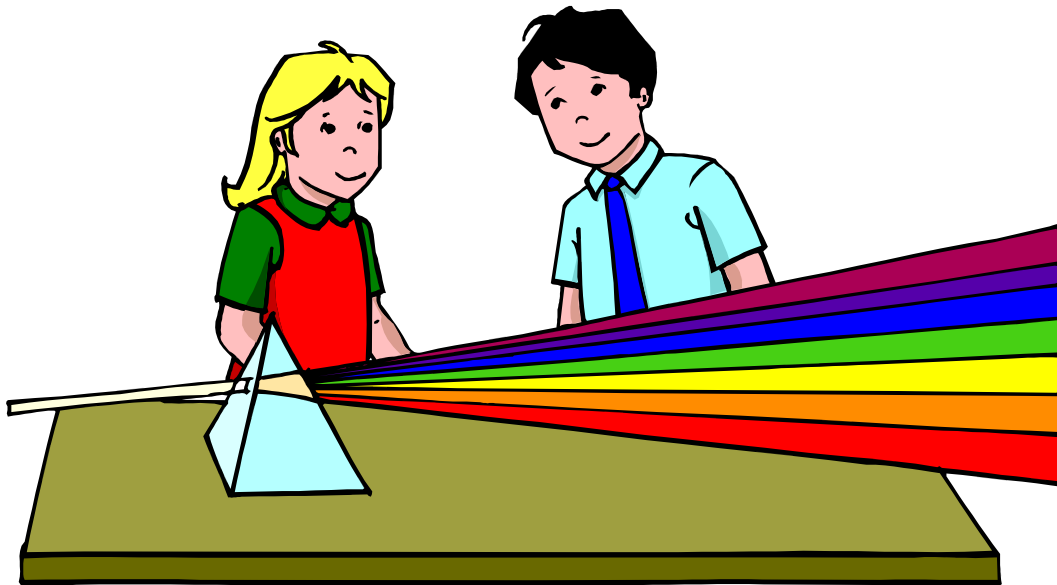


# ACCELERATED SCIENCE



## M.A.D PHYSICS UNIT WAVES, SOUND AND LIGHT KS 4 (foundation)

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# OVERVIEW OF MAIN LEARNING INTENTIONS

To be able to explain what a wave is  
To be able to identify and remember the different parts of a wave  
To be able to distinguish between transverse waves and longitudinal waves

To be able to explain how sounds are made;  
to be able to explain how the brain and the ear hear sounds;  
to explore the nature of sound waves and understand the terms frequency and pitch

To be able to remember the equation  $\text{speed} = \text{frequency} \times \text{wavelength}$   
 $\text{speed} = \text{distance} / \text{time}$   
To understand the terms speed, frequency and wavelength  
To be able to use the equation to solve problems

To remember the types of waves in the electromagnetic spectrum  
To use the internet to discover more about electromagnetic waves

To consolidate knowledge of waves, sound, electromagnetic spectrum by making a mindmap

To explore knowledge of light by filling in a KWL chart  
To question the basic properties of light

To explore the laws of reflection and refraction

To be able to work as a group to conduct research and work as a team to present a demonstration to the class

To be able to work as a group to conduct research and work as a team to present a demonstration to the class

To be able to work as a group to conduct research and work as a team to present a demonstration to the class

**Dear Teacher**

**This unit is by no means absolutely comprehensive, neither has it attempted to be; rather, it attempts to show teachers one way of marrying accelerated learning methods with existing curriculum**

To incorporate an accelerated learning cycle into the structure of lessons:  
Motivate  
Activate  
Demonstrate

To introduce students to concept of mindmapping

To introduce students to more VAK methods

To introduce students to the concept of memory hooks

To allow students opportunity to discover things in a variety of ways

To incorporate ICT opportunities for research

To provide activities which access the multiple intelligences?

To introduce students to mental maps – Venn, spider, Petal, KWL chart

To incorporate as much group work as possible

To allow for more opportunities for self-study

To ensure homework consolidates and prepares

To foster a mindset of questioning

Accelerated Learning Methods

# WAVES/SOUND/LIGHT: LESSON ONE: WAVES

## MOTIVATE

CHALLENGE	To be able to explain what a wave is To be able to identify and remember the different parts of a wave To be able to distinguish between transverse waves and longitudinal waves
CONTEXT	Display <u>Mindmap 1</u> ; Explain how this lesson fits into the overall unit. Explain how to read a mindmap: identify topic; then main headings (branches) then specific colour coded information
REASON	Ask students to explain why it is important to know about how we see and how we hear. Explain that understanding waves helps us better understand our senses
STARTING POINT	Ask groups of 5 to brainstorm all they know about waves in the form of a spider diagram on one large sheet of paper/card. Each member should contribute two ideas/observations or facts. (Giving each member a different coloured marker allows you to see who did/didn't contribute). Each group aims to record 10 ideas about waves. Now collate the ideas on the board in the form of a Venn diagram. Divide the class in half - record their findings; the findings of the other half, and the areas they overlap.

*(TAKE A HALF-MINUTE STRETCHING BREAK)*

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
TEACHER TIME  Explain how we use a model to represent physical concepts Display <u>OHT 1</u> , the anatomy of a wave and indicate the parts. Explain difference between transverse and longitudinal	Transverse waves Longitudinal waves (sound) Crests, Troughs Amplitude Frequency Speed Pulse Medium	* A rope/hose/slinky is excellent to use to show transverse waves; give slinky left to right pulse to show long. waves * A clear bowl with water + food colouring placed on overhead; use medicine dropper to show transverse waves - drop in centre, near edge - compare * OHT 1	* Get students to create sounds for slinky as it makes a transverse or longitudinal wave * Predict the sound different objects will make dropped into bowl of water vs bucket of water * talk as if you are a mobile phone losing signals/ breaking up	* Create a mexican wave to demonstrate that energy, not matter, is what moves * Students stand, linking arms. One starts to shudder, bumps another who starts to shudder and so on

*(DIVIDE THE CLASS INTO 5 GROUPS OF 6. Groups can record findings on reverse side of poster paper)*

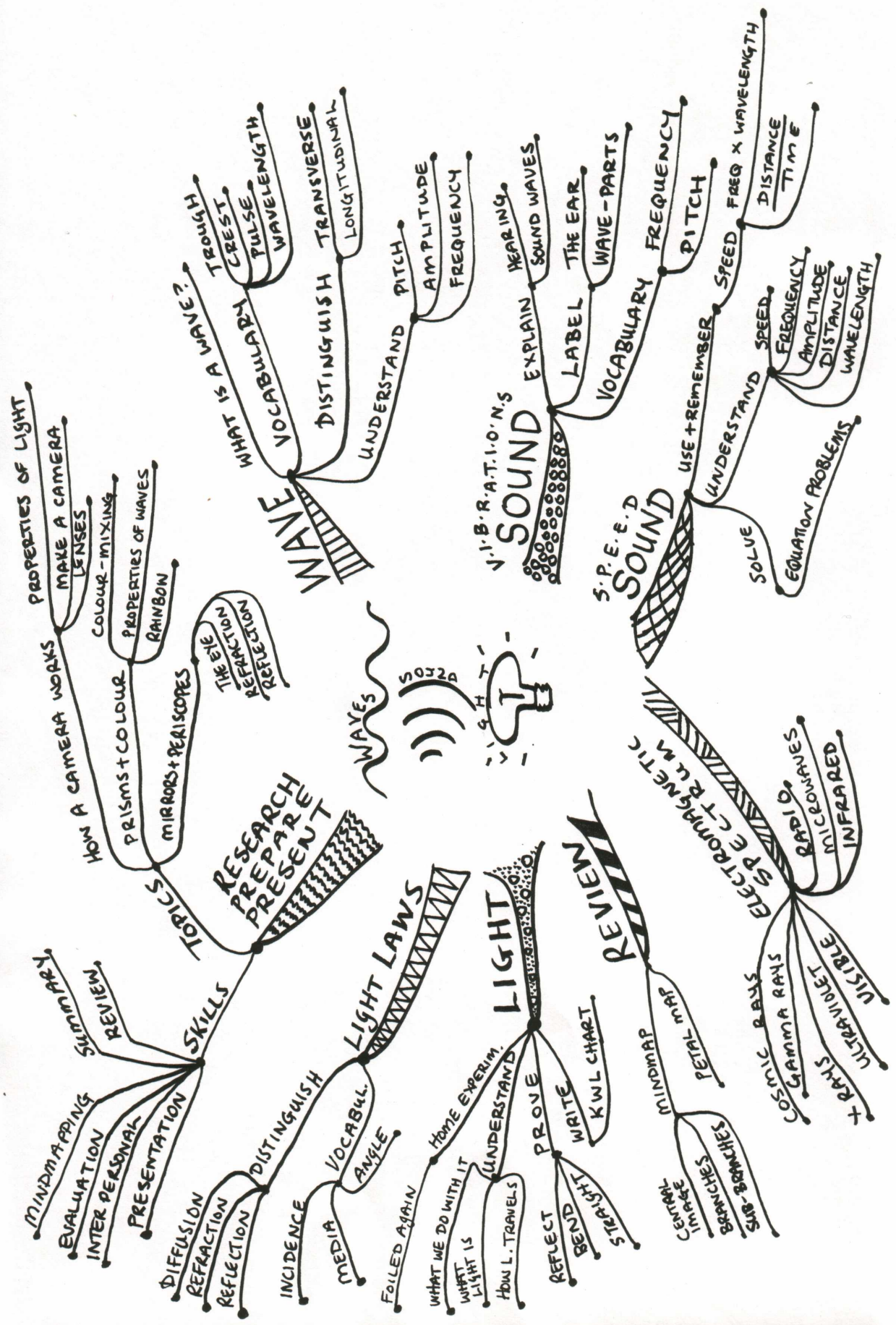
## DEMONSTRATE

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
Musical	Write a song, using a familiar tune, that teaches others about the parts of a wave	<u>Task Card 1</u> <u>Text book/reference pages on parts of waves</u>
Bodily-Kinesthetic	Create 3-D working models to demonstrate wave motion using equipment provided	<u>Task Card 2</u> <u>Bottle, Water, Oil, Food colouring, Straws x12, Masking tape, 6 marbles</u>
Visual-spatial	Create a study poster, converting written facts about waves into a visual feast	<u>Task Card 3</u>
Logical-mathematic	After observing a shallow dish filled with water next to a fan, students create "What if..." questions, then design tests to answer the questions about wave motion	<u>Task Card 4</u> <u>Shallow pan of half-filled with water</u> <u>Deep pan half-filled with water</u> <u>A medium sized fan, aimed at surface of pans</u>
Verbal Linguistic	Students have to research The Doppler Effect, then to recreate it using a pool of water and an alarm clock	<u>Task Card 5</u> <u>Access to internet/ library reference books/ textbooks/ encyclopaedia / CD Rom</u> <u>Motorised toy boat (something similar)</u> <u>Bowl of water</u>

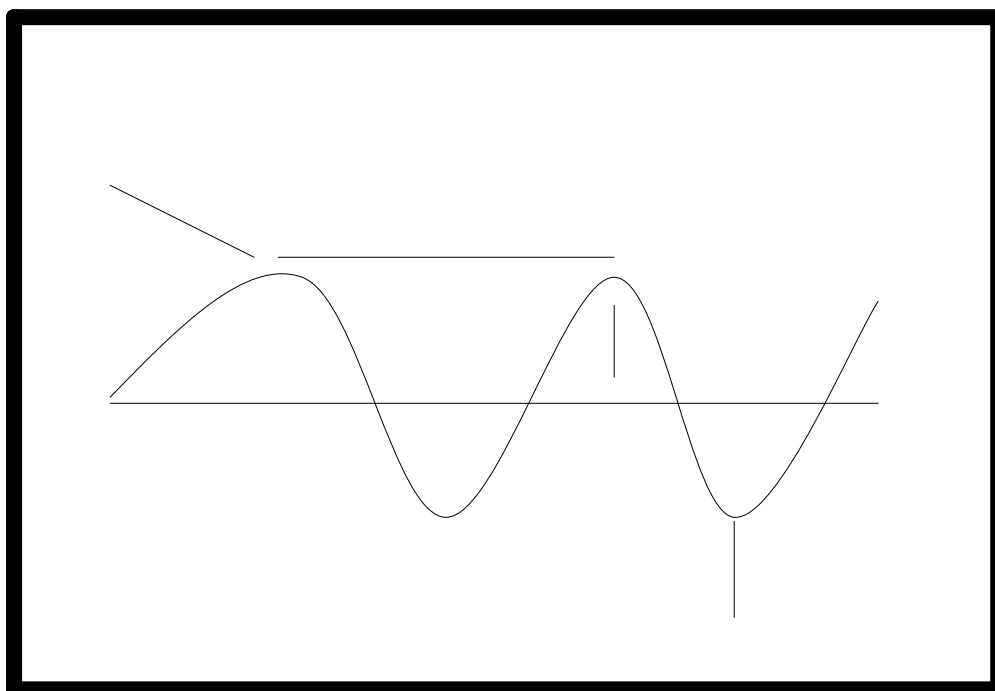
**Plenary #1** – Each group presents its work in turn to the class

**Plenary #2** – Display OHT 1 again – quiz class on parts of wave; revise learning points

**Plenary #2** – Hand out **HOMEWORK SHEET 1**; explain what is expected

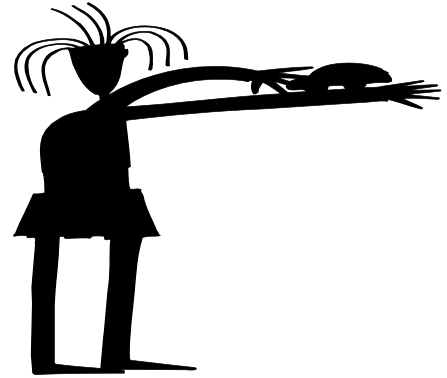


# OHT 1 The Anatomy of a Wave





# TASK CARD 2



## Your Task

The instructions on how to make wave models have been lost to these three designs. Your job in pairs within the group is to decide on how best to make a 3D model of a wave using the materials provided. Your models are to be used to show wave principles to the class. Build your models. Write down your instructions and the uses for your models.

### Model 1

**Resources:**

A plastic litre/2l bottle, a jug of water, some food colouring, a bottle of vegetable oil

**Task:**

Use these materials to demonstrate a 3D model of transverse waves. Build the model. Write down the instructions, with labelled diagrams, and provide uses for your model.

### MODEL 2

**Resources:**

2 straws, masking tape, 6 marbles

**Task:**

How do you make a model that shows how energy is moved in longitudinal waves, not matter? Build the model, write the instructions with labelled diagrams, and write a short paragraph about the use of the model.

### MODEL 3

**Resources:**

12 straws, masking tape

**Task:**

How do you make a 3D model that shows the movement of a transverse wave? Make your model, write out the instructions on how to make it, and write a short paragraph explaining how the model can be used to explain wave motion.

## HOW TO MAKE A 3D MODEL TO EXPLAIN THE MOTION OF WAVES.

**FIRST**

**THEN**

**AFTER**

**FINALLY**

**USES**

# TASK CARD 3



## YOUR TASK

You will be designing an information pamphlet or poster about waves and wave motion. The pamphlet/ poster is aimed at pupils in year 6, so must be visually exciting, easy to understand, and fun to remember. Use the information in the facts column and transform it into something visually more appealing. Remember it is for kids who don't like reading a lot.

### JUST THE FACTS

Waves transfer energy without transferring matter.

If the disturbance moves parallel to the direction in which the pulse moves, the pulse is said to be longitudinal.

If the disturbance is at right angles to the direction in which the pulse moves, it is said to be transverse.

The crest of a wave is measured from the undisturbed position to the height of the hump.

The trough is measured from the undisturbed position to the lowest point of the wave.

Wavelength is the distance between one crest and the next or one trough and the next.

Amplitude is the maximum displacement from the rest position.

Frequency is the number of waves which pass a point in one second.

Speed is the distance a wave travels in one second.

**Sketch your rough ideas here**  
**(You will need poster paper and coloured markers)**

# TASK CARD 4

## YOUR TASK

- a) Look at the 3 items before you.
- b) Now generate 5 questions each, starting with the words “WHAT IF ....?”  
You must be able to answer your questions in class, using the materials before you.
- c) Share your questions with the group. Listen to others’ questions.
- d) From all the questions, as a group, choose the 3 that you as a group will try to answer using the materials before you.

### **RESOURCES:**

**A shallow pan half-filled with water**

**A deeper pan half-filled with water**

**A medium-sized fan**

**A strip of stiff card fit half in water (use as a barrier)**

- e) Record how you tried answering the questions by using the headings in the box on the right. Record your findings on the reverse sheet of the large card used earlier.
- f) Draw all your observations neatly.
- g) Are your tests fair? Can they be repeated with the same results?



## HEADINGS TO USE:

**Question: What if**  
.....?

**What test can we devise to attempt to answer the question? How will we do it?**

1) \_\_\_\_\_

2) \_\_\_\_\_

3) \_\_\_\_\_

**What do we predict will happen?**

**What actually happened?**

**What did we learn from this?**

ENSURE THAT YOU MAKE ACCURATE AND NEAT OBSERVATIONAL DRAWINGS OF ALL STAGES OF YOUR TESTING

TRY TO AGREE AS A GROUP ON ALL DECISIONS MADE

WHEN GIVING FEEDBACK TO THE CLASS, TRY TO USE AS MUCH SCIENTIFIC VOCABULARY AS POSSIBLE

# TASK CARD 5

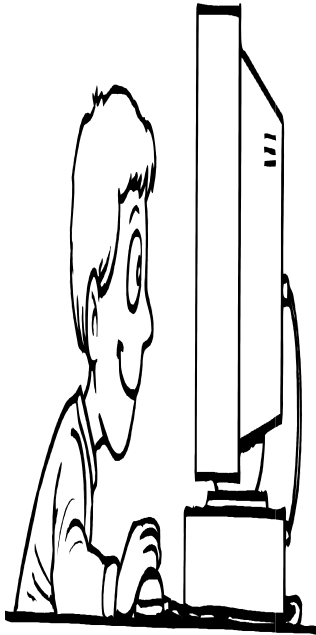
## YOUR TASK

Using the research material that your teacher has provided, or the internet if possible, research all you can about the Doppler Effect. Then decide how best to demonstrate the effect to the rest of the class, using only a battery-powered toy and a bowl of water. Record your findings on the reverse of the large card used earlier. Provide diagrams to explain your results.



Draw DIAGRAMS to show how a toy in water can be used to demonstrate the Doppler Effect.

# HOMework SHEET 1



Use the sites below or any search engine to research the motion of waves.

(Type in “waves+motion+tutorial” or you could try “science waves tutorials” or “physics tutorials online)

Use the knowledge gained to create an animated flipBOOK.

Staple a deck of card slips together and draw in the stage by stage animation of transverse and longitudinal waves. Then flip to make the animation come alive.

You will need to bring this in to school in time for your next science lesson.

Cut out about 20 pieces of stiff card, the size of this instruction box

Staple them together at one end

You can use your textbook as a means of research, not as a medium for a flip animation!

<http://www.physicsclassroom.com/Class/waves/U10L1a.html>

<http://www.brainpop.com/general/presentation>

<http://www.learn.co.uk/default.asp?WCI=Unit&WCU=35769>

# WAVES/SOUND/LIGHT: LESSON TWO: SOUNDS AND VIBRATIONS

MOTIVATE ACTIVATE DEMONSTRATE

CHALLENGE	To be able to explain how sounds are made; to be able to explain how the brain and the ear hear sounds; to explore the nature of sound waves and understand the terms frequency and pitch
CONTEXT	Display <u>Mindmap 1</u> . Review the main points on previous lesson's branch; then move to today's branch, and briefly explain what they will be covering.
REASON	Ask pupils to say what their favourite sound is. Ask them in turn to say what two sounds they would miss the most if they lost their sense of hearing. Ask them to share a sound they most dislike and explain why. Ask them to think of two reasons why studying the physics of sound is a good idea.
STARTING POINT	Display <u>OHT 2</u> and get the students, in pairs, to explain why the words have been written the way they have been written. Explain that a pictonote is a more efficient way of remembering some facts – instead of writing down the word and its definition, the skill is in being able to write the word so that the meaning can be seen from the way the word is written. Display <u>OHT 1</u> and quiz class on parts of a wave. Now ask pupils to share their flip animations with each other.

*(TAKE A HALF-MINUTE STRETCHING/ WATER BREAK)*

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
TEACHER TIME  Relate sound to mechanical vibrations; explain the scientific meaning of "tuning in" and frequency; stress that sound waves are longitudinal; demonstrate what resonance means; explain that sound waves can be reflected, absorbed and transmitted	Vibration creates sound Amplitude of sound = volume Frequency of sound = pitch Sound waves = longitudinal	* <u>Clear water dish</u> on OHT; <u>tuning fork</u> – strike and place to show air vibrating = water vibrating; discuss wave pattern	*Use <u>bottles</u> filled with different amounts of <u>water</u> to highlight pitch and volume *Use a <u>ruler</u> on edge of table and vibrate – how can frequency and pitch be changed?	*Spinning a <u>bicycle wheel</u> while holding a <u>stiff card</u> so the spokes strike it; faster wheel spins, greater frequency and higher the pitch *Repeat the pupil shudder line (see lesson 1) to reinforce ideas on how sounds travel

*(DIVIDE THE CLASS INTO 5 GROUPS OF 6)*

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
Bodily-kinesthetic	This group will create a model of the human ear and will explain how the ear works to the rest of the class	<u>Task Card 6</u> ; a diagram of the human ear <u>1 long paper roll (gift roll); plastic wrap; medium-sized disc of foil; rubber bands; 2 cardboard paper discs; double-sided tape; pink tissue paper; flashlights; 1 large box; scissors; cardboard fork shape</u>
Logical-mathematic	This group will discover using inference and deduction, how to hear a vinyl record using a balloon and a straw	<u>Task Card 7</u> <u>Balloon, plastic straw, tape, scissors, vinyl record (old record player if possible)</u>
Logical-mathematic	This group will experiment with a home made speaker to improve sound quality	<u>Task Card 8</u> <u>1 permanent magnet; 2 feet of wire, 1 pencil, tape or glue, 1 styrofoam cup, 1 paper cup, 1 walkman, 1 plug with alligator clips for tape player</u>
Musical	Using a range of homemade instruments, this group will perform a well-known song to the class	<u>Task Card 9</u> <u>Bottles, elastic bands, boxes, rulers</u>
Existential/spiritual	The bible says that a walled city was brought down because it was surrounded by people blowing trumpets. This group will devise an experiment to see if this is possible.	<u>Task Card 10</u>

**Plenary #1** – Groups present their findings to the class;

**Plenary #2** – Hand out Homework sheet 2, explain what is expected

# OHT 2: Pictocnotes

Can you tell what these words mean just by looking at them?

A hand-drawn wavy line with an arrow pointing upwards from the center of the wave. The word "transverse" is written below the arrow.

A hand-drawn wavy line with the word "trough" written across the lowest point of the wave.

A hand-drawn wavy line with the word "crest" written across the highest point of the wave.

A hand-drawn wavy line with a vertical arrow pointing from the equilibrium line to the peak of the wave. The word "Amplitude" is written to the right of the arrow.

The word "longitudinal" is written in a stylized font where the letters are formed by vertical lines. A red line traces the path of a longitudinal wave through the letters.

A hand-drawn wavy line with a horizontal double-headed arrow indicating the distance between two consecutive peaks. The word "wavelength" is written below the arrow.

# TASK CARD 6

## YOUR TASK

Look at a diagram of the human ear, and briefly read up about how sound travels and is interpreted by the brain. Your job as a group is to reconstruct, using the material provided, a working model of the human ear. You need to explain to the class, using simple terminology, how the ear works. Everyone in the group must participate equally in the presentation to the class.



## MATERIALS NEEDED

A diagram of the ear

1 long gift-wrap paper

roll

Plastic wrap

Medium size disc of foil

Rubber bands

2 Cardboard paper discs

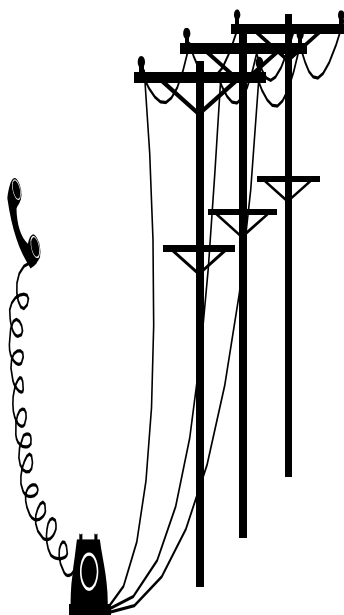
Double-sided tape

1 large box

Scissors

Coloured tissue paper

Cardboard fork shape



## INSTRUCTIONS

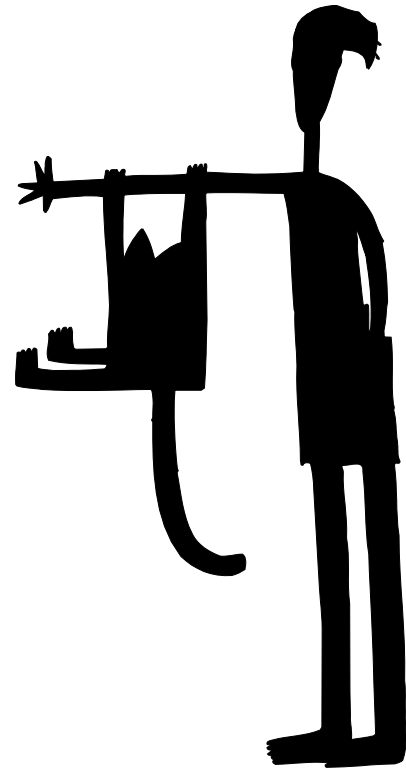
- 1) Create an eardrum by stretching a piece of plastic wrap across the end of the paper roll. Fix it in place with a rubber band.
- 2) Create a set of ossicle with two cardboard discs and a fork shape of thin cardboard. Hold this together with double-sided tape.
- 3) Attach a disc of shiny foil to one end of the roll, and attach another to the plastic wrap "ear drum" on the tube. This is the middle ear.
- 4) Make an outer ear with a cone of cardboard with a hole at its end. Place it on the inside of the tube. Use tissue paper to decorate your ear.
- 5) Place the middle of the model of the ear on a box, leaving the ends of the rolls hanging off the front and the back.
- 6) Shine a light onto the mirror and ask a partner to talk into the ear and watch for vibrations.
- 7) Watch the window of the ear. Describe how it responds to shouting, whispering, whistling.
- 8) Write a brief paragraph, explaining how your model helps explain the workings of the human ear.

# TASK CARD 7

## YOUR TASK

Here is a record player and an old vinyl record. Your job is to be able to use the materials provided to hear the record. You may read up about how record players work, but you will not be given the instructions at any time.

Use trial and error. During plenary, your group must play the record so we can hear sounds, AND SHOULD PROVIDE A BRIEF EXPLANATION on how record players covert vibrations into sounds.



## MATERIALS NEEDED

Balloon, plastic straw, tape, scissors, record player, old vinyl record, notes from encyclopaedias/ textbooks on how phonograms work.

Record your endeavours in your books under the following headings:

- Title: Making Sound
  - Materials needed
- What we tried first + diagram
  - What worked/ didn't work
- What we tried next + diagram
  - What worked/ didn't work
- What we tried after + diagram
  - Finally we ...

# TASK CARD 8

## Your task

Here are the materials you need to make a speaker. Unfortunately, some of the instructions are lost, or vague, or unclear - your task is to build a speaker, and to rewrite the instructions, so others can build the speaker too. During plenary, your group must explain how you went about building the speaker, the steps you took, and should be able to demonstrate it working.



## MATERIALS NEEDED

1 permanent magnet, with a hole in middle; 2 feet of wire, 1 pencil, tape or glue, 1 styrofoam cup, 1 walkman tape player; 1 plug with alligator clips for tape player

## INSTRUCTIONS

1. Leaving about 10 cm on the end, wrap the \_\_\_\_\_ around the pencil to make a wire \_\_\_\_\_, and tape or glue it to the \_\_\_\_\_ of the cup. The coil should be about 1 cm in diameter and should contain about 15 coils.
2. Strip the insulation off the \_\_\_\_\_ of the wire.
3. Place the magnet on the \_\_\_\_\_ coil.
4. Connect the signal source.
5. Adjust until you get sound coming out of your speaker.

Create a drawing to show the different steps you took to make the sound work.

# TASK CARD 9

## Your Task

Your task is simple, yet so clear - you must make music for the class to hear. Using only the materials provided, create musical instruments. Now decide on a simple tune. Now try to recreate the music by using your instruments. Please note, singing is not allowed - this is strictly instrumental. Fill in the table below.



### MATERIALS NEEDED

Empty bottles, water, elastic bands, rice, cardboard rolls, sticks, empty boxes, pipes etc

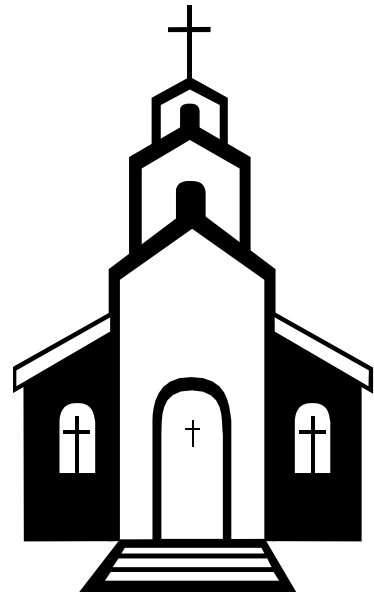
The instruments and what they are made of	How to change the pitch and tone on the instrument

# TASK CARD 10

## YOUR TASK

The bible states that a walled city was brought down by people blowing trumpets loudly. Is this actually possible?

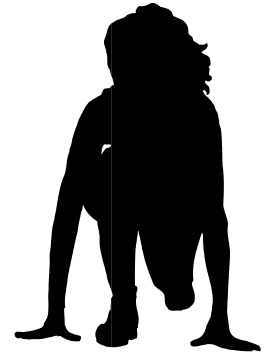
Devise an investigation to test whether sound can bring down walls.



Write in bullet form, how you went about setting up the experiment. Draw diagrams to illustrate points.

# HOMework SHEET 2

1. Visit the web site below.
2. <http://www.brainpop.com/science/energy/sound/index.weml>
3. Watch the film about SOUND.
4. Then do the investigation on SOUND MATERIALS on this page.



## SOUND MATERIALS INVESTIGATION

Design an investigation to discover which materials sound travels through best. You will need a ticking alarm clock as your sound source. How would you go about constructing an investigation? Watch the BrainPop film on the scientific method if you are stuck. Alternatively, you can design an investigation to discover which materials muffle sound best. Record your investigation below:

What I wanted to find out.....

Which materials do I need?

.....  
.....

Making the test

fair.....  
.....

I predict that

.....  
.....  
.....

The investigation

.....  
.....  
.....

My results

.....  
.....  
.....

# WAVES/SOUND/LIGHT: LESSON THREE: soundspeed

## MOTIVATE

CHALLENGE	To be able to remember the equation speed = frequency x wavelength / speed = distance divided by time To understand the terms speed, frequency and wavelength To be able to use the equation to solve problems
CONTEXT	Display <u>Mindmap 1</u> . Revise the previous two branches, and show what will be learned in this lesson
REASON	Calculating wave equations helps astronomers tell how far away distant planets are; it enables bats to fly blind; it allows some animals to catch their prey - it is an important aspect of physics - can you think of other reasons why it is important to calculate wave speed?
STARTING POINT	Ask students to share their experiments done for homework. Discuss any difficulties. Record what students learned from the exercise on the board. Use the analogy of standing near the shore, counting the number of waves that pass a given point to introduce the idea of speed and frequency. Link to homework = speed of waves depends on medium

TAKE A HALF-MINUTE STRETCHING BREAK)

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
TEACHER TIME  The pitch of sound = determined by the frequency of the vibration of the source, how many times it vibrates per second	Pitch Frequency Speed Wave equation	* <u>Water filled glass dish</u> on overhead; use medicine dropper to drop in drops; count the number of waves produced = intro to wave equation * <u>OHT 3</u>	* <u>Different tuning forks</u> ; why do they produce different sounds?	* <u>ruler</u> on edge of desk. Flick the end, observe the vibration and note the pitch - vary the position - how does this affect frequency and pitch?

(DIVIDE THE CLASS INTO 5 GROUPS OF 6 The first activity is done in the classroom; the next activity is done outside)

## DEMONSTRATE

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
Logical mathematic	Each group will use tuning forks and graduated cylinders to determine the speed of a sound wave	<u>Task Card 11</u> <u>Tuning forks x 3; graduated cylinders; water, rulers with cm markings per group</u>
Logical mathematic Bodily-kinesthetic Visual-spatial	Each group will conduct an experiment using a big drum to determine the speed of sound. Each group will produce a table - groups will compare results and work out averages.  <b>Return to classroom and compare results.</b>	<u>Task Card 12</u> <u>Measuring tape</u> <u>Rope</u> <u>Stopwatch</u> <u>Big drum</u> <u>Drumstick</u>
Logical mathematic	Each group will compete to see who can calculate the answers to problems the fastest	<u>OHT 4</u>

**Plenary #1** – Revise main learning points

**Plenary #2** – Hand out Homework 3; explain what to do



## OHT 3



We have learned that sound is produced by something that vibrates. A vibrating object sets the molecules around it in vibration. These vibrations travel as waves. The sound waves must have some material to carry them. Sound waves are longitudinal waves that have compressions and rarefactions. Some sounds are louder than others because they have more energy. We call this energy, intensity, and intensity can be measured in units called decibels. Frequency is the number of vibrations a second and it is related to pitch. The more vibrations per second, the higher the pitch. Frequency is measured in units called hertz. Man uses sound in many ways: to communicate, musical instruments, echoes, sonar, and ultrasonic waves.

- $\text{SPEED} = \text{FREQUENCY} \times \text{WAVELENGTH}$
- $\text{SPEED} = \text{DISTANCE DIVIDED BY TIME}$
- $\text{DISTANCE} = \text{SPEED DIVIDED BY TIME}$

How many different ways are there to remember these equations?

# OHT 4

Here are three problems. Pair up in your groups. Try to solve the problems as quickly as possible. Only when everyone in the group has agreed on the answer must the groups indicate that they have finished.

## Problem 1

Joe sees a lightning flash. 5 seconds later, he hears the thunder. If the speed of sound in the air is 350 m/s, how far away is the storm?

## Problem 2

Playing middle C on the piano keyboard produces a sound with a frequency of 256 Hz. Assuming the speed of sound in air is 345 m/s, determine the wavelength of the sound corresponding to the note of middle C.

## Problem 3

An elephant produces a 10 Hz sound wave. Assuming the speed of sound in air is 345 m/s, determine the wavelength of this infrasonic sound wave.



# TASK CARD 11



**AIM:** To determine the speed of sound.

**MATERIALS:** Tuning forks, graduated cylinders, water, rulers with centimetre markings.

## **INTRODUCTION:**

Sound is a wave. The speed of any wave can be found with the equation:

$$\text{Speed} = \text{frequency} \times \text{wavelength}$$

The wavelength of a sound wave can be found by allowing the sound wave to pass near a tube. When the length of the tube is one-quarter the wavelength, the sound wave will resonate. This means that the sound wave will get stronger (louder) By finding the length of a tube that causes a sound wave to resonate, the wavelength of the sound wave can be calculated. If the frequency of the tuning fork is known, the equation above can be used to find the speed of the sound wave.

## **WHAT TO DO:**

1. Pour some water into a 100 mL or 500 mL graduated cylinder.
2. Tap a tuning fork on a soft object and place the fork near the opening of the graduated cylinder.
3. If the sound resonates (gets loud), proceed to step 5.
4. If the sound does not resonate, either add or remove water then to back to step 2.
5. Measure the distance in centimetres from the top of the water level to the top of the graduated cylinder. Record this distance.
6. Convert the distance in step 5 to meters.
7. Multiply the distance recorded in step 6 by 4. This will give you the wavelength of the sound wave.
8. Now examine the tuning fork you used. There should be a number printed on the tuning fork. This number is the frequency of the sound wave.
9. Using  $\text{speed} = \text{frequency} \times \text{wavelength}$ , work out the speed of the sound wave. Your answer should be in units of meters/second.
10. Do the experiment again using different frequency tuning forks. Do you get the same speed for different tuning forks?

# TASK CARD 12

Your group will need to go outside for this exercise. Each group should split into 2 groups of 3.

Materials needed: A measuring rope to measure 100 meters in a straight line  
1 stopwatch  
Large drum with a drumstick

1. Use the measuring rope to measure 100m in a straight line
2. One person stands at the end of the rope with a drum. The other two stand at the other end with a stopwatch.
3. Have the group with the stopwatches carefully watch the drummer. Start the stopwatch at exactly the same time as you see the drum being struck. Stop the watch at exactly the time you hear the noise.
4. Create a table to record your data. Strike the drum 3 times and record your results.
5. Get together with the other three members of your group. Get the times and work out the average.
6. Calculate the speed of sound by dividing the distance by the average time. What is the speed of sound?

Record your results here:

# HOMework SHEET 3

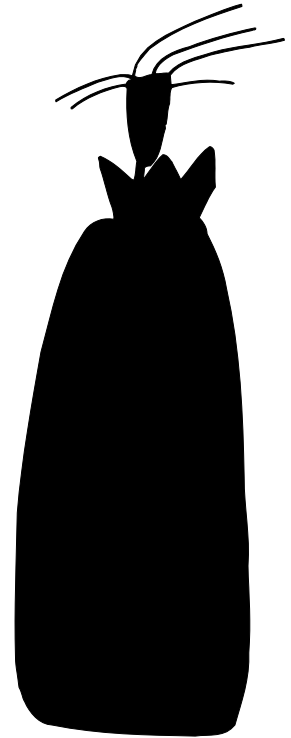
## Visit the following site

<http://library.thinkquest.org/19537/?tqskip1=1>

Your task is to find out what you can about these areas of sound:

- a) Constructive and destructive interference
- b) Ultrasound

Make brief notes, explaining the meanings of a) and b)



A

B

# WAVES/SOUND/LIGHT: LESSON FOUR: THE ELECTROMAGNETIC SPECTRUM

## MOTIVATE

CHALLENGE	To remember the types of waves in the electromagnetic spectrum To use the internet to discover more about electromagnetic waves
CONTEXT	Display <u>Mindmap 1</u> . Explain how this section fits in with the rest of the unit
REASON	Our relationship with the universe depends on our understanding of electromagnetic waves. From being aware of the dangers of ultraviolet light to using radio waves to detect alien life – our understanding of earth in the context of the universe is integral to our understanding ourselves
STARTING POINT	Display <u>OHT 3</u> again and brainstorm ways to make the equations more memorable. Ask students to form their groups, and for each person, using a different coloured marker each, to write, on a large poster card, at least six facts from homework sheet 3. Share these posters with the class. Display <u>OHT 5</u> . Get the students to draw a picture next to the different waves to represent that wave. This is an important activity – the rest of the lesson depends upon it.

(TAKE A HALF-MINUTE STRETCHING BREAK)

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
TEACHER TIME Teach the number rhyme memory system (see <u>Teacher Note 1</u> )	A way of remembering the electromagnetic spectrum	*Draw the pictures next to the numbers	*chant the hooks (one is sun; two is shoe etc)	* Air draw the hooks

(TAKE A HALF-MINUTE STRETCHING BREAK)

## DEMONSTRATE

INTELLIGENCE ACCESSED	WHOLE CLASS ACTIVITIES	RESOURCES
Visual-spatial	Once the class knows the hooks, get them to close their eyes and associate the images they created for the electromagnetic spectrum with the numbered rhyme images (hooks). Once this is done, quiz them for recall, and then get them to recount the electromagnetic spectrum without looking at any notes.	<u>Teacher Note 1</u>
Verbal linguistic	Now move to the ICT room where everyone has access to a computer. Usually students pair up for this. Get them to choose three electromagnetic waves from the spectrum, and challenge them to find out more about those waves, using the internet. Typing Electromagnetic waves+tutorial will help. Each pair must visit at least three sites. At the end, challenge the class to vote on which of the sites should be chosen for the class top 5.	<u>Computers – two pupils per</u>

**Plenary #1** – Students quiz each other on using memory hooks to remember the electromagnetic spectrum

# OHT 5

**Which picture can you draw next to the electromagnetic wave? You need to do this carefully as this activity forms the foundation for the rest of the lesson.**

**Write down the wave and next to each draw a picture to represent the wave. You do not have to be too serious about this: for example, if a backgammon board helps you to remember gamma rays, then draw that!**

- 1. Radio Waves**
- 2. Microwaves**
- 3. Infrared waves**
- 4. Visible waves**
- 5. Ultraviolet rays**
- 6. X rays**
- 7. Gamma Rays**
- 8. Cosmic Rays**

# Teacher Notes 1

*Teaching the Electromagnetic Spectrum using memory hooks*

## 1. First teach them the hook system

This works by getting the pupils to always associate the same image with a particular number. It's reasonably easy to do as the images rhyme with the numbers. So, ONE rhymes with SUN and that is the hook for ONE. Get the students to close their eyes and to "see" a huge sun – imagine a ONE being sunburnt onto their skin.

It is important for the student to internally visualise the image associated with a number, as this forms the hook structure onto which new information can be added.

First, though, to get the hooks in place. Read the list below. After each number, get the students to see the image in an exaggerated, unusual way.

1 = sun; 2 = shoe; 3 = tree; 4 = door; 5 = hive; 6 = sticks; 7 = Heaven (an angel); 8 = gate.

Thinking of the rhyme "one two buckle my shoe" helps here.

Quiz the class to make sure they know the hooks by heart.

## 2. Now attach new information

The students need to look at their list of images drawn to represent the electromagnetic spectrum. For one, they close their eyes and see the sun. Then they associate a RADIO with their image of

the sun. If they imagine a giant radio melting in the heat, while closing their eyes, the image is more likely to remain in their long term memories.

Then they turn to TWO – a shoe – (the 2<sup>nd</sup> wave is MICROWAVE) – and they associate the microwave with the shoe. Perhaps they can “see” their shoe in a microwave heating up till it explodes.

So they continue with each of the waves, attaching them to the numbered hooks as they go along.

This activity can be done as a whole class activity, led by the teacher, who goes through each hook and image one at a time. The students are not expected to write or draw (although they can), but they are expected to close their eyes, exaggerate the image, and to associate it with a numbered hook.

### 3. Check for recall

Now the class can quiz each other, or you can quiz the class for the order of the waves in the electromagnetic spectrum.

What was three? Think of a tree. What did you associate with the tree? Etc.

After, by drawing their images and the numbered images together, they will be further improving their memory of it all.

# WAVES/SOUND/LIGHT: LESSON FIVE: MINDMAP

**MOTIVATE**

CHALLENGE	To consolidate knowledge of waves, sound, electromagnetism spectrum by making a mindmap
CONTEXT	Display <u>mindmap 1</u> . Review key points about waves and electromagnetic spectrum
REASON	Understanding how waves function is crucial to understanding light and its properties Mindmapping allows the left and right hemispheres of the brain to be activated; it allows for more lateral thought and it enables ss to clarify their thinking better.
STARTING POINT	Display <u>mindmap 1</u> . Explain that, while that has the shape of a mindmap, to be a true mindmap it needs colour-coding (deliberately choosing your colours to help you remember) and it needs pictures to represent ideas and concepts. Ask the class to suggest graphics to go with some of the words on the lines. ie How can this idea be best represented by a picture?

(TAKE A HALF-MINUTE STRETCHING BREAK)

**ACTIVATE**

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
<p>TEACHER TIME</p> <p>Explain that, before making a mindmap themselves, they will first collaborate to make a petal map</p> <p>Explain what a mindmap is; show an example; ss convert their petal maps into mindmaps</p>	<p><u>OHT 6</u>: Display Petal map and describe basic Components</p> <p>Groups brainstorm to produce petal map on waves, sound, electromagnetism</p> <p><u>Display OHT 7</u></p> <p>When petal maps completed, groups join up to compare and add new info</p> <p><u>Display OHT 8</u>. Explain that they will be making their own mindmaps by converting their petal maps</p>	<p><u>OHT 6</u>: We organise our thinking into 3 steps: Topic; Heading; Info</p> <p><u>OHT 7</u>: Instruction page</p> <p><u>OHT 8</u> - example of a mindmap, showing how petalmap is converted</p>	<p>3 pupils stand: one says a topic; the next has to say a heading; the next has to add info</p>	<p>As students do auditory activity; others mime actions to assist the deaf</p>

(TAKE A HALF-MINUTE STRETCHING BREAK)

**DEMONSTRATE**

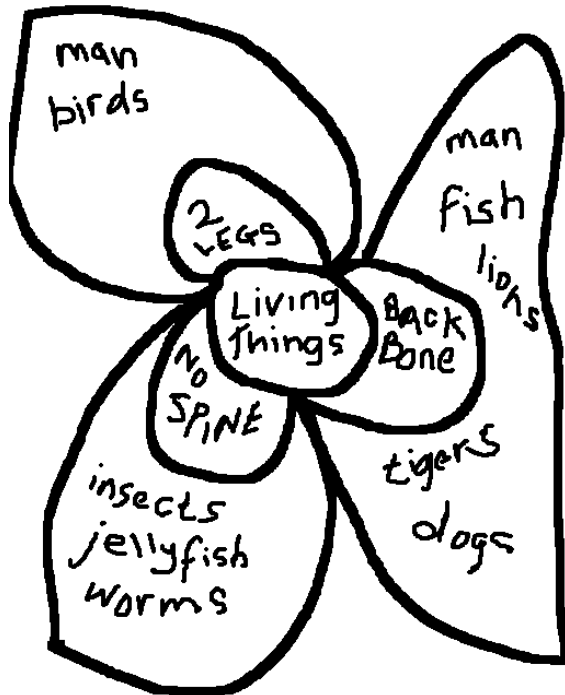
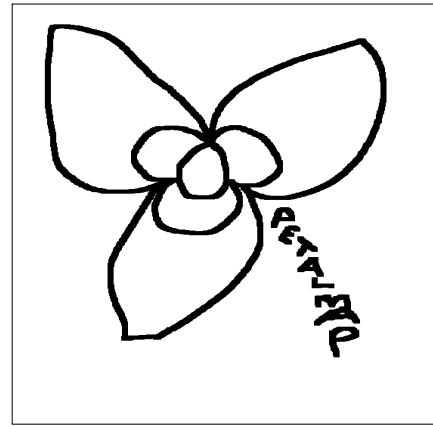
INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
Visual-spatial/ Logical mathematic	Individual activity within groups: students design, colour and add graphics to their personalised mindmaps. Using the information from the petal maps, they convert their notes into a mindmap. They must use as many pictures, images, graphics as possible, and should aim to make a comprehensive mindmap containing everything they have learned so far about waves, sound and electromagnetism. Play contemporary music in background to create relaxed atmosphere	<p><u>Modern music in background</u></p> <p><u>A3 sheet blank paper each</u></p> <p><u>Coloured pens and pencils</u></p>

Plenary #1 - Mindmaps are passed to three other students whose job it is to pass 3 positive comments about the mindmap under these headings: What is good about the mindmap? How can it be made better? What do you like most about it? These comments can be written or verbally shared.

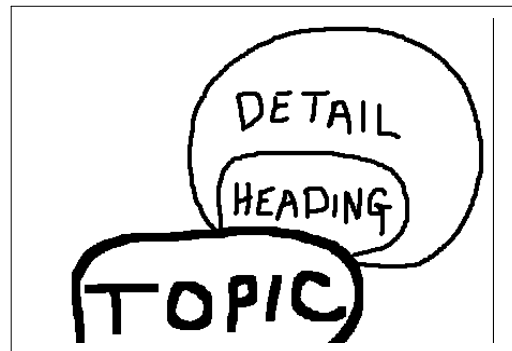
Plenary# 2 - Challenge the pupils to remember the details on the mindmaps without looking at them - in pairs they can hold a fact quiz: how many facts can you remember? One holds the map while the other attempts to recall details.

Plenary #3 - Hand out Homework Sheet 4. Explain what needs to be done (refer to page)

# OHT 6



Place the topic in the centre  
Draw a circle around the headings  
Draw a circle around the details



As a group, create a big petal map on the following topic, using the following headings. It is the group's responsibility to fill in as much detail as possible around the headings.

**Topic:** WAVES, SOUND, SIGHT

**Headings:**

WAVES

SOUND

ELECTROMAGNETIC SPECTRUM

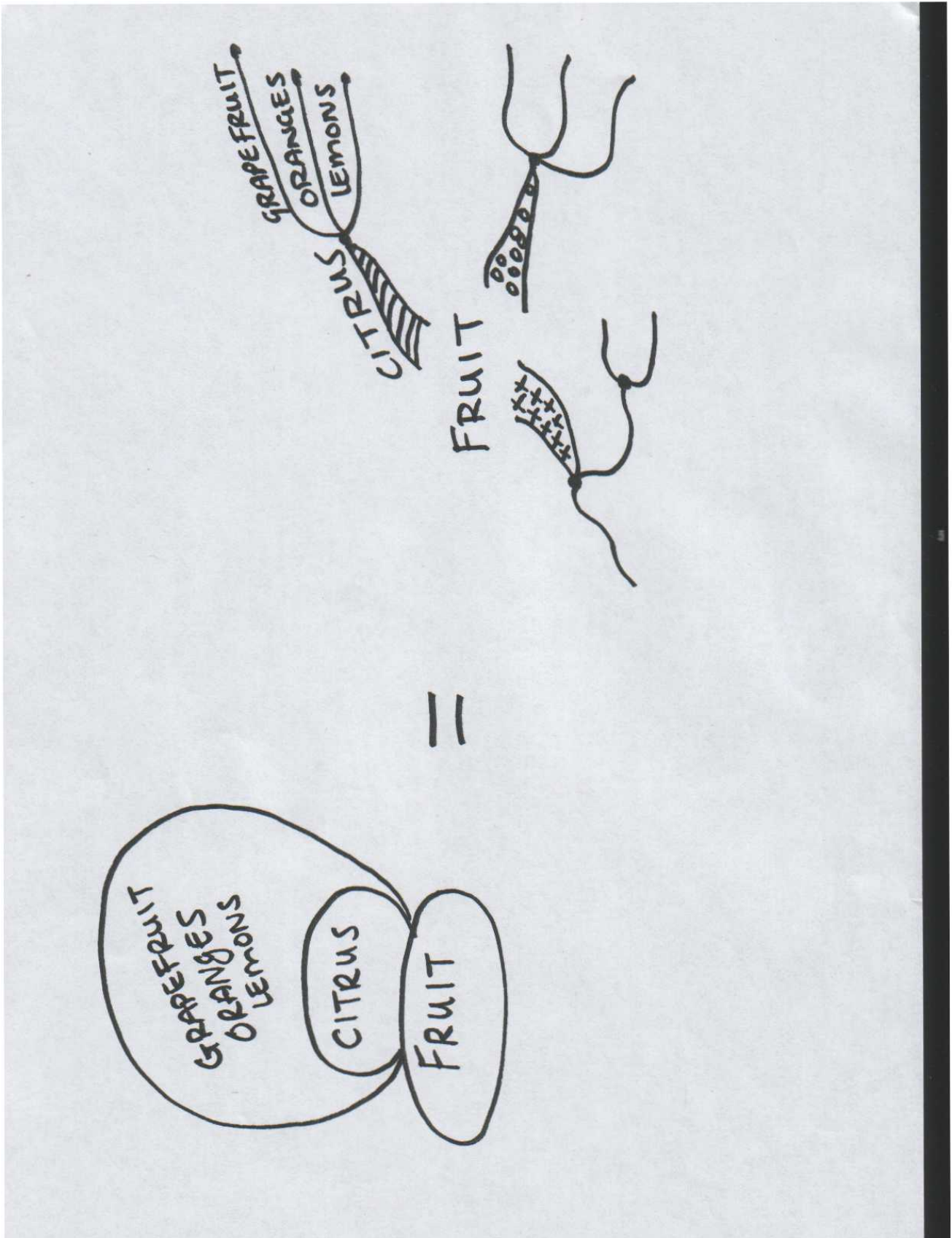
# OHT 7

Once individual groups have completed filling in detail around their headings –

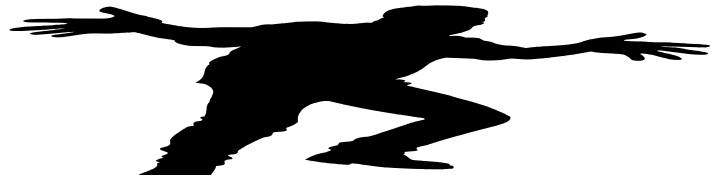
- groups need to pair up
- compare their details
- add in extra missing information



# OHT 8



# HOMework SHEET 4



**VISIT THE  
FOLLOWING SITE  
TO FIND THE  
ANSWERS TO THESE  
QUESTIONS**

<http://www.opticalres.com/kidoptx.html#MainPoints>

1. What is light?  
.....  
.....
2. How does light travel? .....
3. How fast? .....
4. How straight? .....
5. Name 3 ways to control light: .....
- .....  
.....
6. Why should we care about controlling light anyway?  
.....  
.....  
.....  
.....  
.....

# WAVES/SOUND/LIGHT: LESSON SIX: LIGHT

MOTIVATE

CHALLENGE	To explore knowledge of light by filling in a KWL chart To question the basic properties of light
CONTEXT	Display <u>mindmap 1</u> - talk through branch on light; show how it fits in to overall unit
REASON	In groups of 3 - ss create a spider diagram, listing 10 reasons why understanding light is an important thing to learn.
STARTING POINT	Display <u>OHT 9</u> - explain that a KWL chart consists of writing down what you already know about a topic; then adding what you would like to find out; before adding later, what you have learned. SS fill in the WHAT I ALREADY KNOW rung, collaborating in groups of three, but each writing the same facts. Then, as an individual activity, ss fill in questions in the second rung about what they would like to find out. Share these questions as a whole class activity - explain that the unit of light will attempt to answer some of those questions

(TAKE A HALF-MINUTE STRETCHING BREAK)

ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
Tell them that you were going to teach them, but you have lost your memory and have forgotten how to prove these things to the class. They have to brainstorm ways to help you. Challenge the groups to prove that light travels in a straight line; that it reflects; that it bends/refracts	Display <u>OHT 10</u> . How can you prove that light travels in a straight line? How can you prove that light reflects of some surfaces and not off others? How can we prove that light bends when it goes through different media?  Hand out <u>Task Cards 13, 14, 15</u>	Two groups must think of visual ways of proving these three things - but to do so without speaking; just using pics/comics/animations/posters etc	Two groups must think of a radio script answering the questions	Two groups must come up with ways of proving these things but by not using words or pictures at all - just by using their bodies

(TAKE A HALF-MINUTE STRETCHING BREAK)

DEMONSTRATE

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
Logical mathematic/ visual spatial/ body kinesthetic	Groups brainstorm ideas to prove the challenge questions. They may only use objects readily available in classroom. Once they have come up with ways to prove those things, they then have to demonstrate, through experimentation, to decide which of their ideas is the most practical and effective at proving the question. Once they have found the best method of presenting their findings, they demonstrate in turn how their best methods for proving the properties of light.	<u>Provide as many resources as the school can allow to assist ss to complete task. Torches, lasers, lenses etc</u> <u>Ensure there are copies of text books, resource material for each group - leave them there but do not refer to them: it is up to the students to use research initiatives to answer the questions</u>

**Plenary #1** – Groups feed back to the class; other groups provide feedback in the form of: What was especially good about the presentation? What could be done to have made it better? Overall, what did you like about the presentation?

**Plenary #2** – SS go back to KWL chart, add in any extra questions

**Plenary #3** – Hand out and explain homework sheet 5.

# OHT 9

# THE K W L CHART

**What  
do I  
know  
about  
this  
topic?**

**K**

**What  
would I  
like to  
find out  
about  
his  
topic?**

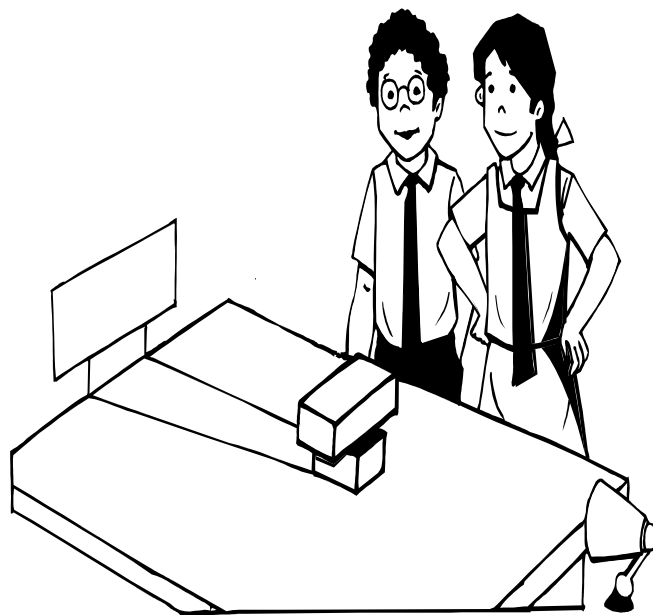
**W**

**What  
have I  
learned  
about  
this  
topic?**

**L**

# OHT 10

HOW CAN WE  
PROVE



THAT LIGHT TRAVELS IN  
A STRAIGHT LINE?

THAT LIGHT CAN BE  
REFLECTED?

THAT LIGHT CAN BE  
BENT?

# TASK CARD 13

Your task is to prove to the class, through demonstration, that light travels in a straight line; that it reflects; that it can be bent.

BUT

YOU MUST PRETEND THAT YOUR AUDIENCE IS DEAF - SO YOUR PRESENTATION MAY NOT CONTAIN ANY SPOKEN WORDS.



P  
R  
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T  
!

# TASK CARD 14

Your task is to prove to the class, through demonstration, that light travels in a straight line; that it reflects; that it can be bent.

BUT

YOU MUST PRETEND THAT YOUR AUDIENCE IS BLIND - SO YOUR PRESENTATION MAY NOT CONTAIN ANY VISUAL ASPECTS - PRETEND YOU ARE TRYING TO PROVE THIS ON RADIO.



P  
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!

# TASK CARD 15

Your task is to prove to the class, through demonstration, that light travels in a straight line; that it reflects; that it can be bent.

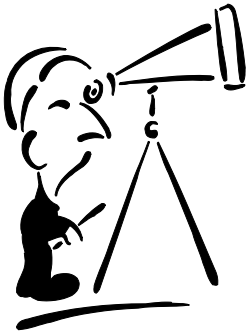
BUT

YOU MUST PRETEND THAT YOUR AUDIENCE IS ONLY ABLE TO LEARN THROUGH DANCE. WHAT DANCE WOULD YOU TEACH THE CLASS TO PROVE THE ASSERTIONS ABOUT LIGHT?



P  
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!

# HOMWORK SHEET 5



## HOME EXPERIMENT

### FOILED AGAIN!



- 1) Use a pair of scissors to cut a length of kitchen foil – about 25cm by 25cm
- 2) Ensure you do not crease the foil – it must remain as smooth as possible
- 3) Hold the square up, shiny side facing you
- 4) How much of your reflection can you see?
- 5) Now scrunch the foil into a loosish ball, taking care not to press it too tightly together
- 6) Flatten out the square, shiny side up
- 7) Look at your reflection now
- 8) What has happened?

In scientific terms, explain why you cannot see your reflection anymore. Use as many of the words in the box as possible:

Rays, reflect, surface, straight, smooth, back, scrunchy,  
light, bounces, all directions, reflected rays, different angles

# WAVES/SOUND/LIGHT: LESSON SEVEN: LIGHT LAWS

## MOTIVATE

CHALLENGE	To explore the laws of reflection and refraction
CONTEXT	Display <u>Mindmap 1</u> : explain what it is they will be doing today
REASON	Think of 2 solid reasons why it is important to understand the laws of reflection and refraction – share these with the pupils
STARTING POINT	Ask students to explain what is meant by scientific laws. How do they differ/ are the same as other laws? Is there a difference between a law of nature and a scientific law? Ask ss to share their homework with other members of their group

(TAKE A HALF-MINUTE STRETCHING BREAK)

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDI TORY	KI NESTHETIC
TEACHER TIME Demonstrate the laws of reflection and refraction	<ul style="list-style-type: none"> <li>- angle of reflection/ angle of incidence</li> <li>- incident ray, normal ray, reflected ray</li> <li>- reflection off diff surfaces</li> <li>- refraction</li> </ul>	Display <u>OHT 11</u> SS Copy from board and label	Tell the analogy of a line of people racing into a shallow river; all run at same speed, but person at front is slowed down when entering water; as is others when they enter water; when they leave, they pick up speed again = light travelling through different media	SS place pencil in glass water to observe refraction; ss have half a straw each – look through their straw and try to see the other's straw in the mirror = must arrange straw so angles are the same

(TAKE A HALF-MINUTE STRETCHING BREAK)

## DEMONSTRATE

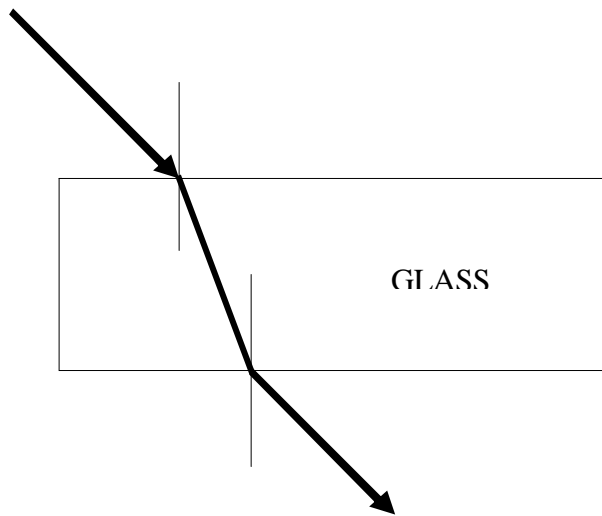
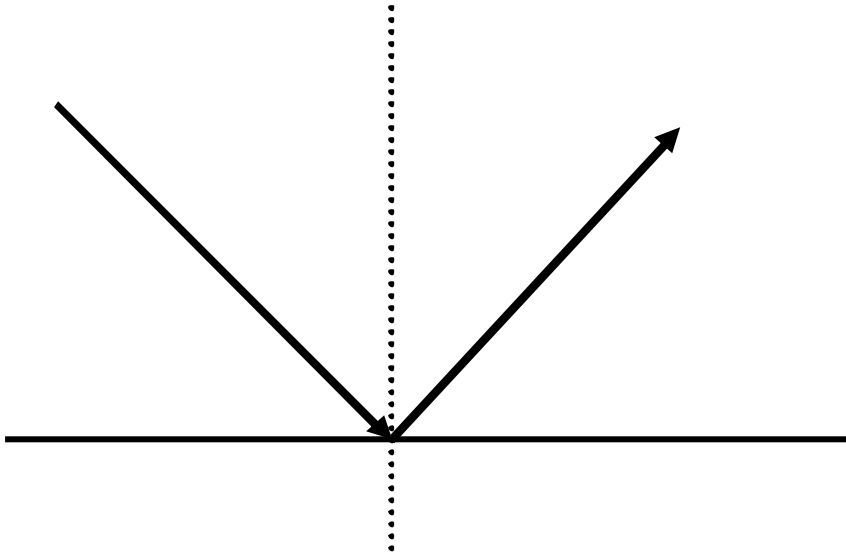
INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
Inter-personal Visual-Spatial Body-kinesthetic Logical mathematic	Groups will use the law of reflection to bounce a beam of light around the classroom to hit targets and to attain lowest elapsed time to reach targets. Arrange for each group to have 2 targets to aim for around the room, at different angles (See <u>taskcard 16</u> )	<u>TASKCARD 16</u> <u>3 pocket sized mirrors for each group</u> <u>1 filmstrip projector</u> <u>several bullseye targets</u>
Visual spatial Logical mathematic Body-kinesthetic	Place a small mirror (very small) in a goldfish bowl. One student from each group gets one chance to shine a laser into the bowl to "shoot" the mirror. One catch: you may not practise beforehand; another catch: you may not point the light directly above the mirror.	<u>TASKCARD 17</u> <u>Fishbowl</u> <u>Water</u> <u>Coin sized mirror</u> <u>Laser pointer</u>

**Plenary #1** – Discuss the laws of reflection/refraction observed in the activities

**Plenary #2** – Display OHT 11 and revise vocabulary

**Plenary #3** – Hand out **Homework Sheet 6**

# OHT 11



# TASK CARD 16

## Note to Teacher:

The aim of the game is for each team in each group to see how quickly they can bounce a beam of light around the classroom to hit a target. Each group is divided into two teams. Each team has to hit one target. Targets are foil plates/ or card placed around the room. Once it is their turn, the team has two minutes to line themselves up around the room so that, when the projector is turned on, the beam is bounced off the 3 mirrors until it hits the target. The winning team is the team who hits their target in the shortest length of time.

Targets should be placed around, above, below objects to maximise use of angles and difficulty.

## NOTES TO STUDENTS

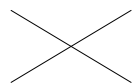
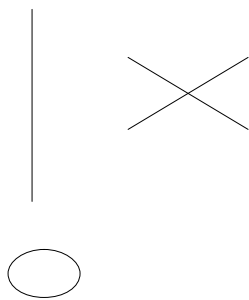
1. Form a team of 3 people.
2. Each person should have a pocket-sized mirror.
3. There is a projector light in the classroom.
4. When it is turned on, you have 2 minutes to bounce the beam off your mirrors, so that it lands on your target.
5. Your teacher will indicate which your target is.
6. The winning team is the team which hits its target in the shortest amount of time.
7. Therefore, each group (comprising 2 teams) should have at least one official timekeeper.



# TASK CARD 17

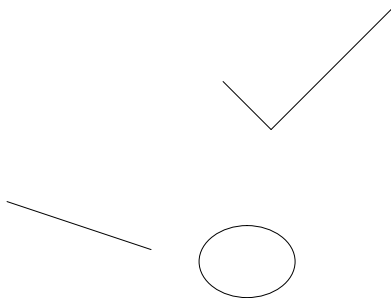
## The Goldfish Bowl Challenge

In the goldfish bowl full of water, you will find a small mirror. Your mission is, with only one shot of the laser, to hit the mirror target. You may not shine the laser directly down onto the mirror by holding the laser above the water.



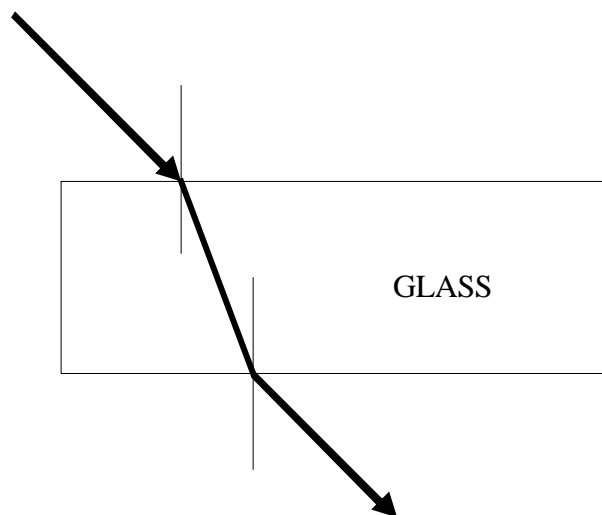
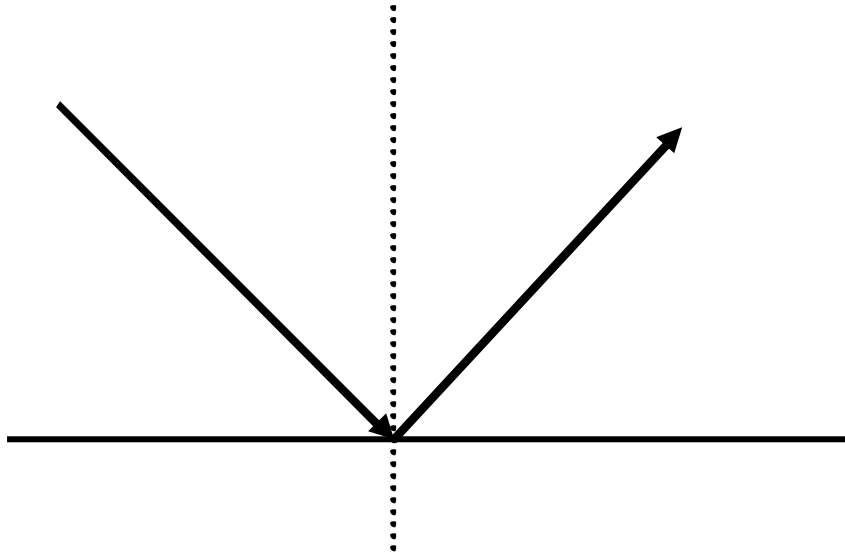
Stand in a circle around the bowl. One by one you step forward, pick up the laser, and within 5 seconds, you have to aim and shoot at the target.

The winner is the person who shoots the target first time every time for three times in a row.



# HOMWORK SHEET 6

What do these lines tell you about the laws of light? Label and provide brief notes explaining the diagram



# WAVES/SOUND/LIGHT: LESSON EIGHT: PREPARING ...

## MOTIVATE

CHALLENGE	To be able to work as a group to conduct research and work as a team to present a demonstration to the class
CONTEXT	Display <u>Mindmap 1</u> : Explain that it is each group's responsibility to teach a section about light to the class. They will be combining all the skills they have learnt so far in this unit to demonstrate that they are growing as young scientists. 2 Groups will each give the same presentation.
REASON	Being able to teach others is a sure fire way of demonstrating that you know the work yourself. Instead of a written test at the end of this unit, each group will give a presentation, and each will receive marks from the rest of the class. All the marks are then added and the total is the average.
STARTING POINT	Allow each group ten minutes to agree on 10 groupwork rules – i.e. what rules need to be in place in order for a group to work successfully? Each group decides on 10 rules – then chooses the most reasonable 5; they then write it down, and all sign to adhere to the contract. Discuss the rules the ss created – brainstorm any difficulties that may arise. What obstacles might

(TAKE A HALF-MINUTE STRETCHING BREAK)

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDI TORY	KI NESTHETIC
TEACHER TIME Discuss the elements that make a good presentation	<ul style="list-style-type: none"> <li>- eye contact</li> <li>- volume</li> <li>- enthusiasm</li> <li>- clarity</li> <li>- content</li> <li>- participation</li> <li>- scientific knowledge</li> </ul>	Brainstorm ways that visual information can be made to be more stimulating	Brainstorm ways that sounds, sound effects/ music and voice can add spice to a presentation	Brainstorm ways that objects and props can be used / ways to include the whole body in the learning process/ discuss use of dance and mime

(TAKE A HALF-MINUTE STRETCHING BREAK)

## DEMONSTRATE

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
all	Hand out Task cards 18-20 a,b,c Explain what each group needs to do Emphasise the time frame needed  Students answer questions 1 - 10 before beginning to plan for the presentation	To be determined by students and teacher on the day

**Plenary #1** – Ask ss which materials/resources they think they are unable to provide on their own.  
Brainstorm possible alternatives

**Plenary #2** – Homework = to prepare for the next lesson + the presentation

# TASK CARD 18a

"Very interesting!"

"Clever use of humour!"

"Scientifically spot-on!"

"Very stimulating and refreshing!"

"Easy to remember!"

THIS IS WHAT OTHERS SHOULD SAY ABOUT YOUR PRESENTATION WHEN YOU HAVE FINISHED



## YOUR TASK



"Dynamic!"

"Everyone played an equal part!"

"Highly entertaining!"

"Captured the teenage imagination!"

**Present a 7 minute presentation to the class, teaching them**

THE LEARNER OBJECTIVES ARE:

- a) to understand how a camera captures images
- b) to revise the properties of light
- c) to have an understanding of concave and convex lenses
- d) to know how to make a pinhole camera
- e) to know a little about the history of cameras
- f) to be given a brief homework exercise to consolidate what is learned

## HOW A CAMERA WORKS.

**You must include something to appeal to *visual* learners, something to appeal to *auditory* learners, and something for the *kinesthetic* learners in the class. Your presentation must aim to reach the standards mentioned above in the speech bubbles.**

**You have this lesson and the next to research, prepare and practise your presentation.**

### Research

- a) history of cameras
- b) how a camera works

### Revise

- a) light waves
- b) reflection, refraction, absorption

### Research

- a) how to make a pinhole camera
- b) materials needed

### Devise

- a) a way to present the information in an interesting way

### Research

- a) lenses – concave and convex
- b) uses of lenses in real life

### Make

- a) a pinhole camera
- b) posters, overheads, models

# TASK CARD 18b

1. Names of group members

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2. Where are you most likely to find the information you need to research?

- a) text book b) teacher c) magazines d) library  
e) encyclopedia f) internet g) other

3. Which search terms do you need to use to find the information you need?

4. Who is responsible for researching what?

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5. What materials do you think you are going to need to build, to make, to present and to give to the class?

6. Where are you going to get those materials?

# TASK CARD 18c

7. How can you make sure your presentation appeals to:

a) visual learners?

b) auditory learners

c) kinesthetic learners

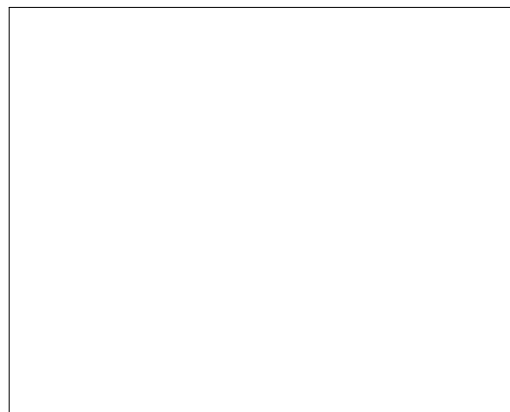
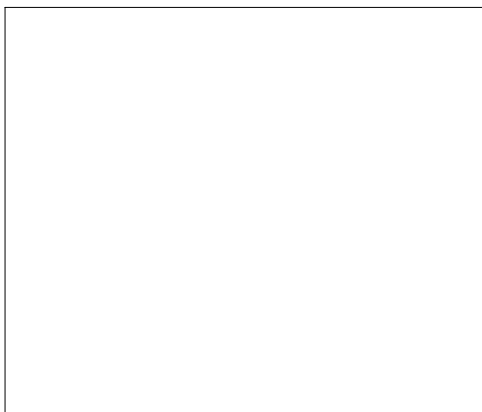


8. Think of 10 dynamic ways that you could make your presentation the best presentation given by any group – ever?

9. What is the best way to

a) Start your presentation

b) End your presentation?



10. How are you going to keep in contact to ensure everyone knows what to do and is prepared for the day?

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# TASK CARD 19a

"Dynamic!"

"Everyone played an equal part!"

"Highly entertaining!"

"Captured the teenage imagination!"

"Very interesting!"

"Clever use of humour!"

"Scientifically spot-on!"

"Very stimulating and refreshing!"

"Easy to remember!"

THIS IS WHAT OTHERS SHOULD SAY ABOUT YOUR PRESENTATION WHEN YOU HAVE FINISHED



## YOUR TASK

**Present a 7 minute presentation to the class, teaching them**

THE LEARNER OBJECTIVES ARE:

- a) to learn a way to remember the colours of the rainbow
- b) to know how rainbows are made
- c) to know what prisms are and how they are used
- d) to revise the properties of waves
- d) to learn 2 experiments to try with prisms
- e) to know how 3 basic colours are used to create all the others in television sets

## FASCINATION FACTS ABOUT PRISMS AND COLOUR

**You must include something to appeal to *visual* learners, something to appeal to *auditory* learners, and something for the *kinesthetic* learners in the class. Your presentation must aim to reach the standards mentioned above in the speech bubbles.**

**You have this lesson and the next to research, prepare and practise your presentation.**

### Research

- a) White / visible light
- b) The colour spectrum

### Revise

- a) Light and sound waves
- b) How light travels through different media

### Research

- a) History of prisms
- b) uses of prisms

### Devise

2 experiments or investigations involving prisms

### Research

- a) Investigations with prisms
- b) how 3 colours are used in tv sets

### Research

What makes rainbows? How can we make our own?

# TASK CARD 19b

1. Names of group members

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2. Where are you most likely to find the information you need to research?

- a) text book b) teacher c) magazines d) library  
e) encyclopedia f) internet g) other

3. Which search terms do you need to use to find the information you need?

4. Who is responsible for researching what?

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5. What materials do you think you are going to need to build, to make, to present and to give to the class?

6. Where are you going to get those materials?

# TASK CARD 19c

7. How can you make sure your presentation appeals to:

a) visual learners?

b) auditory learners

c) kinesthetic learners

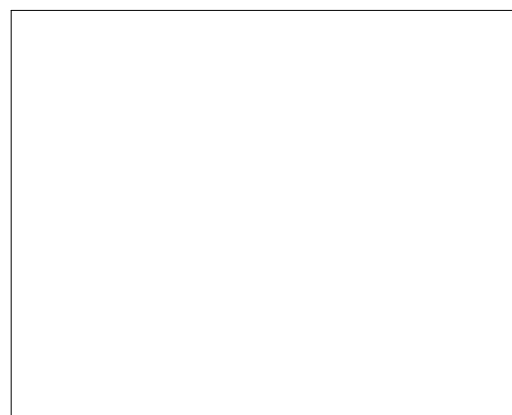
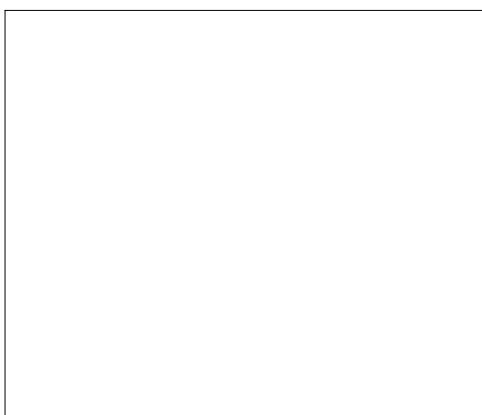


8. Think of 10 dynamic ways that you could make your presentation the best presentation given by any group – ever!

9. What is the best way to

a) Start your presentation

b) End your presentation?



10. How are you going to keep in contact to ensure everyone knows what to do and is prepared for the day?

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# TASK CARD 20a

"Very interesting!"

"Clever use of humour!"

"Scientifically spot-on!"

"Very stimulating and refreshing!"

"Easy to remember!"

THIS IS WHAT OTHERS SHOULD SAY ABOUT YOUR PRESENTATION WHEN YOU HAVE FINISHED



"Dynamic!"

"Everyone played an equal part!"

"Highly entertaining!"

"Captured the teenage imagination!"

## YOUR TASK

**Present a 7 minute presentation to the class, teaching them**

THE LEARNER OBJECTIVES ARE:

- a) to know how the human eye sees
- b) to recognise and be able to name the parts and functions of the human eye
- c) to have a basic understanding of mirrors
- d) to know how to make a simple periscope
- e) to revise reflection and refraction
- g) to have notes that they could use to study for the exams

## The Eye, Mirrors and a Periscope

**You must include something to appeal to *visual* learners, something to appeal to *auditory* learners, and something for the *kinesthetic* learners in the class. Your presentation must aim to reach the standards mentioned above in the speech bubbles.**

**You have this lesson and the next to research, prepare and practise your presentation.**

### Research

The parts of the human eye

### Revise

Reflection, refraction, diffusion

### Research

a) different kinds of mirrors

### Devise

A study / revision page

### Research

How we see

### Make

A simple periscope

# TASK CARD 20b

1. Names of group members

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2. Where are you most likely to find the information you need to research?

- a) text book   b) teacher   c) magazines   d) library  
e) encyclopedia   f) internet   g) other

3. Which search terms do you need to use to find the information you need?

4. Who is responsible for researching what?

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5. What materials do you think you are going to need to build, to make, to present and to give to the class?

6. Where are you going to get those materials?


# TASK CARD 20c

7. How can you make sure your presentation appeals to:

a) visual learners?

b) auditory learners

c) kinesthetic learners

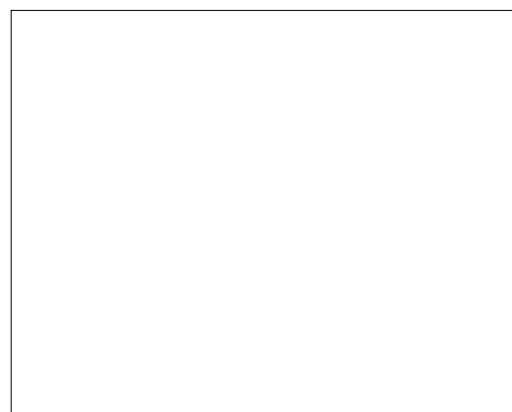
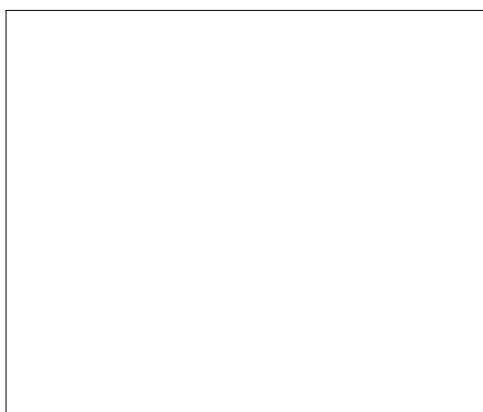


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9. What is the best way to

a) Start your presentation

b) End your presentation?



10. How are you going to keep in contact to ensure everyone knows what to do and is prepared for the day?

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# WAVES/SOUND/LIGHT: LESSON NINE: PRACTISING ...

## MOTIVATE

CHALLENGE	To be able to work as a group to conduct research and work as a team to present a demonstration to the class
CONTEXT	Remind groups of their contracts to each other. Reinforce the importance of a time frame and careful time management.
REASON	Being able to teach others is a sure fire way of demonstrating that you know the work yourself. Instead of a written test at the end of this unit, each group will give a presentation, and each will receive marks from the rest of the class. All the marks are then added and the total is the average.
STARTING POINT	Check on progress of groups. Brainstorm solutions to problems that may have arisen. Remind the class of the standard they are chasing. Groups may share resources but may not collaborate to present together.

(TAKE A HALF-MINUTE STRETCHING BREAK)

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
TEACHER TIME Reinforce the elements of a good presentation	<ul style="list-style-type: none"> <li>- eye contact</li> <li>- volume</li> <li>- enthusiasm</li> <li>- clarity</li> <li>- content</li> <li>- participation</li> <li>- scientific knowledge</li> </ul>			

(TAKE A HALF-MINUTE STRETCHING BREAK)

## DEMONSTRATE

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
all	Groups prepare and practise and rehearse for the presentation in the next lesson	To be determined by students and teacher on the day

**Plenary #1** – Ask ss which materials/resources they think they are unable to provide on their own. Brainstorm possible alternatives

**Plenary #2** – Homework = to prepare for the next lesson + the presentation

# WAVES/SOUND/LIGHT: LESSON TEN: PRESENTING ...

## MOTIVATE

CHALLENGE	To be able to work as a group to conduct research and work as a team to present a demonstration to the class
CONTEXT	Remind groups of their contracts to each other. Reinforce the elements of a good presentation
REASON	Being able to teach others is a sure fire way of demonstrating that you know the work yourself. Instead of a written test at the end of this unit, each group will give a presentation, and each will receive marks from the rest of the class. All the marks are then added and the total is the average.
STARTING POINT	Discuss the star rating system used to rate movies and some theatre shows. Ask what criteria they would use to award a film 5 stars. Explain that before the presentations take place, each group will spend 5 minutes deciding on the criteria for a star-rating system they could use to evaluate the other groups.

(TAKE A HALF-MINUTE STRETCHING BREAK)

## ACTIVATE

INPUT	TEACHING FOCUS	VISUAL	AUDITORY	KINESTHETIC
TEACHER TIME Establishing criteria for evaluation	Draw 1 - 5 ***** on board. Next to each provide 2 spaces In each space write a criterion needed in order to be awarded that star rating	* = a) b) ** = a) b) *** = a) b) **** = a) b) ***** = a) b)		

(TAKE A HALF-MINUTE STRETCHING BREAK)

## DEMONSTRATE

INTELLIGENCE ACCESSED	GROUP ACTIVITIES	RESOURCES
all	Groups present their presentations to the class. After each presentation, the other groups discuss and agree on the rating At the end, all the ratings are added, and divided to get an average That is the rating for a group's presentation Feedback should be given in the form of: A) WHAT WAS GOOD ABOUT IT? B) HOW IT COULD BE MADE EVEN BETTER? C) RATING + uplifting comment	To be determined by students and teacher on the day

**Plenary #1** – SS provide feedback

**Plenary #2** – Homework = to make a mindmap about light

## ACKNOWLEDGEMENTS

Many thanks to the science staff at Sandown High for providing the opportunity to develop this unit.

Also, huge gratitude to the many science teachers who provided suggestions in various forms, but particular thanks to:

Simon Winter, Irene Plunkett, Robert Thorpe, Arnold Lorrie, Elaine Dingshoff, Denise Columbus, Jan Ray, Lez Jay

Author's Note:

***Because this began as a proposal, and because the lessons have yet to be tried, it is not recommended that the unit be adopted by NQTS or teachers who have never taught this unit before.***