

EXERCISES ON SOUND WAVES AND ULTRASOUND

BY

M.A. TOLENTINO

Tolentino Tuition, Year 10 Physics

28 July 2026

CONTENTS

3	EXERCISE 1
4	EXERCISE 2
5	EXERCISE 3
6	EXERCISE 4

EXERCISE 1

‘Sound’ is a type of movement of energy produced by vibrations that travel through a medium.

As sound is a movement of energy, we may model its behaviour using waves:

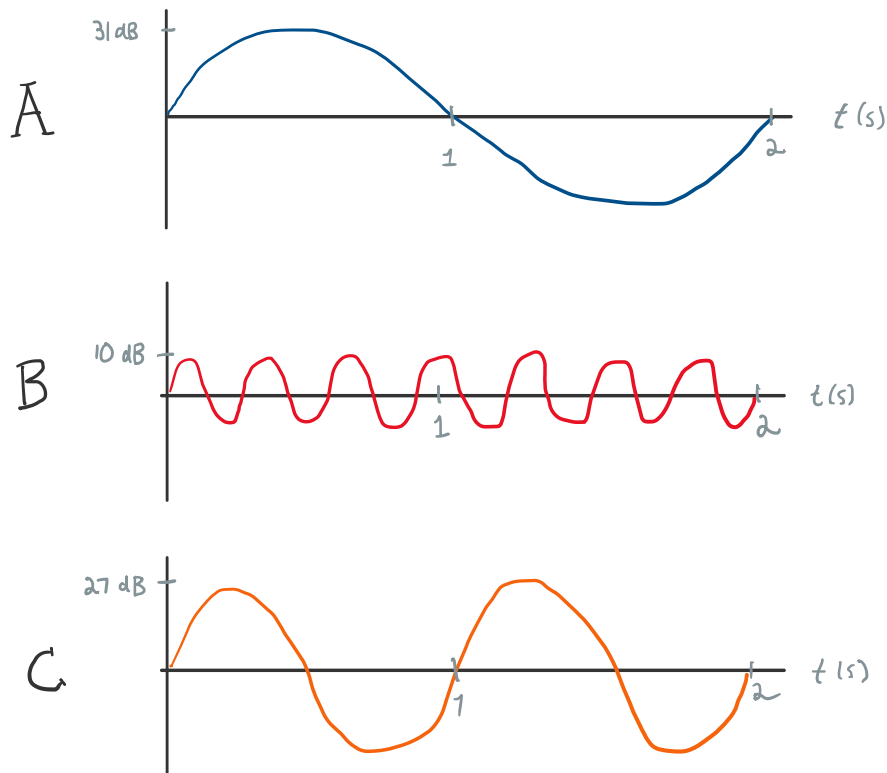


Figure 1

1. Why are sound waves classified as ‘mechanical waves’ rather than ‘electromagnetic waves’ – which we investigated last lesson?
2. Which sound wave in Figure 1 is
 - A. The loudest/quietest, and why?
 - B. Has the highest/lowest pitch, and why?
3. Please approximate the frequency of each sound wave in Figure 1.

EXERCISE 2

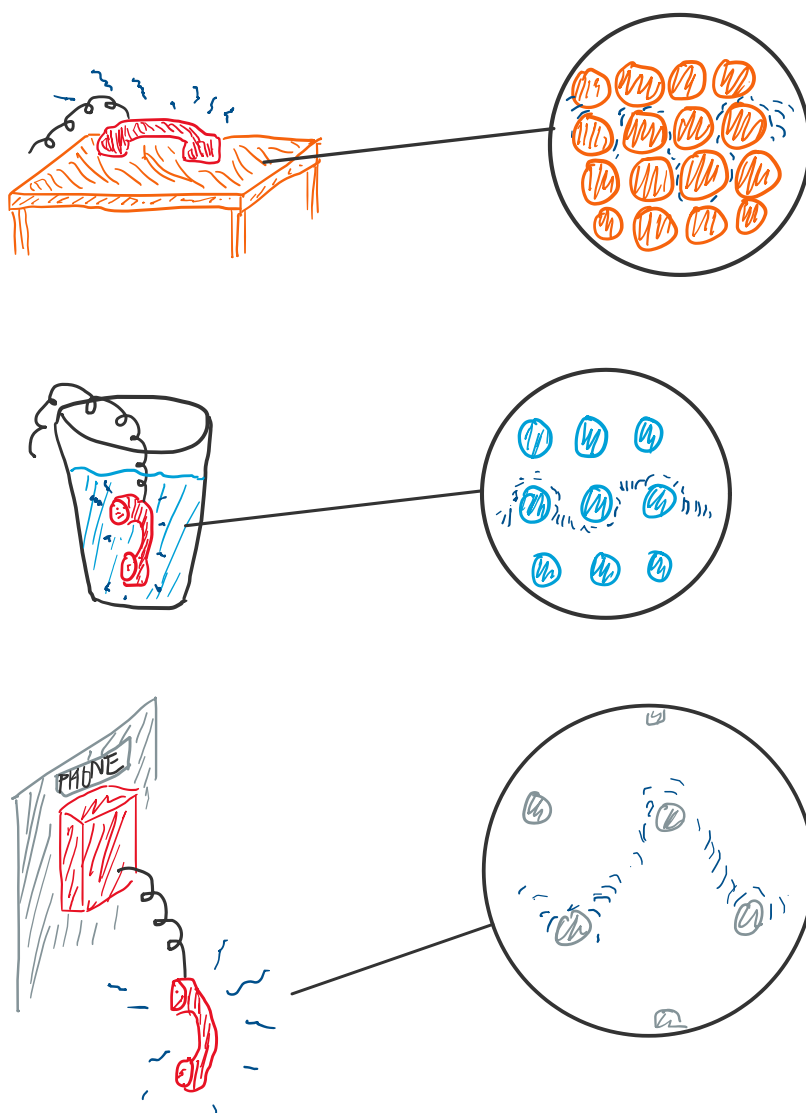


Figure 2

Please use the depictions in Figure 2 as an example to explain why the speed of sound differs in solids, liquids and gasses (4 marks).

EXERCISE 3

- I. What does SONAR, stand for?
 - A. What *is* SONAR?
 - B. What is SONAR's purpose?
 - C. Please outline the process of SONAR in *four* steps, utilising all terminology below:

'ultrasound' 'echo' 'detector' 'calculation' 'surface'

2. Jenny, who is 5 months pregnant, is undergoing a pregnancy check, which utilizes a transducer that emits an ultrasound to allow a specialist to examine Jenny's embryo (see Figure 3).

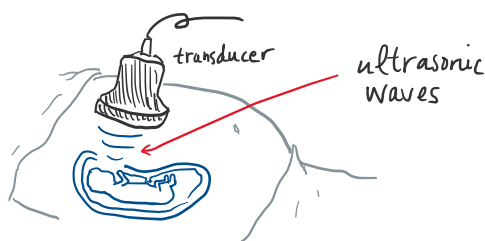


Figure 3

The average speed of sound through soft human tissue is approximately $1,540 \text{ ms}^{-2}$.

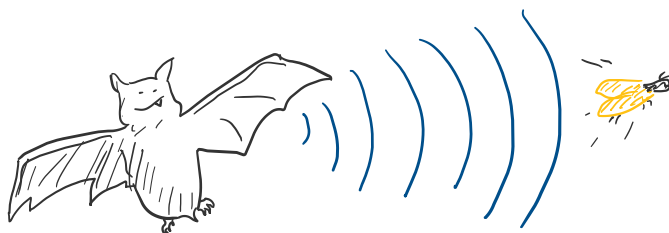
Table 1. Distance between mother's external belly surface and embryo across trimesters of a 9 month pregnancy

Trimester	Distance (cm)
1	4
2	10
3	13

Given Jenny's circumstances, how long will it take for the transducer to detect Jenny's embryo?

EXERCISE 4

A bat is hunting for bugs to eat in a cave:



- A. The bat lets out a high pitched ultrasound. After 2.12 seconds, the bat becomes aware of a cave cricket which is 305.1 metres away.

Please provide an estimate for the speed of sound in the cave.

- B. A caver is taking a nap on the floor of the cave.



The bat begins hovering 7.5 metres directly above the caver's water bottle, and the caver is sleeping 3.3 metres Southeast from his water bottle.

If the bat emits a second ultrasound, how long will it take for the bat to detect the sleeping caver?