Question 2
Vibrations in the earth’s crust deep beneath the sea can cause a Tsunami. The frequency of a vibration was 60s\(^{-1}\). The amplitude of the pulse generated was 10m and the speed of the pulse was 300m\(\cdot\)s\(^{-1}\).

2.1 Determine the period of the pulse. 

2.2 Determine the wavelength of the pulse. 

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Questions for Discussion

Question 1:
A fly flaps its wings back and forth 200 times each second. Calculate the period of a wing flap.

Question 2:
Microwave ovens produce radiation with a frequency of 2 450 MHz (1 MHz = 10\(^6\) Hz) and a wavelength of 0,122 m. What is the wave speed of the radiation?

Question 3:
A wave travels along a string at a speed of 1, 5m \(\cdot\) s\(^{-1}\). If the frequency of the source of the wave is 7,5 Hz, calculate:

a) the wavelength of the wave
b) the period of the wave
LONGITUDINAL PULSES & WAVES

STUDY NOTES

Longitudinal waves: A longitudinal wave is a wave where the particles in the medium move parallel to the direction of propagation of the wave.

Compression: A compression is a region in a longitudinal wave where the particles are closest together.

Rarefaction: A rarefaction is a region in a longitudinal wave where the particles are furthest apart.

Wavelength: The wavelength in a longitudinal wave is the distance between two consecutive points that are in phase.

Amplitude: The amplitude is the maximum displacement from equilibrium. This would be maximum increase (or decrease) in pressure from the equilibrium pressure that is caused when a compression (or rarefaction) passes a point.

Calculations for Longitudinal Waves & Pulses
Use the same equations you used for calculations of transverse pulses and waves.

The motion of particles in a longitudinal wave can be represented by a graph that looks like a transverse wave. It is important to recognize the difference between a graph and a representation of a wave.

Example 1: 0 minutes
The graph below shows the distance particles of a longitudinal wave moves versus the distance the wave moves through the medium.
1.1 What is the amplitude of the wave? (1)
1.2 How long does it take a particle to complete one cycle? (2)
1.3 What is the speed of the particle? (3)
1.4 What is the frequency of the wave? (3)
1.5 What is the wavelength of the wave? (3)

Solution

1.1 4 mm ✓
1.2 In one complete cycle the particle moves from rest to max displacement past the rest position (zero deflection) to max displacement and back to rest.

From the graph the wave moves 8 m in the same time as the particles move through one cycle.

\[ v = \frac{D}{t} \]

\[ 10 = \frac{8}{t} \]

\[ t = \frac{8}{10} \]

\[ = 0,8 \text{ s} \]

1.3 Distance travelled by particle = 4 x Amplitude = 16 mm

\[ v = \frac{D}{t} \]

\[ = 16 \times 10^{-3} \div 0,8 \]

\[ = 0,02 \text{ s} \]

1.4 \[ f = \frac{1}{T} = 1/0,02 \checkmark = 50 \text{ Hz} \checkmark \]

1.5 \[ v = f\lambda \]

\[ 10 \checkmark = 50 \times \lambda \checkmark \]

\[ \lambda = 0,2 \text{ m} \checkmark \]