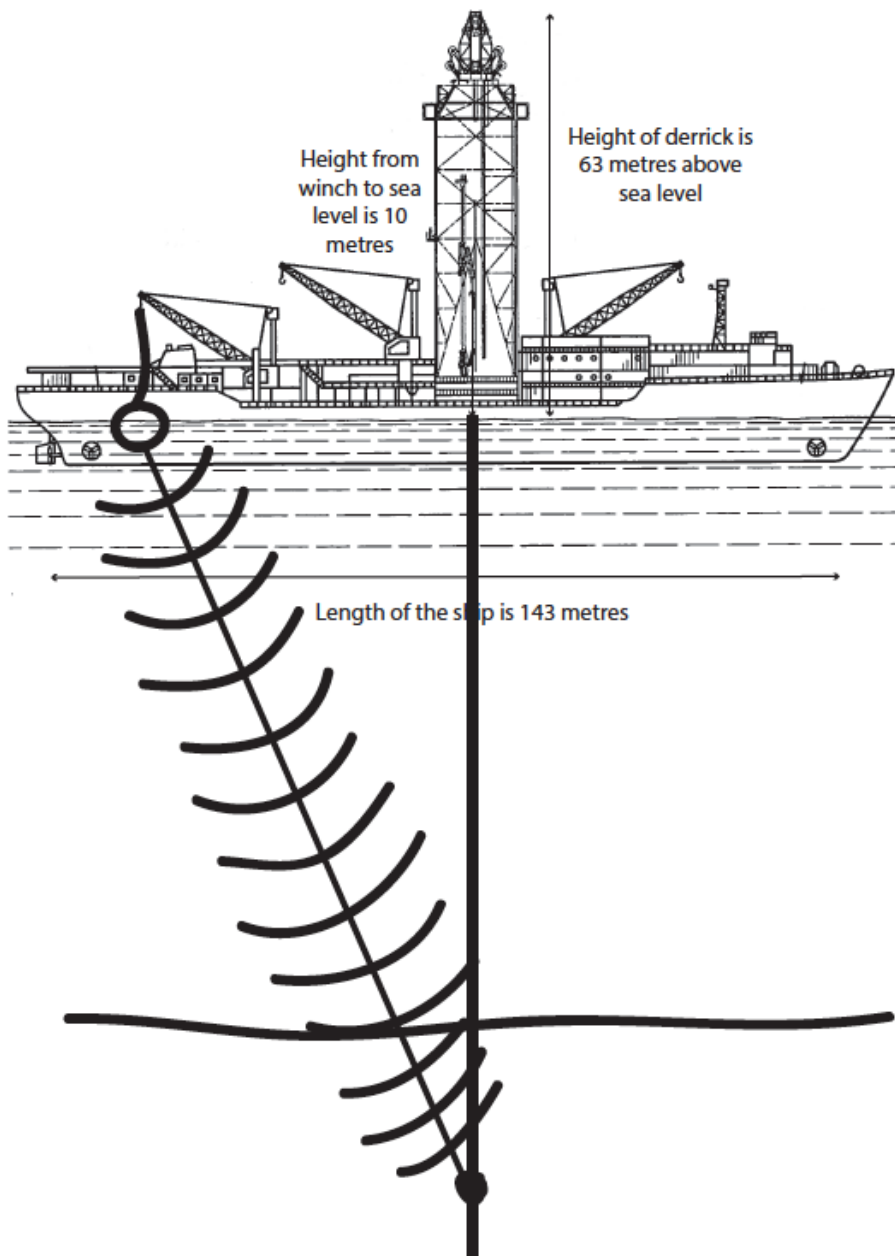


JOIDES Resolution downhole logging ANSWERS

This worksheet will help you practice your table and graphing skills by using real data from an Antarctic research vessel called the *JOIDES Resolution* (JR). These are the same calculations that scientists need to do.

The JR has a speaker in the water at sea level. It sends out sound waves to the hydrophones which are in the hole drilled below the sea floor. Complete this diagram showing where the sound waves travel:



You need to take the data measured on the JR and process it. This means you have to fill in the blank parts of the table below.

Here are 2 useful things to know first:

1. The wireline depth is the distance from the winch to the hydrophone sea and the depth below the sea floor.
2. The one-way time is the time it takes the sound to travel from sea level to the microphone. It's measured in milliseconds. There are 1000 milliseconds in a second.

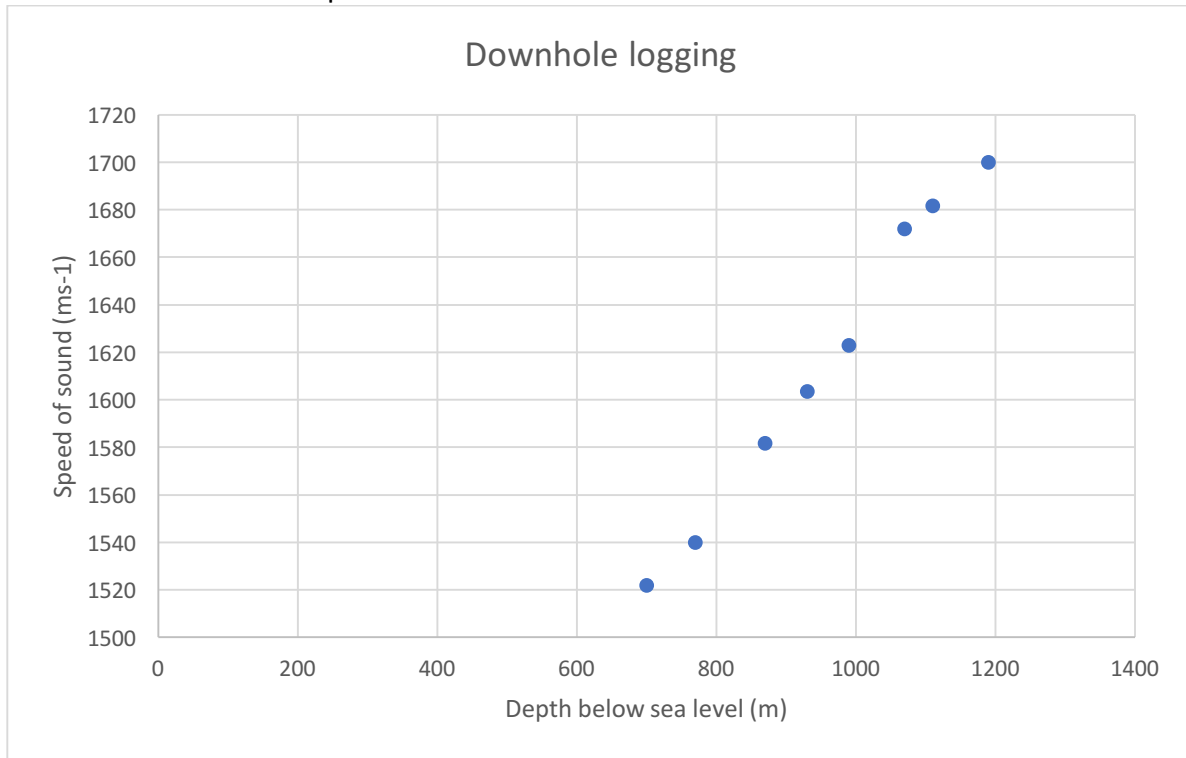
To complete the table, you need to:

1. Calculate the **depth below sea level** by taking the wireline depth and subtracting the distance from the winch to the sea and write it in the table for each depth.
2. Convert the one-way time from milliseconds into seconds using the formula $v = \frac{d}{t}$
3. Calculate the speed using the depth below sea level and the one-way time in seconds.

Wireline Depth (metres)	Depth below sea level (metres)	One-way time (milliseconds)	One-way time (seconds)	Speed (ms-1)
710	700	460	0.46	1522
780	770	500	0.50	1540
880	870	550	0.55	1582
940	930	580	0.58	1603
1000	990	610	0.61	1623
1080	1070	640	0.64	1672
1120	1110	660	0.66	1682
1200	1190	700	0.70	1700

Once you have filled in the table,

- Graph the depth below sea level compared to the speed. What happens to the speed of sound waves deeper under the sea floor?



As the sound waves travel deeper beneath the seafloor, the sound travels faster.

- What do you think causes the change in the speed of the sound waves beneath the seafloor? Hint: think about the density.

As the sediment is deeper under the surface of the sea, it is compacted more by the weight of the sediment above it. This compaction makes the sediment more dense. If something is more dense, sound travels through it more quickly. Therefore sound travels faster through the denser sediment deeper under the seafloor.