

114 Look at the table below.

Temperature of water (°C)	Speed of sound in water (m/s)
10	1480
15	1500
20	1520
25	1200
30	1580
35	1620
40	1640

- a** Write the line of inquiry for this investigation.
- b** Are there any anomalies in the table?
- c** What is the trend from the table?

P5.3 Microphones and ultrasound

How do microphones work?

- 115** What is a diaphragm?
- 116** How does a microphone work?
- 117** In what ways is a microphone similar to an ear?
- 118** How are the direction of the oscillation and direction of the wave related in a longitudinal wave?
- 119** What do waves *not* transfer from one place to another?
- 120** Sound does not travel at the same speed in every medium.
 - a** What is a medium?
 - b** In which state (solid, liquid or gas) does sound travel fastest?
 - c** Explain your answer to part b.
- 121** A diaphragm is made of elastic material.
 - a** What does *elastic* mean?
 - b** What is the name of the force when there is stretched elastic material?
 - c** What happens to the force from part b as the material is stretched more and more?
 - d** What are the units we use to measure force?
- 122** What will happen to a microphone if it detects a sound that is getting louder?
- 123** The diaphragm in a microphone starts to vibrate less frequently. What does this mean about the note that it is detecting?

How do speakers work?

- 124** How does a speaker work?
- 125** What is the definition of the frequency of a wave?
- 126** What are the units we use to measure frequency?
- 127** The diaphragm in a speaker oscillates to produce a sound.
- a** It oscillates 100 times a second. What is the frequency?
 - b** It oscillates 2000 times a second. What is the frequency?
 - c** It oscillates 12 000 times in four seconds. What is the frequency?
- 128** A speaker's diaphragm oscillates four times a second. Why can nobody hear it?
- 129** Explain what happens inside a speaker to produce a louder sound when we increase the volume of the music playing through it.
- 130** A musician plays a sound in a large stadium from a speaker at the front. They stand at the back of the stadium, 99 m away. The sound takes 0.3 s to travel to their ears.
- a** Calculate how fast the sound is travelling.
 - b** Would the sound travel faster or slower if the stadium was entirely underwater?
 - c** Explain your answer to part b.

What is ultrasound?

- 131** What is ultrasound?
- 132** The diaphragm in a speaker oscillates to produce a sound.
- a** It oscillates 15 000 times a second to produce sound A. What is the frequency?
 - b** It oscillates 23 000 times a second to produce sound B. What is the frequency?
 - c** It oscillates 18 000 times a second to produce sound C. What is the frequency?
 - d** It oscillates 50 000 times a second to produce sound D. What is the frequency?
 - e** Which sounds can humans hear?
- 133** Name three animals that can hear ultrasound.
- 134** How is ultrasound similar to 'normal' sound?
- 135** How is ultrasound different to 'normal' sound?
- 136** A dog whistle emits sound that most humans cannot hear, but dogs can. What does this mean about the sound?

- 137** What is oscillating in a sound wave when:
- a** it travels through a piece of metal
 - b** it travels through a swimming pool
 - c** it travels from the speaker in my room to my ear?

What else do we use ultrasound for?

- 138** How can we use ultrasound to find the distance to an object?
- 139** A fishing boat has ultrasound equipment on it. What happens to the ultrasound waves when they hit a shoal of fish?
- 140** In water, ultrasound travels at 1500 m/s. It takes 1 s for the waves to travel from A to B and back.
- a** How far has the ultrasound wave travelled?
 - b** The distance from A to B is only 750 m. Why is this?
- 141** Some animals use echolocation to find prey or obstacles. How does this work?
- 142** What is the definition of *pressure*?
- 143** When in a sound wave is the pressure highest: at a compression or a rarefaction?
- 144** Why are sound waves sometimes called pressure waves?
- 145** How can ultrasound waves be used to clean?
- 146** Why can we not hear ultrasound?
- 147** Measure the amplitude and wavelength of each of the waves below.

Tip

These questions also cover 'How do we use ultrasound?'

