34 Sound&Music

EQUIPMENT

Demonstration loud speaker.
Old loudspeakers to pass round.
Signal generator
Amplifier
Small ball - polystyrene or paper
Frequency meter or Picoscope set as a spectrum analyser.
Microphone.
Sound level meter (+ web cam to display on projector)
Slinky spring
Tin can telephone
http://www.ikes.16mb.com/STEM/Tin_can_telephone.pdf
Length of rope or a skipping rope.
Melde's apparatus.
(http://www.ikes.16mb.com/physproj/Melde.pdf)
Plastic cup and rubber band/string guitar.
(http://www.ikes.16mb.com/physproj/rubber_band_guitar.pdf)
Model electric guitar.
http://www.ikes.16mb.com/physproj/sonometer.pdf
Theremin

RISKS

Students can make a significant (110 - 120dB) when asked!
Trip hazards from trailing wires.

SESSIONS

Not all of the following is covered each time. Topics are selected/omitted to match the group and time available

1). Discussion of what is STEM and the need for more people to work in STEM.
2). Students feel their throats as they make a noise - feel vibrations.
3). Students examine loudspeakers and consider a small ball bouncing around on a loudspeaker cone vibrating at a low frequency.
4). Introduce the word 'frequency' as the number of vibrations per second (Hz)
5). Students investigate the range of frequencies that they can hear.
Students consider the hearing range of other animals.
6). Students investigate a microphone connected to an oscilloscope (Picoscope)
Students consider how frequency and loudness affect the shape of the display.
Using the signal generator, students consider how the shape of the display affects the sound produced. (Sine, triangle and square waves).
7). Students consider loudness of sound with a dB meter.
They investigate how quiet they can be (30 - 35dB) and how loud they can be (110 - 120dB!)
Emphasise that the more sound we hear the deafer we become.

8). Students consider how sound travels.
(Pushes and pulls of the air by a loudspeaker)
Students demonstrate longitudinal travelling wave on Slinky spring.
Students note reflected waves.
Emphasise sound needs something to travel through.
Students test tin can telephone.
"In space, No one can hear you scream! (Alien)"

9). Students investigate stationary transverse waves on a slinky spring.
Students note that stationary waves only occur at certain frequencies.
Students investigate forming stationary waves with a rope (Skipping rope)

10). Set up Melde's experiment, students adjust to give stationary waves.
Name Nodes and Antinodes
Students investigate how string length and tension affect the stationary wave frequency.

11). Students investigate plastic cup and rubber band/string guitar.
Students note that the plastic cup amplifies the sound from the rubber band/string.
Relate to acoustic guitar and violin - their hollow bodies amplify the sound of the vibrating strings.

12). Students consider an electric guitar - solid wooden body. Need an amplifier.
Students investigate a one stringed electric guitar and note how an ordinary wire vibrating in a magnetic field produces a small voltage across the wire.
Students investigate effect of tension of wire and length of wire on pitch.

With discussions of electric guitars, students often think that they were the first electronic musical instrument and pretend to play 'air guitar'.

13). Introduce the Theremin as the first type of electronic musical instrument
and its similarities to air guitar - i.e. it is played without actually touching the instrument!
Students investigate the pitch and volume aerials and try to play a tune.
Play a video of someone playing a Theremin
e.g. Midsomer Murders theme played by Celia Sheen
https://www.youtube.com/watch?v=YTZK9FNgK74