Chapter 12 Teaching notes – section C

Notes

Pupils can list the sources of sound that they hear every day. Apart from parents and teachers, many of the sound sources will originate from a loudspeaker. Show the movement of a loudspeaker cone when it is connected to a signal generator at a frequency of around 1 Hz. As the frequency is increased, pupils notice that the observed movement of the loudspeaker cone becomes blurred and eventually no vibrations can be seen. However, if pupils touch a finger gently on the paper cone, the vibrations can still be felt.

Using instruments 'borrowed' from music, show that in each case the sound is caused by something vibrating. In the case of wind instruments, the 'something' is the column of air that vibrates inside the instrument.

The traditional bell-in-bell jar demonstration shows that sound travels through solid materials as well as through air, but as the air is removed from the jar the volume of the sound decreases.

Pupils should then experiment to find the relationship between the length of the vibrating air column and the pitch of the note produced (Additional Worksheet 12LSW2 Making sounds). A similar experiment for stringed instruments can be done with rubber bands stretched between pairs of nails placed at different separations on a wooden board.

Using a signal generator, oscilloscope, and loudspeaker, show how changing the amplitude of the sound wave affects the loudness. Care needs to be taken when using the same equipment to show that pitch depends on frequency. One common error is to relate the distance occupied by a complete wave cycle on the oscilloscope screen to the wavelength. This is wrong as this distance represents a time and not a distance. Note also that perceived loudness depends on the frequency as well as the amplitude, since the ear is more sensitive to some frequencies than to others. Varying the frequency over only a narrow range when demonstrating the relationship between frequency and pitch avoids this problem.

Finally in this section, pupils learn about how vibrations are transmitted through the ear, about different ear sensitivities, and how excessive exposure to loud sounds can cause ear damage. You can show the range of frequencies that can be detected by different ears by gradually increasing the frequency of a signal generator connected to a loudspeaker. Ask pupils to signal the frequency at which they first hear the sound and the frequency at which they no longer hear the sound. Although it demonstrates the point, it should be noted that a typical loudspeaker will have stopped reproducing sound at a much lower frequency than those at which pupils claim still to be able to hear it.

Key words:

amplitude	loudness
cochlea	ossicles
ear drum	pitch
frequency	sound wave
hertz	vibration