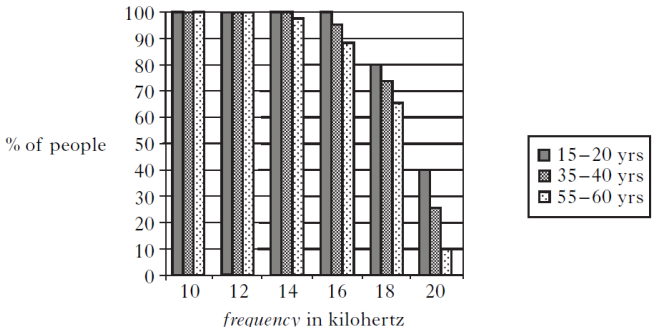
Sound Waves Ex1

1. (a) A drummer in a rock band is exposed to sound levels of up to 110 decibels. Explain why ear protectors are used to reduce the sound level experienced by the drummer.

b) A medical researcher is measuring the upper range of hearing of people in different age groups. The bar graph shows the frequencies of sound detected by these people.



(i) State **two** conclusions which can be made from this bar graph about the hearing of different age groups.

(ii) What name is given to sound frequencies greater than 20 kilohertz?

2. An orchestra uses many different musical instruments.

The table lists the lowest and highest sound frequencies for some of these Instruments

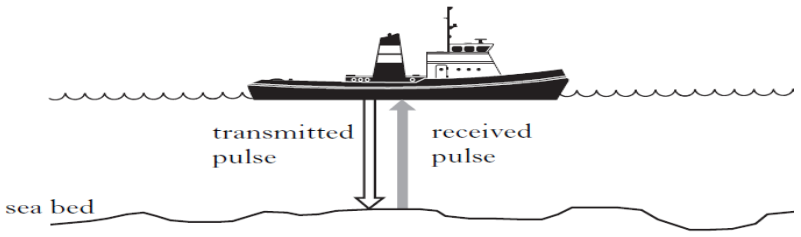
Musical Instrument	*Lowest Frequency* (hertz)	*Highest Frequency* (hertz)
Acoustic Guitar	73	1174
Piano	28	4186
Flute	261	2637
Trumpet	165	1046
Violin	196	3520
Cello	65	660
Piccolo	523	4000

(a) (i) Which instrument in the table produces the longest wavelength?

(ii) Calculate the wavelength for the lowest frequency of a piccolo.
(The speed of sound in air is 340 metres per second.)

(b) During one concert performance the sound level was measured.
State the unit of sound level measurement.

3. A ship is carrying out a survey of the sea bed using ultrasound waves.
When stationary, the ship transmits and receives pulses of ultrasound waves.
The transmitted ultrasound waves have a frequency of 30 kHz.



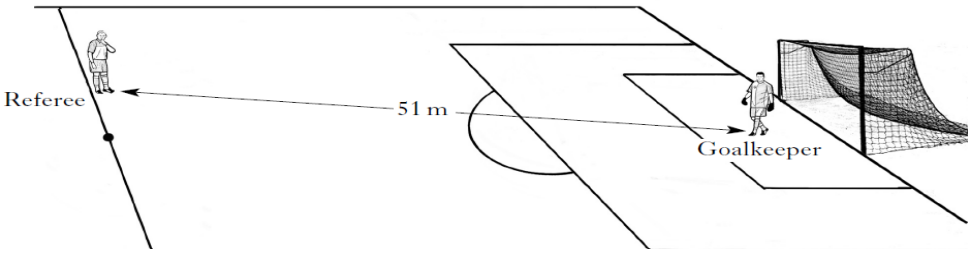
(a) What is meant by ultrasound?

(b) What is the speed of ultrasound waves in water?

(c) One pulse of ultrasound is received back at the ship 0.36 s after being transmitted.
Calculate the depth of the sea bed?

Sound Waves Ex2

1. At the kick-off in a football match, during the World Cup Finals, the referee blows his whistle. The whistle produces sound waves.



(*a*) Using information from the diagram and the data sheet, calculate the time taken for the sound waves to reach the goalkeeper.

(*b*) (i) Are sound waves transverse or longitudinal waves?
(ii) Describe **two** differences between transverse and longitudinal waves.
(iii) What is transferred by waves?

2. A student uses a sound level meter to measure some sound levels. The student records the results in the table.

Source of sound	*Sound level* (decibels)
school bell at 1 metre	100
inside a classroom	60
normal conversation	50
whisper	20

(*a*)

i. Humans can only hear sounds above a certain sound level. What is the value of this sound level in decibels?

ii. When one source of sound is twice as loud as another, the sound level increases by 10 decibels. Which one of the **above sources** is twice as loud as the level of a normal conversation?

b) The student measures the sound levels from earphones connected to an MP3 player.

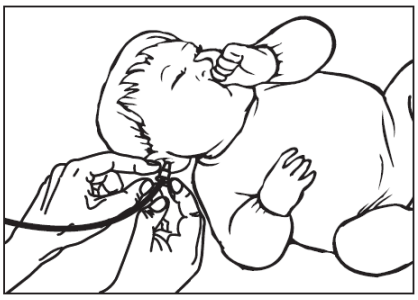
Sound levels up to 102 decibels are measured. Explain why the student should reduce the sound level to below 80 decibels before wearing the earphones.

(*c*) The student now measures the range of sound frequencies that humans can hear.

(i) What name is given to high frequency sounds beyond the range of human hearing?

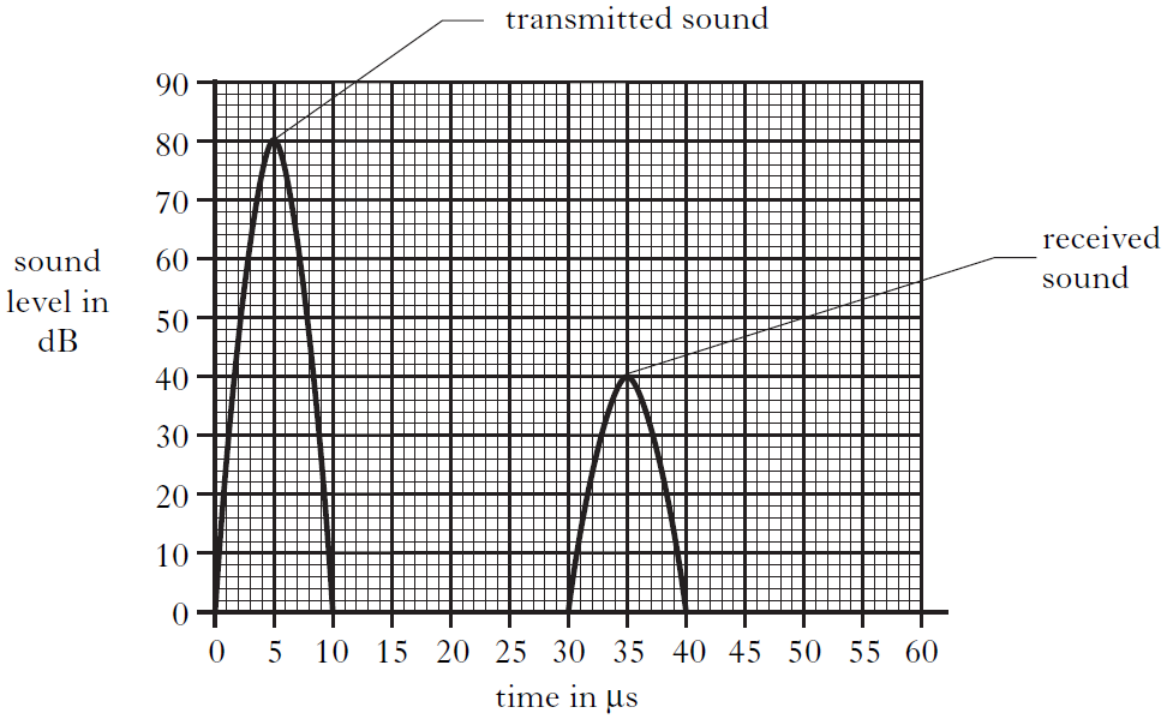
(ii) Give **one** example of a use of these high frequency sounds in medicine.

3. A newborn baby is given a hearing test. A small device, containing a loudspeaker and a microphone, is placed in the baby's ear.



(a) A pulse of audible sound lasting 10s is transmitted through the loudspeaker. The sound is played at a level of 80dB. Give a reason why this pulse of sound does not cause damage to the baby's hearing.

(b) The transmitted pulse of sound makes the inner ear vibrate to produce a new sound, which is received by the microphone. Signals from the transmitted and received sounds are viewed on an oscilloscope screen, as shown below.



i. The average speed of sound inside the ear is 1500 m/s. Calculate the distance between the device and the inner ear.

ii. Suggest a frequency that could be used for the hearing test.

iii. An ultrasound scan can be used to produce an image of an unborn baby. Explain how the image of an unborn baby is formed by ultrasound.