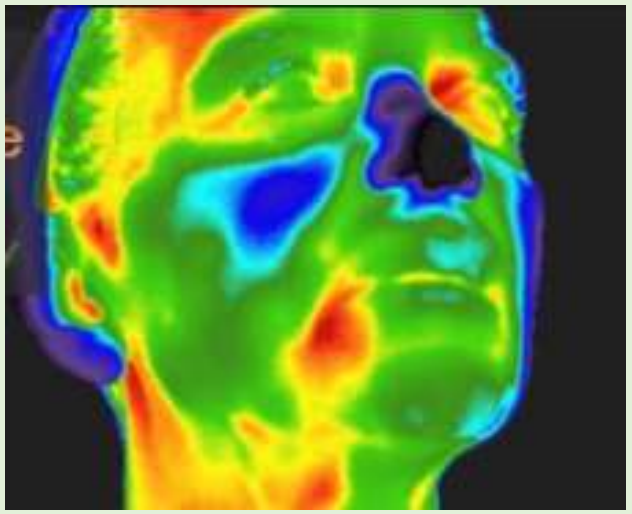
For heating food

communication (e.g. phones).

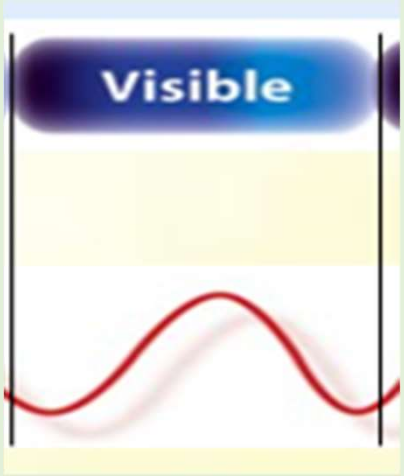
Infrared

For
Cooking

Thermograms allow us to see the temperatures of parts of the body. We feel infrared as heat.



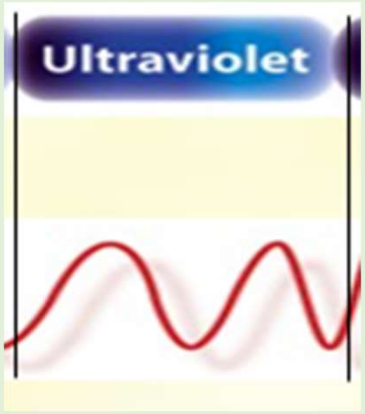
Visible

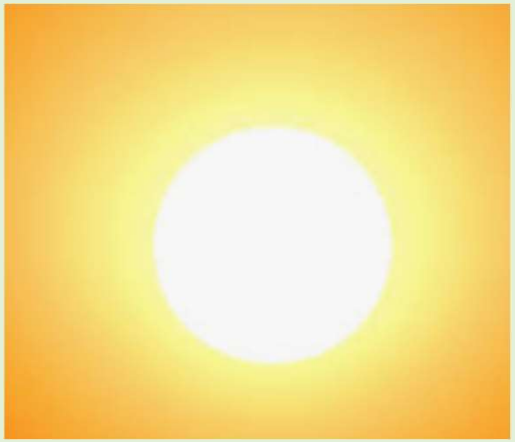


Visible light allows us to see.

Cameras also use visible light to take pictures.

Ultraviolet





Darkens or Tans our skin. It is found in sunlight.

Also used to see security marks on bank notes.

X-rays

Used for X ray photographs.

Gamma Rays

Used in medicine as tracers.
Tracers are chemicals that we can follow as they move around, inside the body.

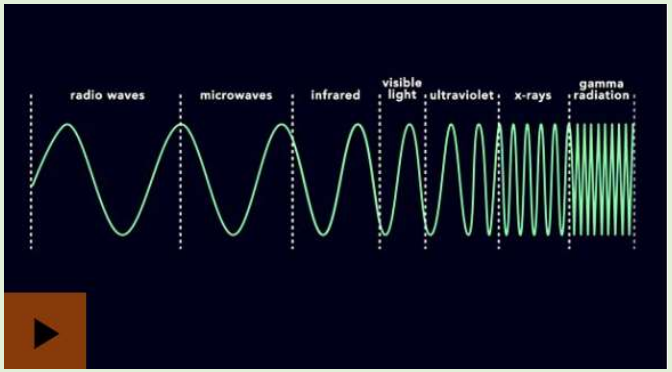
The doctor can see any issues inside the body

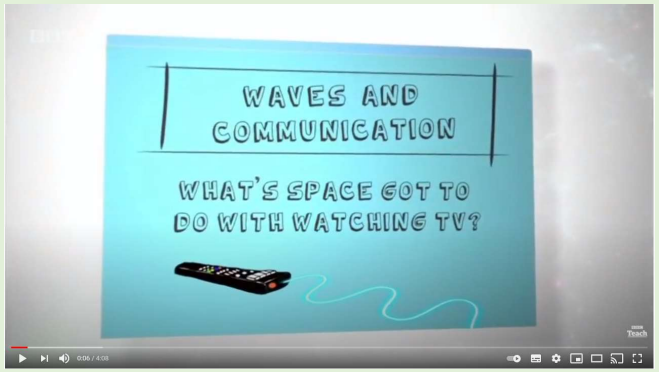
The EM Spectrum

Watch the videos below to learn about the electromagnetic spectrum. Take note of any important points. Think about…..

- The names of the 7 parts of the electromagnetic spectrum.
- Describe what each part of the EM spectrum has in common and what makes it different.
- Explain how we use the EM spectrum in our everyday lives.

Click each image:





Summary - Poster

Now use the information to create a poster of the EM Spectrum.

The poster must include…

- A **bold** title “EM Spectrum”
- A drawing showing the wave spectrum.
- The names of the waves in order, from radio waves to gamma rays, next to the drawing of the spectrum wave.
- Sketches to show the uses of each wave.

Waves

28/01/2025

Plenary:

Can you spot the odd one out in this list, the device that does **NOT** use waves from the electromagnetic spectrum to work?

A T.V.

A microwave oven

A camera

A pair of earphones

An X-ray photograph

(clue : which one has NOT been mentioned in the lesson)

Tick me at the end if ***you can*** …

Success Criteria

❑ I can state a use for each part of the electromagnetic spectrum.

Extra

Richard Hammond – Invisible Worlds

Using Infrared

28/01/2025

Starter:

Draw a line to match the part of the E.M spectrum with its application

Wave Type	Application
microwaves	medical tracers
infrared	mobile phones
gamma rays	thermograms

Using Infrared

28/01/2025

Learning Intentions:

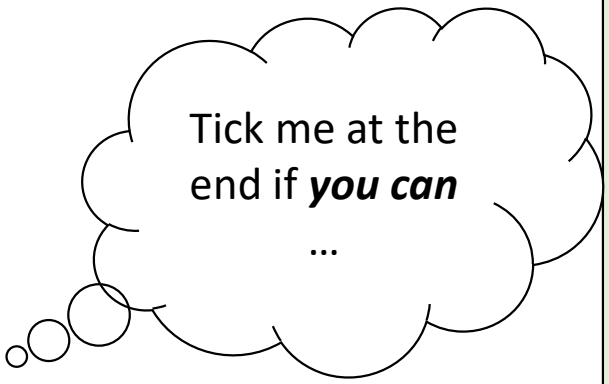
- To state what a thermogram is.
- To explain how infrared is used in medicine.

Using Infrared

28/01/2025

Success Criteria

- ❑I can state what a thermogram is.
- ❑I can explain how infrared is used in medicine.



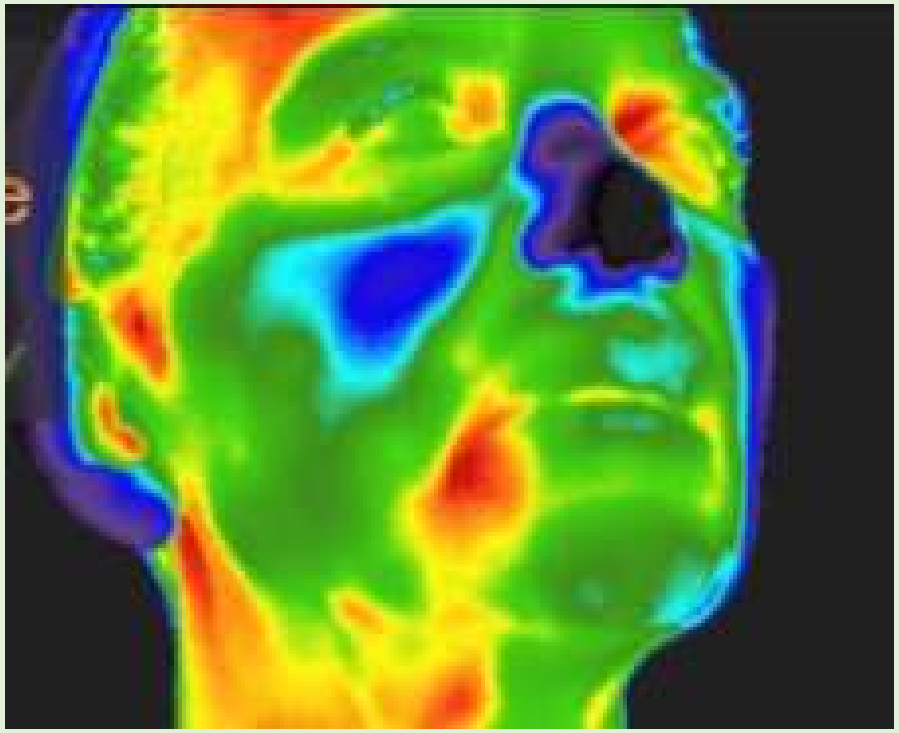
Thermograms

28/01/2025

Look at this picture. What information do the different colours give us?

This is called a **THERMOGRAM.**

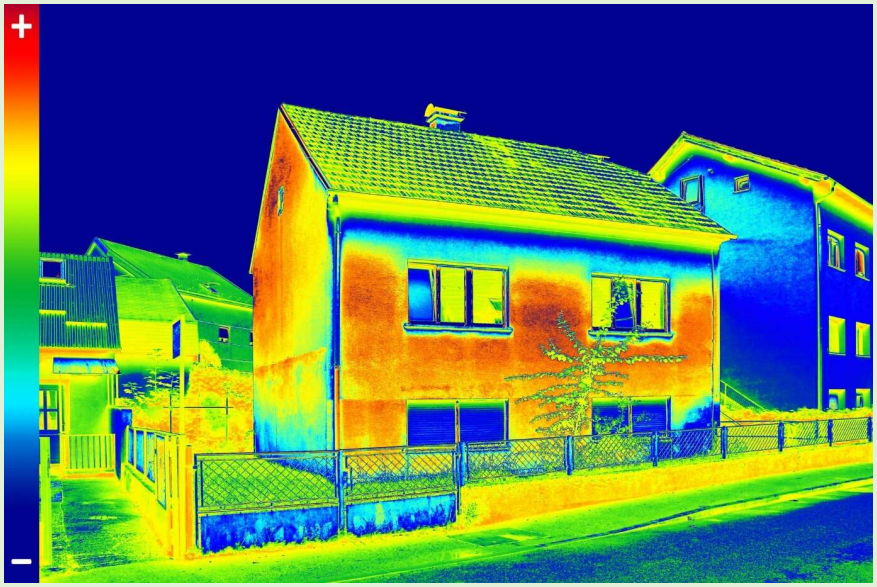
The different colours tell us that different parts of the face have different temperatures.



Using Infrared

28/01/2025

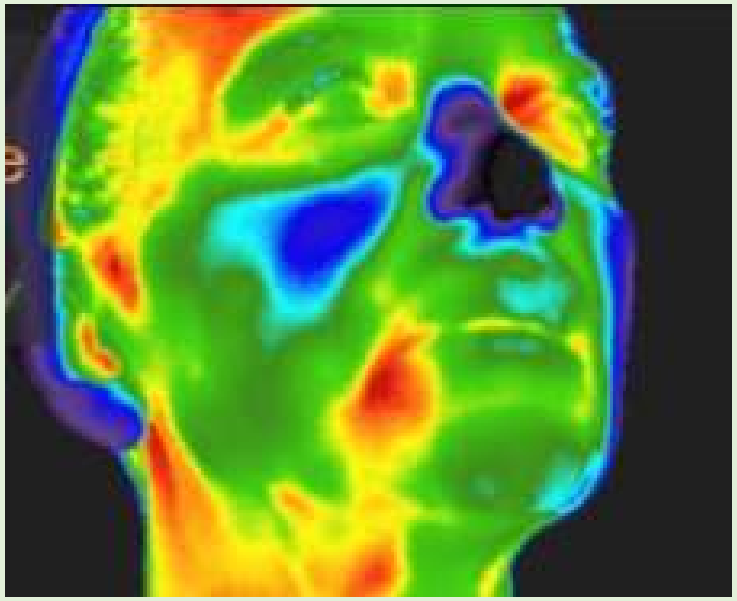
The image made when a thermal camera is used is called a thermogram.



Infrared Camera

Using an infrared camera or this picture complete the table in the booklet.

Area of Face	Colour in thermogram	Hot, warm or cold
Nose		
Cheek (front)		
Cheek (back)		
Side of mouth		



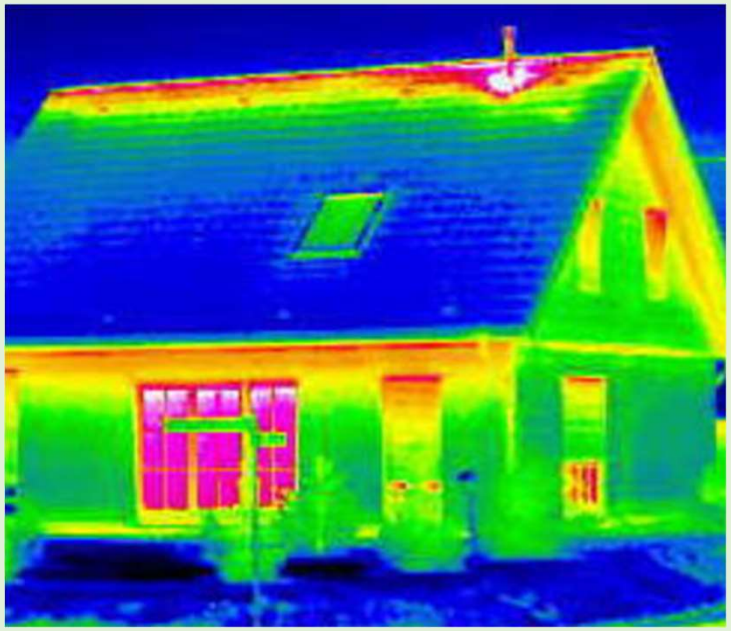
Blue = cold

Green = warm

Red = hot

Infrared Camera

What information do the different colours give us about where heat is escaping this house?



Place	Colour	How much heat is escaping?
roof		
windows		
doors		
walls		

Blue = cold : LITTLE heat escaping
Green = warm : SOME heat escaping
Red/pink = hot: A LOT of heat escaping

Using Infrared

Thermograms show how the temperature can change across different parts of an object.

Different colours represent different temperatures.

Using Infrared

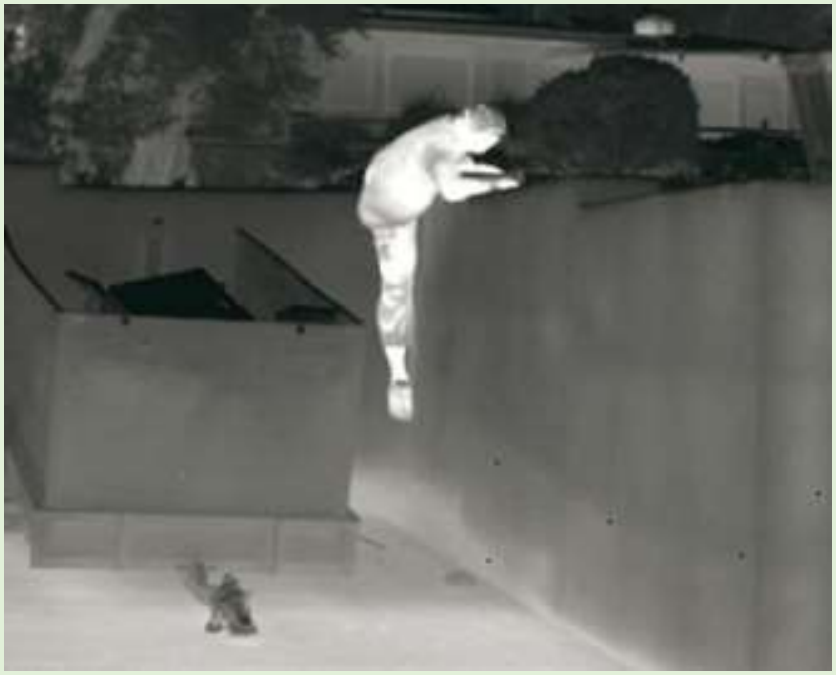
Infrared cameras can also allow us to “see in the dark”.
Why do you think the intruder appears brighter in the picture than the surroundings?

The intruder looks brighter in a thermogram because

_____

_____

_____



Infrared Camera

28/01/2025

Demonstration: Your teacher may show you a few more objects with the IR camera.

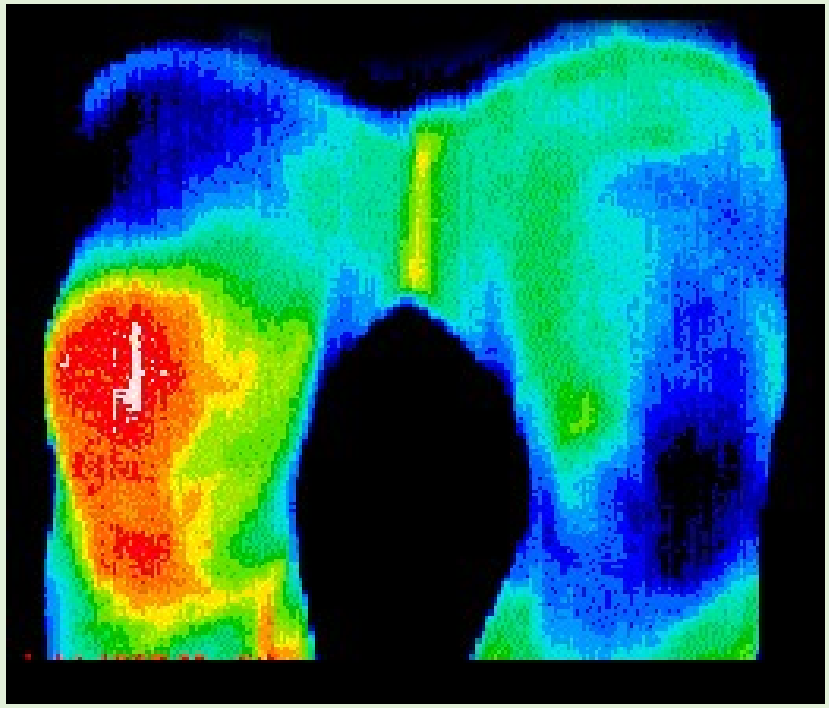
Thermograms

28/01/2025

The thermogram shows two knees of an athlete.

1. Which knee is likely to be damaged?

2. How could you tell?



Thermograms

28/01/2025

Do you remember what we feel when we are exposed to infrared radiation?

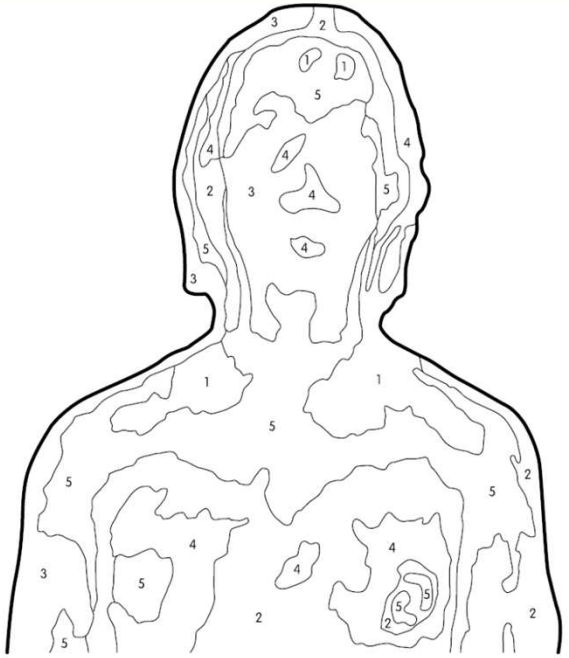
We feel infrared as heat.

Using Infrared

Infra-red can be used to help speed up the healing of muscles. The warmth encourages blood to flow freely.

Using Infrared

Extension: colour in the thermogram using the key below the picture:



number	colour	appropriate temperature (°C)
1	blue	23 – 26
2	green	27 – 29
3	red	30 – 32
4	orange	33 – 35
5	yellow	35 – 37

Using Infrared

28/01/2025

Plenary:

Which of these two people have just come inside from being outside in the cold?

Mike

Betty

Success Criteria

- ❑ I can state what a thermogram is.
- ❑ I can explain how infrared is used in medicine

Tick me at the end if ***you can*** …

Ultraviolet

28/01/2025

Starter:

1. What do thermograms show?

2. Give a use for infrared radiation.

Ultraviolet

28/01/2025

Learning Intentions:

- To state the uses of ultraviolet light.
- To explain the term fluorescent.
- To state that ultraviolet can be used to treat some skin conditions.

Ultraviolet

28/01/2025

Tick me at the end if ***you can*** …

Success Criteria

- ❑I can state the uses of ultraviolet light.
- ❑I can explain the term fluorescent.
- ❑I can state that ultraviolet can be used to treat some skin conditions.

Ultraviolet Light

UV light is invisible to the eye, but florescent materials can absorb the energy in UV light and re-emit it as visible light.

Other Uses of UV Light

Experiment:

Aim: Which objects fluoresce under UV light and why is it useful?

Method:

- Collect a variety of objects.
- Turn the classroom lights off
- Turn the UV lamp on and shine it on the object.
- Record what objects fluoresce or 'glow'

Safety warning!
UV light can damage your eyesight.
Do not shine the light into your eye or anyone else's!

Other uses of UV Light

Results: Which objects fluoresce?

Conclusion: Why is fluorescence useful?

Other uses of UV Light

Where have you seen UV lamps and fluoresce materials?

Useful Ultraviolet

Ultraviolet light can be harmful to human skin, however, in the right dose it can help heal some skin conditions such as psoriasis and eczema.

psoriasis

eczema

Ultraviolet

28/01/2025

Plenary:

- Why are UV beads useful?
- What could they be used for?

Success Criteria

- ❑ I can state the uses of ultraviolet light.
- ❑ I can explain the term fluorescent.
- ❑ I can state that ultraviolet can be used to treat some skin conditions.

Tick me at the end if ***you can*** …

Ultraviolet

28/01/2025

Starter:

1. List three uses of UV radiation

Ultraviolet

28/01/2025

Learning Intentions:

- To state the dangers of overexposure to sunlight.
- To explain how to protect yourself from the damage caused by ultraviolet.
- To explain what the sun protection factor number on sunscreen means.

Ultraviolet

28/01/2025

Success Criteria

Tick me at the end if ***you can*** …

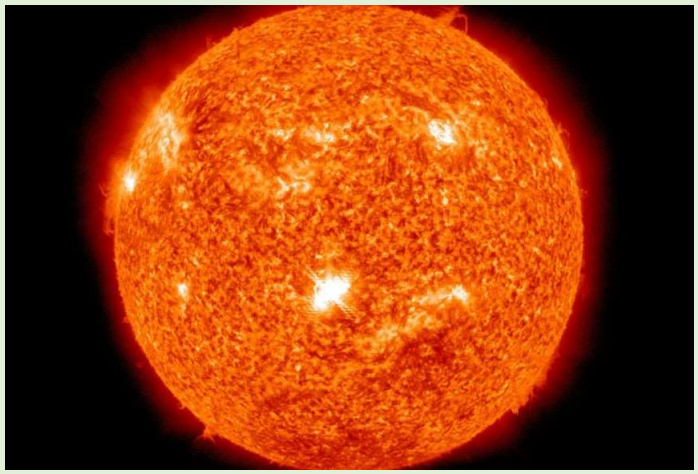
- ❑I can state the dangers of overexposure to sunlight.
- ❑I can explain how to protect yourself from the damage caused by ultraviolet.
- ❑I can explain what the sun protection factor number on sunscreen means.

Ultraviolet Light

UV light is emitted from the sun.

UV light causes the skin to produce vitamin D, which is important for the development of healthy bones.

Exposure to a low level of UV light can help heal some skin conditions.



Ultraviolet = Danger

Remember the warning from last lesson.

Over exposure to UV light is dangerous.

It can cause damage to the skin such as **sunburn** and increase the **risk of cancer**.

Safety warning!
UV light can damage your eyesight.
Do not shine the light into your eye or anyone else's!

Ultraviolet = Danger

Page 13

Watch the following video – Dear 16-year-old me.

Write down 3 facts you learn from the video in your booklet

3 facts from the video: Dear 16-year-old me.

1. _____
2. _____
3. _____

Ultraviolet

Sunlight contains ultraviolet.

Ultraviolet causes human skin to darken or tan.

Too much exposure to the ultraviolet in sunlight can cause sunburn or even skin cancer.

All types of human skin can get sunburn or skin cancer.

This is how we lost Bob Marley

Ultraviolet

Where do you think you are in the most danger of UV rays?

or

Ultraviolet

Is there any danger from ultraviolet here?

Ultraviolet rays can pass through cold air too.

They can also reflect off snow.

Ultraviolet

Why do we have to be extra careful here?

Ultraviolet can reflect off water.

Ultraviolet

"Getting a tan" is popular.

- What do you think about these two methods?
- Which do you think is safer?

From a sunbed (uses UV)

From a lotion (so-called "fake tan")

Protection from UV Light

What can be done to protect your skin from exposure to UV light?

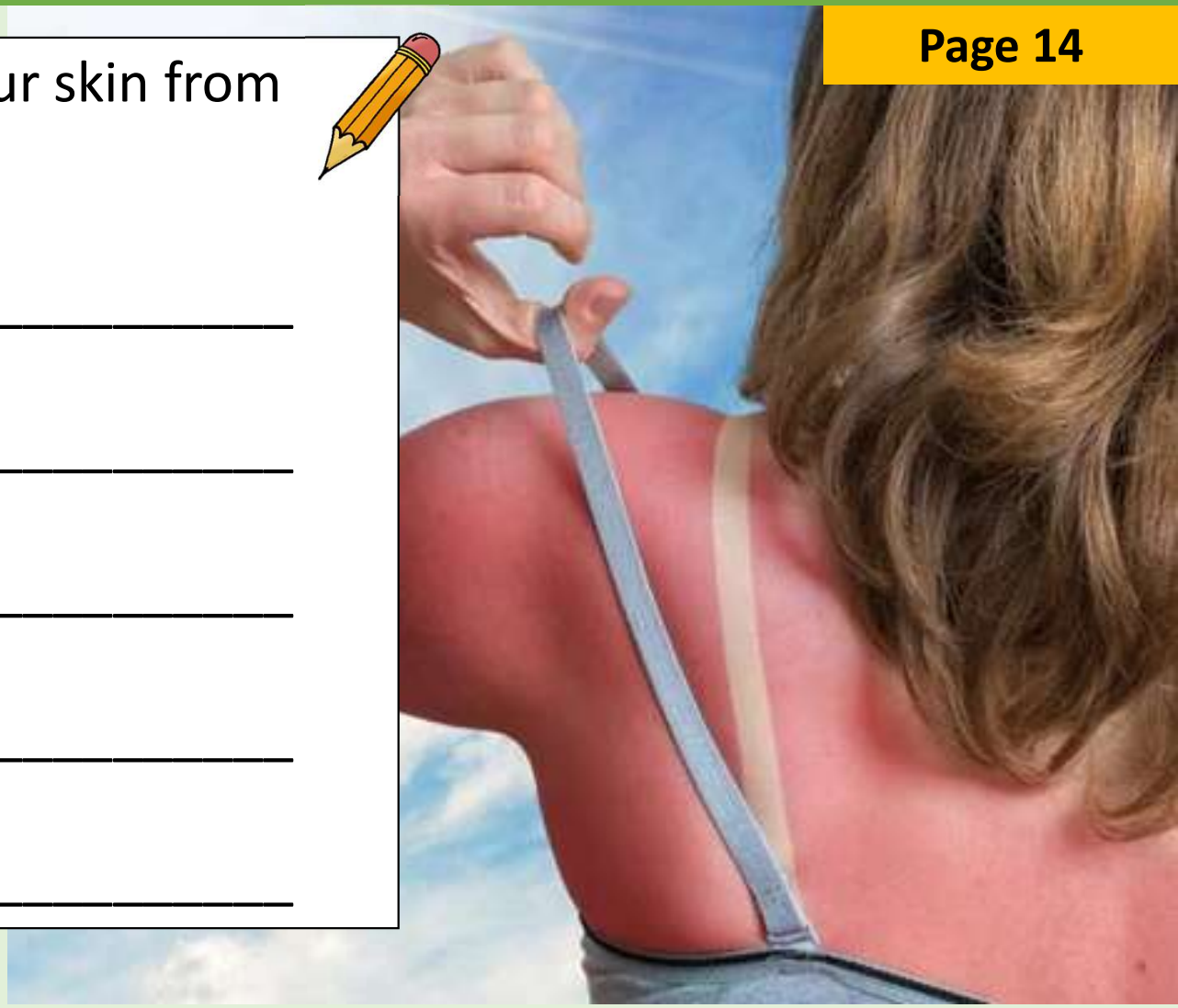
_____

_____

_____

_____

_____



Sunscreen SPF

Watch this video and answer the questions in your booklet.

Page 14

1. What does SPF stand for?

_____

2. As the SPF number gets bigger what happens to the amount of UV that is blocked?

_____

3. Write down two things, other than sunscreen, that can affect how long you can stay out in the sun.

_____

Extension Task:

The UV Index measures the strength of sunburn-producing ultraviolet radiation at a particular place and time. Research and note down today's UV Index for your location and two other cities/countries from different continents. Then, categorize each UV Index value: Low, Moderate, High, Very High, or Extreme.

- Your Location:
  - Today's UV Index: _____
  - Category: _____

- City/Country 1: _____
  - Today's UV Index: _____
  - Category: _____

- City/Country 2: _____
  - Today's UV Index: _____
  - Category: _____

Considering the differences in UV Index between these locations, discuss the importance of being aware of daily UV Index values, especially when traveling.

_____

_____

Ultraviolet

28/01/2025

Plenary:

Australia has a campaign called **'Slip, Slap, Slop'** to help reduce problems caused by too much exposure to ultraviolet radiation.

From what you have learned, what do you think people are being asked to do?

Success Criteria

- ❑ I can state the dangers of overexposure to sunlight.
- ❑ I can explain how to protect yourself from the damage caused by ultraviolet.
- ❑ I can explain what the sun protection factor number on sunscreen means.
- ❑ I can state that ultraviolet can be used to treat some skin conditions

Tick me at the end if ***you can*** …

X-rays

28/01/2025

Starter:

1. What is the danger of overexposure to ultraviolet?
2. What should you use to block ultraviolet?
3. What does sunscreen “SPF” stand for?

X-rays

28/01/2025

Learning Intentions:

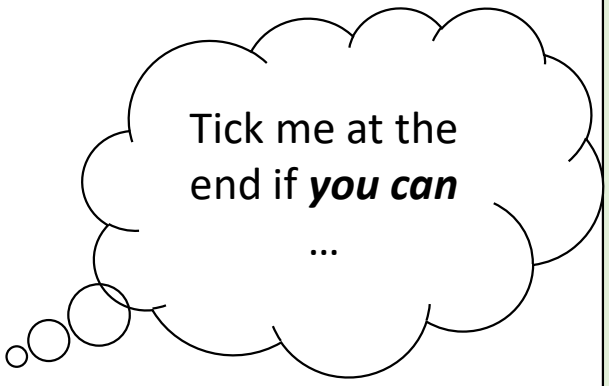
- To explain how we can use X-rays.
- To describe how an X-ray photograph works.
- To identify bones in an X-ray photograph.

X-rays

28/01/2025

Success Criteria

- ❑I can explain how we can use X-rays.
- ❑I can describe how an X-ray photograph works.
- ❑I can identify bones in an X-ray photograph.

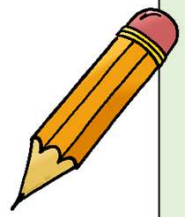


X-rays

Which type of wave has the shorter wavelength, **visible light**, or **X-rays**?

X-rays

Try the paper man experiment and answer the following questions:



1. Were you able to see the “bones” when it was sitting on the table?

   No – they were hidden

2. What had to happen to the light waves for you to see the bones?

   They had to pass through the paper

3. Looking through the paper man how did the bones appear?

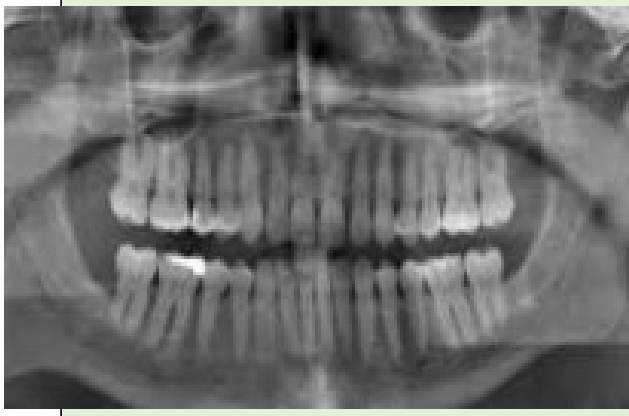
   Like dark shadows.

4. What must have happened to the light waves when they tried to pass through the bones?

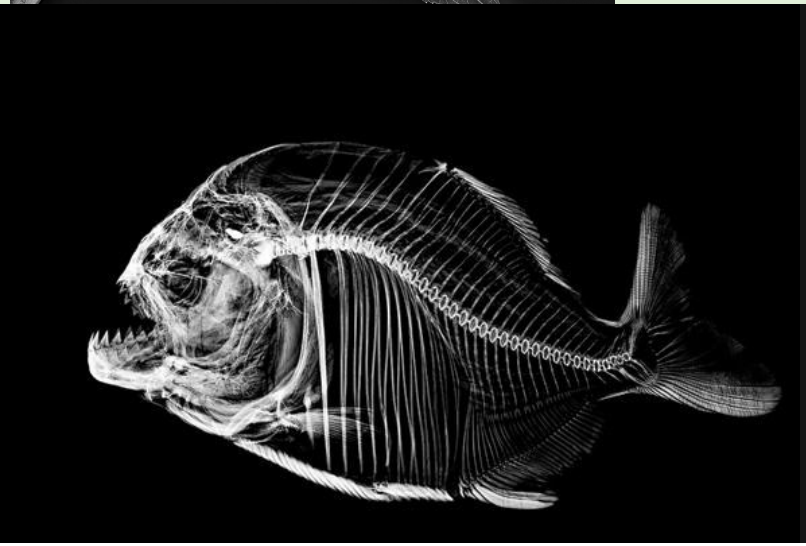
   Some or all of the light didn’t pass through

X-ray photographs

Have a look at the X-ray photographs and answer the following questions



1. What do bones look like? XX
2. What do organs (e.g. the lungs) look like?
3. Write down two things than an X-ray photograph could tell us. XX XX

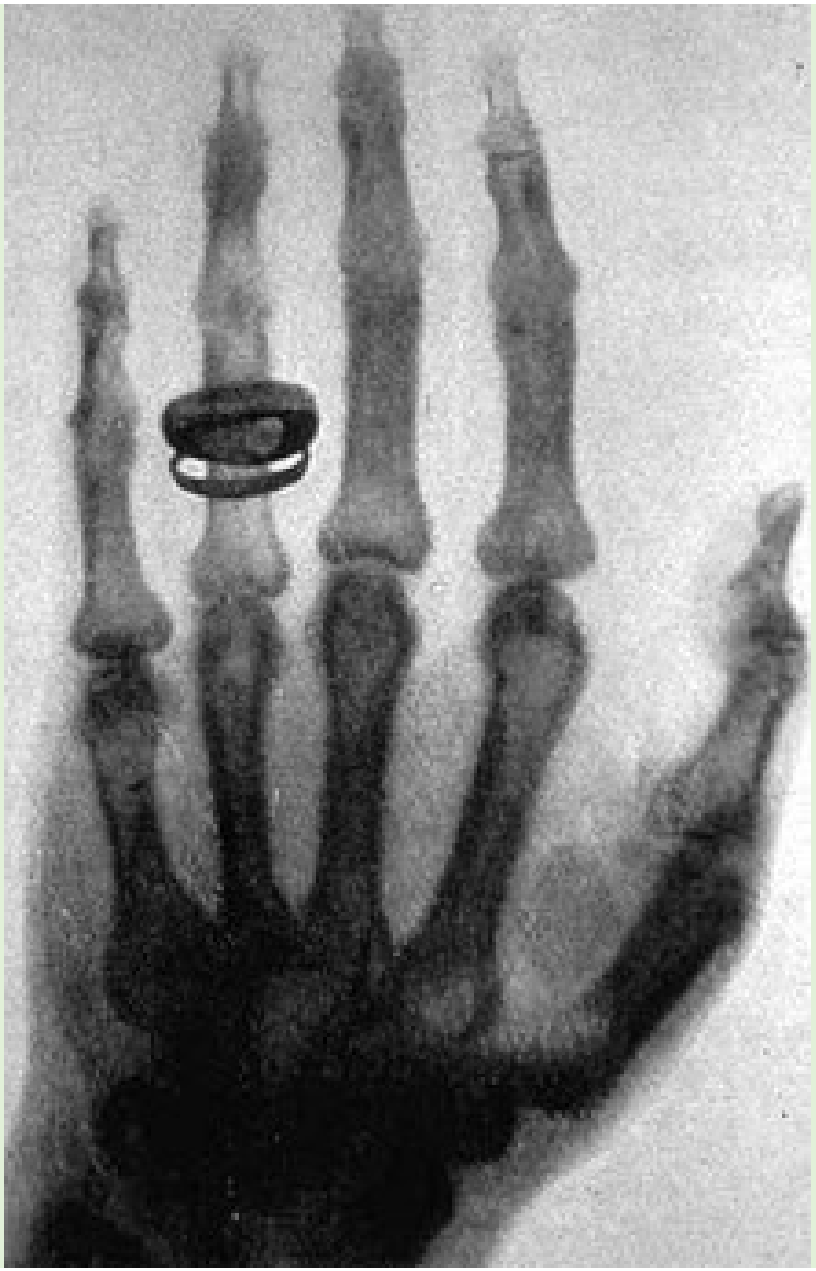


How X ray pictures work

X rays can pass through soft tissue, like organs. These areas appear _____dark_____.

X rays can't pass through _____bone_____ so they appear white or clear.

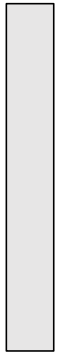
X rays have a shorter wavelength, so we get more _____detail_____.



Getting the order right

Page 16

X rays must pass through the patient to take a photograph.
In your booklet TICK the arrangement that show the correct order.

		
photographic film	x ray machine	patient

X-rays

Page 17

Write down what the x-ray image shows.

X-RAY IMAGES

Picture	What it is…	Picture	What it is…
			
			
			
			
			
			

X-rays

28/01/2025

Plenary:

Look at this X ray Photograph.

1. What part of the body is it?
2. What kind of operation has this patient had?

Success Criteria

- ❑I can explain how we can use X-rays
- ❑I can describe how an X-ray photograph works
- ❑I can identify bones in an X-ray photograph.

Tick me at the end if ***you can*** …