Unit One

Chapters 3 and 4

Emission, Propagation and Reception of sound

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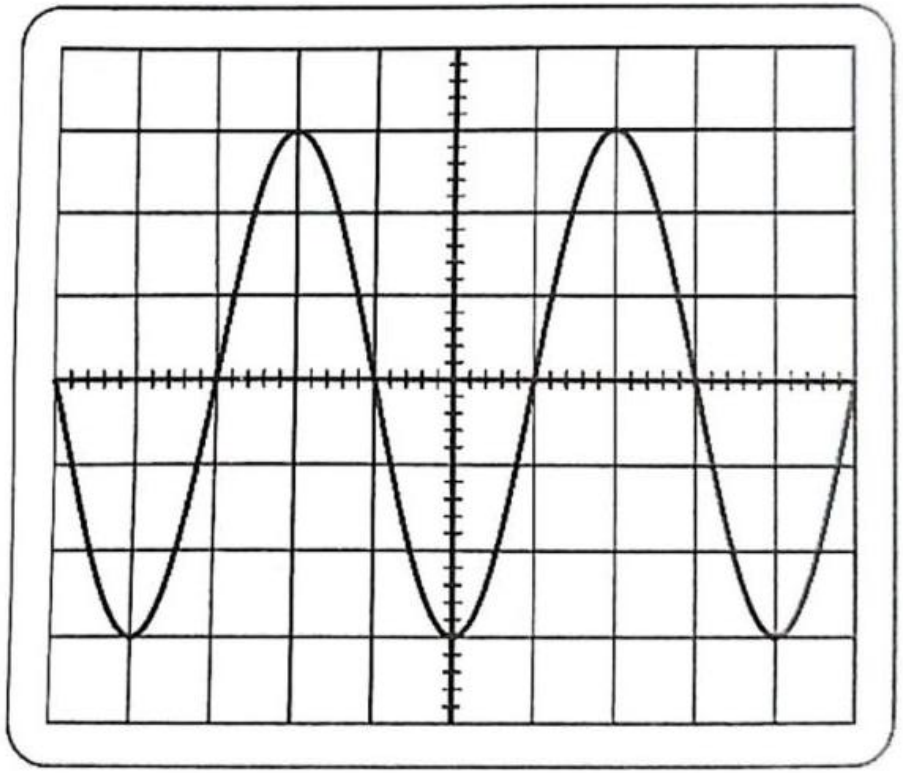
Quiz sound wave Duration: 20min

The physics teacher of grade 11 conducted some experiments in the laboratory to clarify for his students some concepts related to sound waves.

Part A: A loud speaker, connected to a low frequency generator, emits sound waves. A microphone, connected to an oscilloscope, captures the sound waves.

Quiz sound wave Duration: 20min

The screen of the oscilloscope displays the following oscillogram.



The horizontal and vertical sensitivities of the oscilloscope are chosen to be 0.1ms/div and 500mV/div respectively.

1)What is the type of sound waves? Define this type.

2)Calculate the frequency of sound received by the microphone?

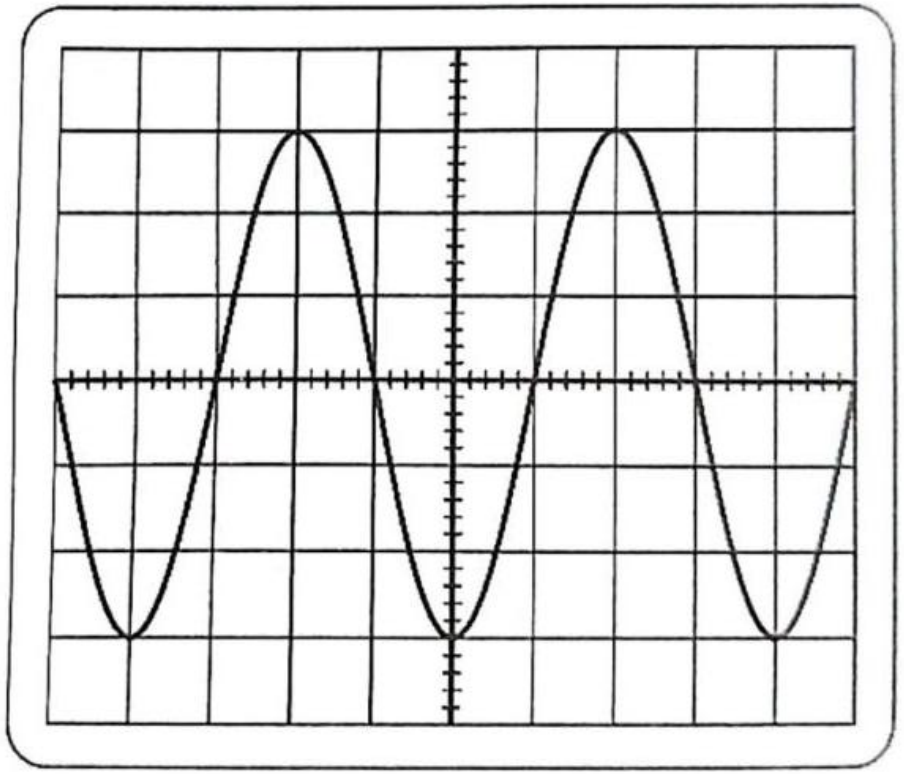
3) What modifications (if any) to the vertical sensitivities occur in order to obtain a new oscillogram whose amplitude is 1.5 cm.

Quiz sound wave Duration: 20min

1)What is the type of sound waves? Define this type.

Longitudinal wave: the direction of propagation of waves is parallel to the direction of vibration of the particles of the medium.

2) Calculate the frequency of sound received by the microphone?

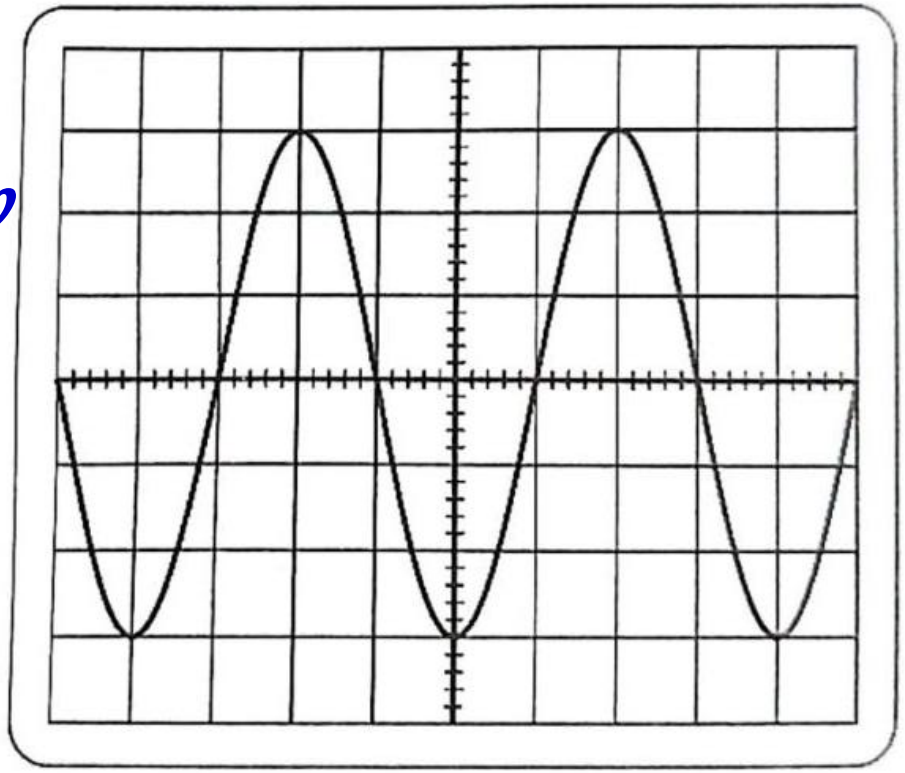


$$T = S_h \times x \Rightarrow T = 0.1ms/s \times 4div$$

$$T = 0.4ms$$

$$f = \frac{1}{T} = \frac{1}{0.4 \times 10^{-3}} \Rightarrow f = 2500Hz$$

3)What modifications to the vertical sensitivities occur in order to obtain a new oscillogram whose amplitude is 1.5 cm.



$$U_m = S_v \times y \Rightarrow U_m = 500 \times 10^{-3} \times 3div$$

$$U_m = 1.5V$$

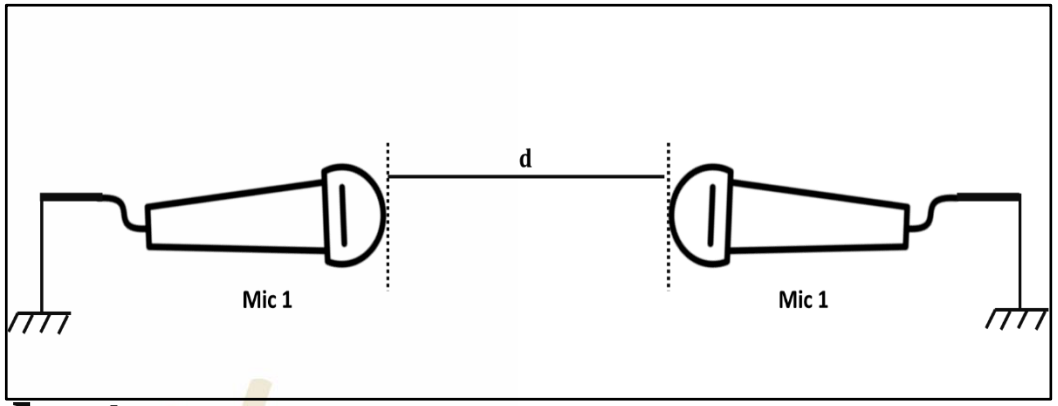
$$U_m = S'_v \times y \Rightarrow S'_v = \frac{U_m}{y} = \frac{1.5V}{1.5div}$$

$$S'_v = 1V/div$$

Quiz sound wave Duration: 20min

Part B: Using the setup shown below, the objective is to measure the speed of sound waves in air at a certain temperature.

A pop sound due to clapping is produced near the microphone 1.

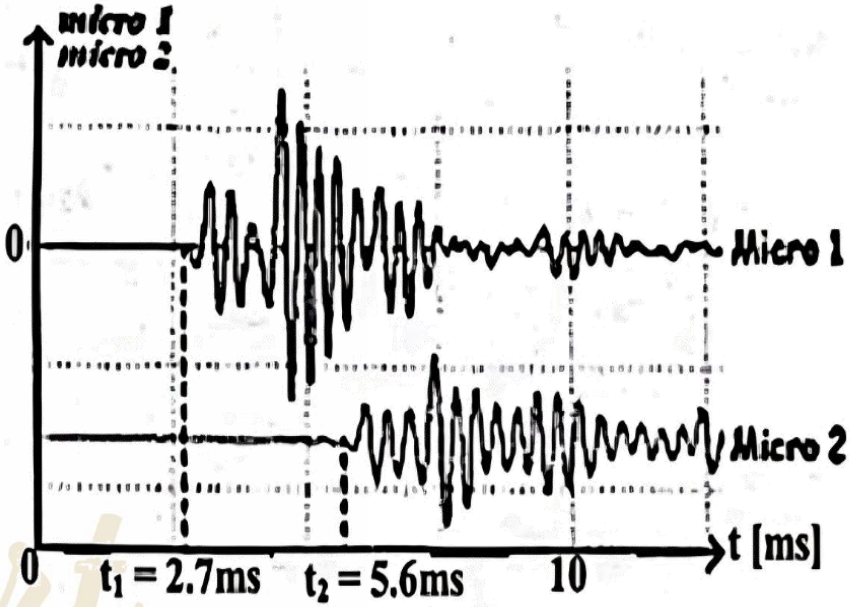


The two microphones are placed at a d=1m.

The two microphones are connected to the input channels of an oscilloscope.

Quiz sound wave Duration: 20min

The following oscillogram is obtained.

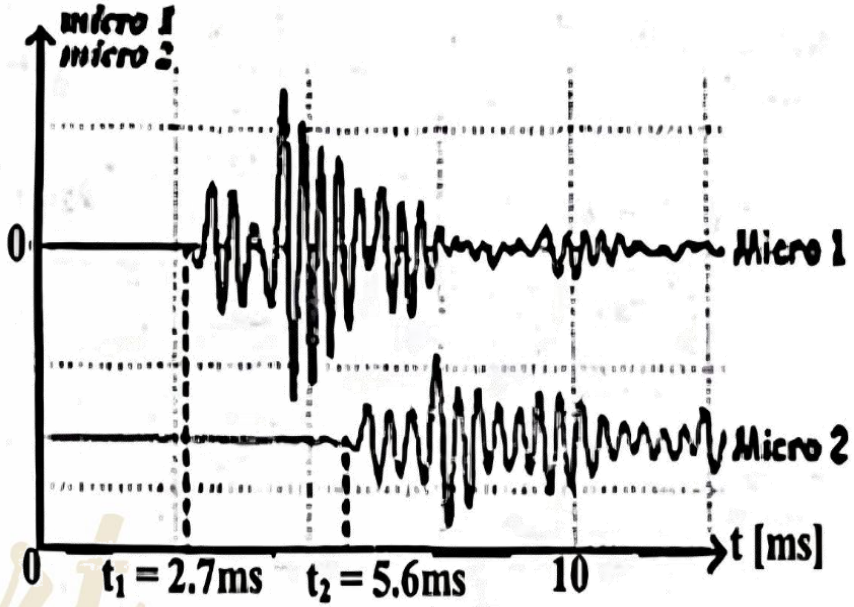


1) Using the above data, calculate the speed of sound waves in air.
2) The speed of sound in air as a function of temperature in the Kelvin is given by: $v = 330.75\sqrt{\frac{T}{273}}$

Calculate the temperature of air in the laboratory room in the Kelvin scale.

3) What instrument could the teacher use in the laboratory to measure the temperature of air directly?

1)Using the above data, calculate the speed of sound waves in air.



$$\Delta t = 5.6 - 2.7 = 2.9ms$$

$$v = \frac{d}{\Delta t}$$

$$v = \frac{1m}{2.9 \times 10^{-3}}$$

$$v = 344.8m/s$$

2)The speed of sound in air as a function of temperature in the Kelvin is given by: $v = 330.75\sqrt{\frac{T}{273}}$. Calculate the temperature of air in the laboratory in Kelvin scale.

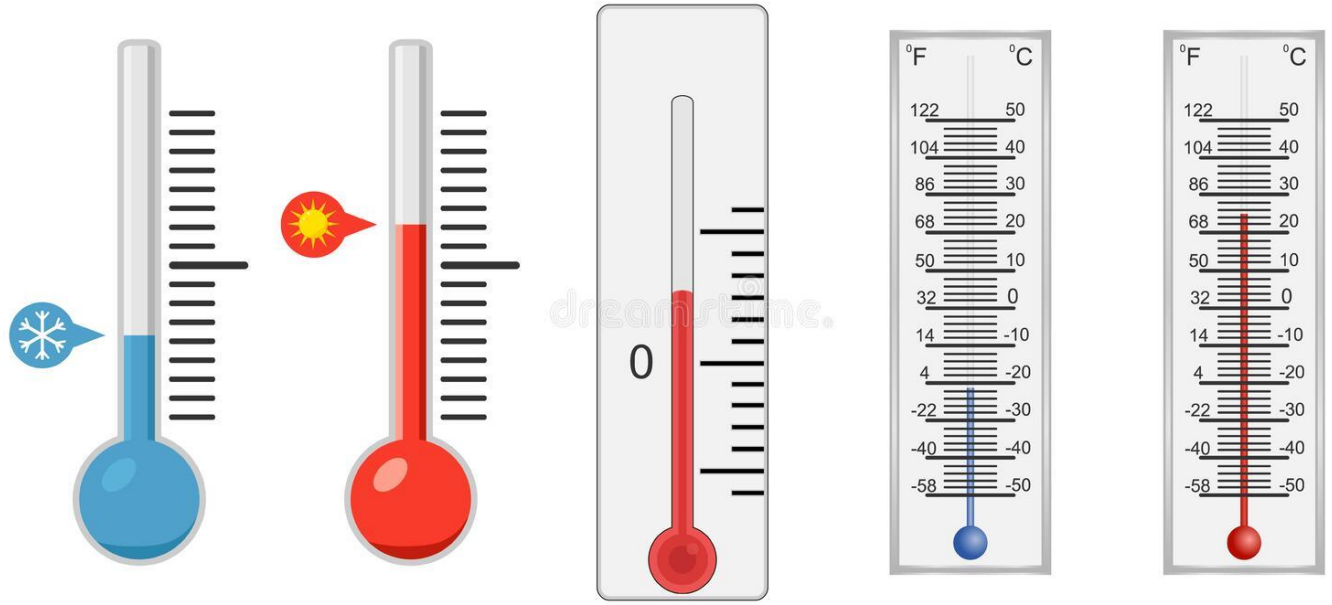
$$v = 330.75\sqrt{\frac{T}{273}} \Rightarrow 344.8 = 330.75\sqrt{\frac{T}{273}}$$

$$\frac{344.8}{330.75} = \sqrt{\frac{T}{273}} \Rightarrow 1.042 = \sqrt{\frac{T}{273}} \Rightarrow T = 296.4K$$

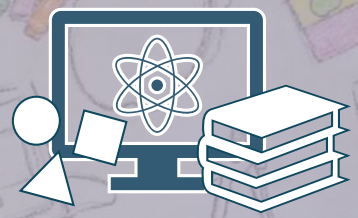
Quiz sound wave Duration: 20min

3)What instrument could the teacher use in the laboratory to measure the temperature of air directly?

The instrument used to directly measure the temperature of air is called Thermometer



The End



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