

## Scheme of work – Light and sound

### Prior learning

#### KS2

*unit 1D – Light and dark*

Key words / ideas linked to light and dark, seeing, the eye and idea of a source

*Unit 3F – Light and shadow*

Key words – idea of blocking light and introduce idea of transparent / opaque. Telling time using shadow

*Unit 6f – how we see things*

Key words / ideas – how light illuminates things and the key idea by investigation of reflection –

mirrors look at the shadow cast by an object and what effects its size

*Unit 1F – Sound and hearing*

Key words / ideas linked to hearing – loud and quite linked to distance and the idea of the ear as a detector. Need also to identify noises made by instruments and how

*Unit 5F – changing sounds*

Key words / ideas – how sound is made and how it travels linking to vibrations. Rudimentary ideas surrounding pitch and instruments

### BIG PICTURE

**Ideas in science often need models to explain them and that many ideas are transferable between what appear vastly different applications**

### Stickability

1. That sound and light are examples of waves.
2. Waves transfer energy from one place to another
3. Many properties of sound and light are identical
4. The differences between sound and light

### Learning gains

1. Attributes and skill of a learner in science
  - a. Reasoning – utilise models and evidence to construct observations of difficult ideas
  - b. Resourceful – utilise a range of resources as sources of information to piece together information
  - c. Reflective – monitor progress through out by careful transfer of ideas between sound and light to formulate an idea about what wave are
2. Subject and procedural skills
  - a. Use of models to explain what we can't necessarily see
  - b. Careful comparison of key concepts to find patterns or similarities
  - c. Careful comparison of key concepts to find patterns or similarities

- d. Collection of reliable evidence – careful practical work and working in teams to solve problems
- 3. Knowledge and understanding
  - a. Pre-structural – what light and sound are from KS2
  - b. Uni-structural – how sound and light can be manipulated to change – for example filters.
  - c. Multi-structural – identify vibration in sound as essential and what pitch and amplitude variations are possible. For light this is linked to describing light journeys using key vocabulary
  - d. Relational- in both cases this requires collection of relevant evidence to find generalisations and links between individual case to explain what is happening (eg in general what do we do to make a high pitched noise and with light establish relationships for reflection etc)
  - e. Extended abstract – here utilisation of the particle model to identify the role of particles in the transfer of energy and the need for a medium for sound to be transferred through – this is extended to explain the action of the ear and why different materials alter the speed of sound. The concept here is to be able to link the similarities between sound and light to be able to conclude light is significantly different but has many of the same properties

## Flow

5 lesson plus a mini PBL on instruments – Science Buzzcocks

### Lesson 1 Wave basics

1. Activate – Stand and share as many things as possible about light and sound (assess PL)
  2. Connect – Think – Pair – Share ‘what is a wave and where have you seen them?’
  3. Demonstrate – Teacher input key concepts frequency, amplitude and characteristic wavelength
  4. Consolidate – wave journeys – key vocabulary (pupils construct journey to explain sound and light)
- Success criteria
    - Draw and label waves diagrams
    - Explain what happens to sound and light as properties of vibrations change

### Lesson 2 Sound and energy transfer

1. Activate – show sand dancing on speaker and tuning forks splashing water – explain
  2. Connect – Particle model simple recap – find a fiction
  3. Demonstrate – use particle pictures to explain speed of sound and energy transfer in solids and liquids and gases. Identify proof for need of a medium – bell jar and vacuum pump.
  4. Consolidate I – difference between light and sound (bell still seen but sound not even though still vibrating)
  5. Consolidate II– use ideas to explain how ear works
- Success criteria
    - explain how sound travels at different speeds in different types of material

- explain everyday phenomena in terms of the different speeds at which sound travels in air and solids
- identify the parts of the ear on a diagram or model
- describe, *eg by annotating a diagram*, how vibrations in the air are transmitted and translated into electrical signals, which pass to the brain

### **Lesson 3      Reflections – a key property of waves**

1. Activate – Assess PL – how does a tree cast a shadow – numbered heads together
  2. Connect – use of reflection idea to see non luminous objects
  3. Demonstrate – practical to study mirrors (assess PL) establish a key rule and apply to explain how a periscope works
  4. Consolidate – explain how sound does the same – sonar, bats or ultra sound
- Success criteria
    - You can explain how we see objects using key vocabulary
    - You can draw and label ray diagrams
    - You can collect and summarise experimental data to make a conclusion about the behaviour of light at a mirror
    - You can apply what you have learned from a mirror to explain periscopes and how sonar works

### **Lesson 4      Refraction – an investigation and good science**

1. Activate – demonstrate some of the effects of refraction
  2. Connect – speed of light and effect of materials
  3. Demonstrate – make prediction of what happens to light – then given equipment establish a consistent test to see what happens
  4. Consolidate I – establish key rules
  5. Consolidate II – demonstrate dispersion – use ideas to explain rainbow
- Success criteria
    - Collect reliable experimental evidence
    - Utilising the evidence you have collected be able to propose a conclusion about what happens when light travels from one medium to another
    - Observe and record what happens to white light in a prism and use your conclusion to try and explain what you observe

### **Lesson 5      Light and colour**

1. Activate – what colour is black in light (assess PL – shadow ideas and opaque etc)
  2. Connect – recap ROYGBIV from prior lesson and that it makes white light
  3. Demonstrate – link intensity and colour to frequency and amplitude – recap of lesson 1 and develop this to explain reflection using colour – recap of lesson 3 – developing learner ability to piece together ideas. Connect to colour blindness. Collect data on how filters work.
  4. Consolidate - optical illusion of complimentary colours
- Success criteria
    - Collect reliable experimental evidence
    - Utilising the evidence you have collected be able to explain how coloured filters work

- Observe and record what happens when we view coloured objects in coloured light and explain why.

### **Mini PBL – Science Buzzcocks**

Introduce idea and set challenge to produce a 'band' with different instruments. Challenge is create a performance of a song using instruments and explain how each instrument can produce more than one note – stretch implicit here with depth of understanding challenged

#### *Rationale*

- Engagement
- Consolidate learning – identification of role key ideas play in changing a note – Multi-structural and relational learners by definition
- Develop responsible and resourceful learners
- Self and peer assessment

#### **Assessment**

*Summative assessment* – placed in Science plan for consistent and consolidated learning within year

#### *Formative assessment*

1. Mini project learning journal and performance
2. How sound and light are the same and different