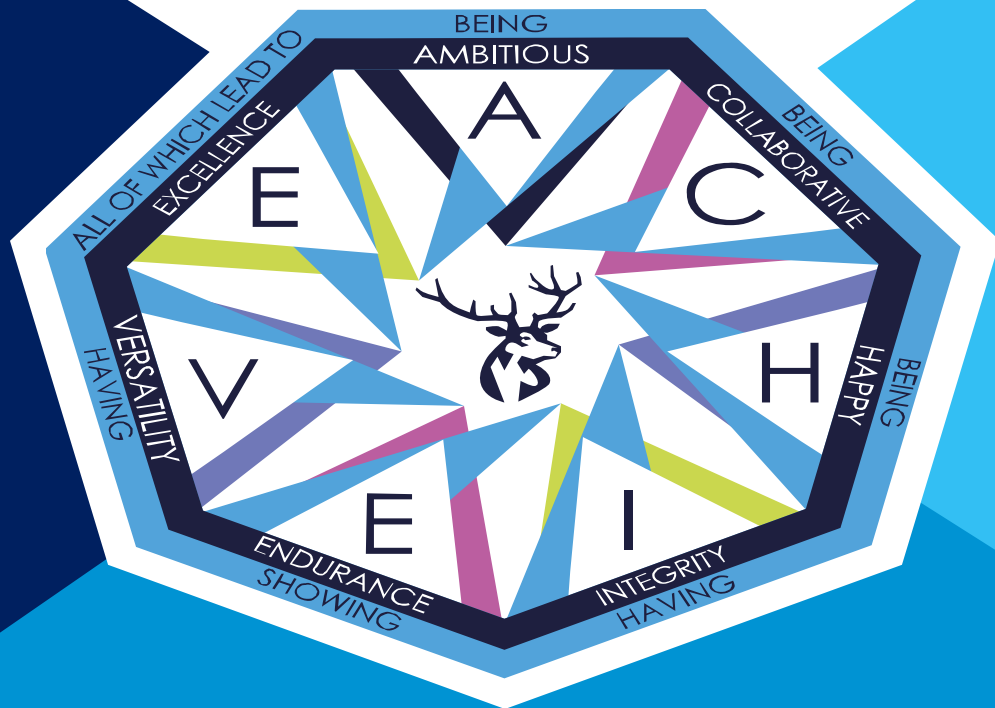


**FURZE
PLATT**
SENIOR SCHOOL



SIXTH FORM TASTER DAY - PHYSICS LESSON 1

Mr Curnow

June 2025

A-level Physics Taster Lesson 1

– Mr Curnow

➤ Welcome!

Starter: Choose one to answer

What do you think happens when these two waves meet?



How do noise cancelling headphones work?

WHY do you think a microwave rotates food while cooking it?



A-level Physics - introduction

What it is NOT...

- Boring
- Impossibly difficult

Mr Mahar
Mr Wright
Mr Curnow
(Head of Physics)

What it IS...

- Challenging
- Related to real life
- Respected on all university applications

You will be taught by outstanding teachers in a highly successful physics department, with a history of being one of the top departments in Furze Platt

Course Content

Year 12

- 1 Measurements and practical skills
- 2 Particles and radiation – **X-rays**
- 3 Waves – **quantum theory**
- 4 Mechanics and materials - **projectiles**
- 5 Electricity – **sensors**

Year 13

- 6 Further mechanics and thermal physics – **thermodynamics, satellites and orbits**
- 7 Fields and their consequences
- 8 Nuclear physics – **$E = mc^2$**

Options... (Year 13)

9 Astrophysics – **stars, Big Bang, Hubble's law**

10 Medical physics – **X-rays, MRI scanners**

11 Engineering physics – **structures and materials**

12 Turning points in physics – **special relativity, waves**

13 Electronics – **digital / analogue amplifiers, logic**

A-level

Assessments

Paper 3	
	<p>What's assessed</p> <p>Section A Compulsory section: Practical skills and data analysis</p> <p>Section B: Students enter for one of sections 9, 10, 11, 12 or 13</p>
Paper 1	
<p>What's assessed</p> <p>Sections 1 to 5 and 6.1 (Per</p>	<p>Assessed</p> <ul style="list-style-type: none">• written exam: 2 hours• 80 marks• 32% of A-level
<p>Assessed</p> <ul style="list-style-type: none">• written exam: 2 hours• 85 marks• 34% of A-level	<p>Questions</p> <p>45 marks of short and long answer questions on practical experiments and data analysis.</p> <p>35 marks of short and long answer questions on optional topic.</p>
<p>Questions</p> <p>60 marks of short and long answer questions and 2 questions on content.</p>	<p>Assessed</p> <ul style="list-style-type: none">• written exam: 2 hours• 85 marks• 34% of A-level
	<p>Questions</p> <p>60 marks of short and long answer questions and 25 multiple choice questions on content.</p>

Why AQA?

- Better outcomes
- More resources available
- Excellent accessibility (organisation etc)

AQA



Your Role

- Turn up and take ownership
- Be interested
- Complete set work
- Attempt further study
- Attend Physics Clinic (Monday 3.20-4.10)
- Revise before and after lessons
- Practice past paper questions

You should be aiming for at least 2 hours outside lesson for every 1 hour of lesson time!

Support

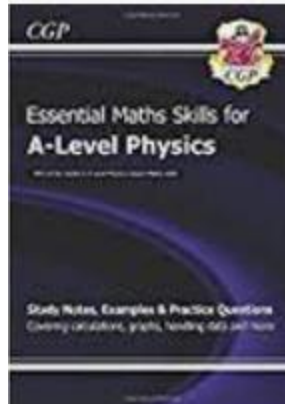
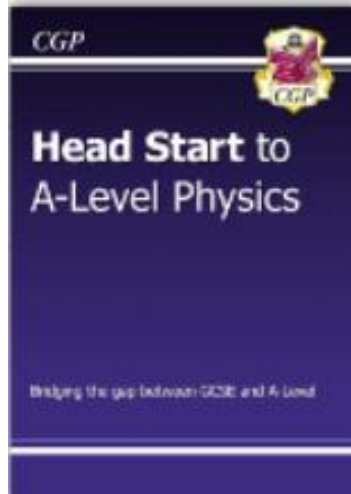
- Resources
 - Text books - £35 from the science department (£15 deposit for second hand)
 - Online Kerboodle resources
 - Revision guides available online
 - Past paper and revision packs
- Physics clinic
- Availability

Holiday homework...

- **Purple “AS Head Start to Physics” book** - make notes on each page and complete questions on lined paper, *and mark/correct using answers at the back*
- **Physics Handbook:** Read through the book, YouTube, and website recommendations, access as much as you can over the summer
→ Then read through and complete questions on standard form and other practical skills

These are the hardest parts of the GCSE course, and give you practice at all the skills required of an A-level Physicist!

Introductory test (first week back) will be based on this content



Physics taster lesson 1

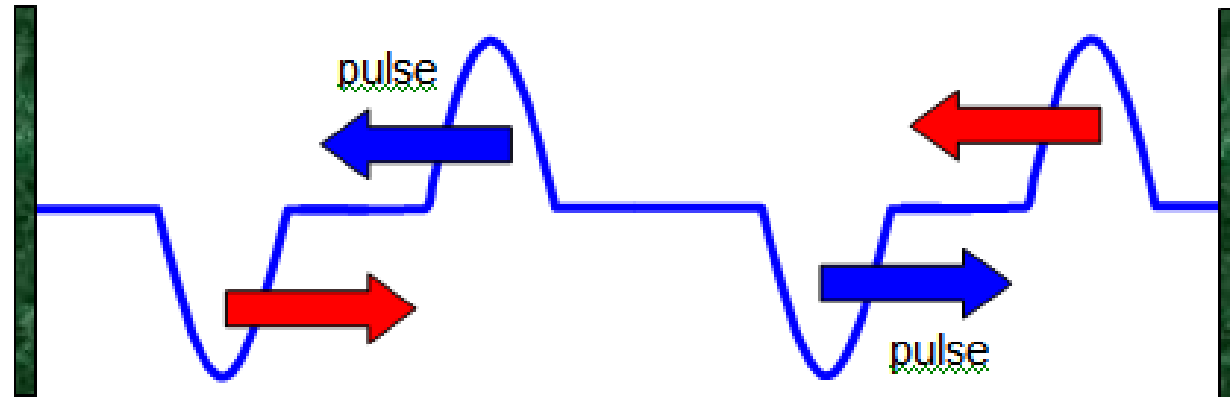
- Stationary Waves

Learning Objectives:

- Observe and describe a stationary wave in terms of 'nodes' and 'antinodes'
- Describe key differences between stationary and progressive waves
- Investigate what factors affect the fundamental frequency on a string

Stationary Waves

What do you think happens when these two waves meet?

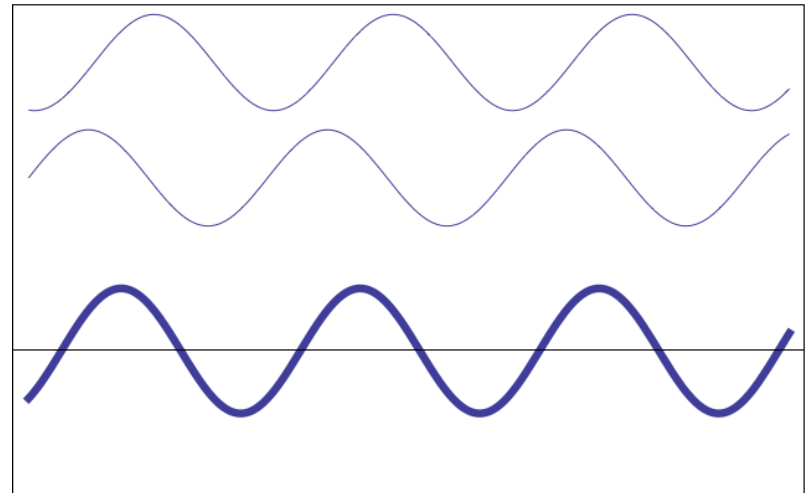
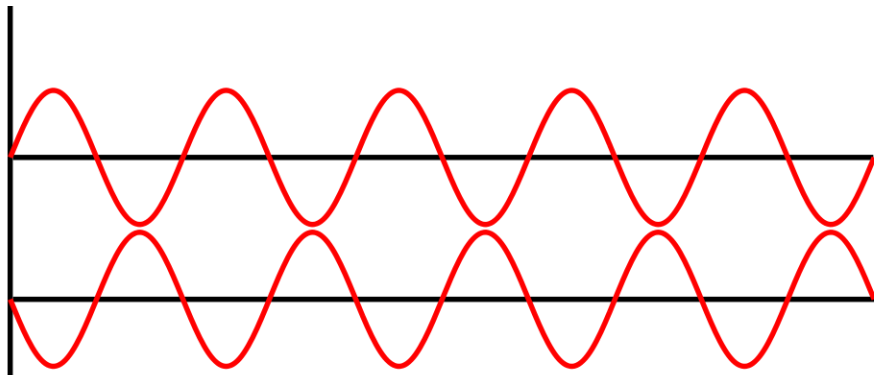


The waves combined together. This is called superposition

Stationary Waves

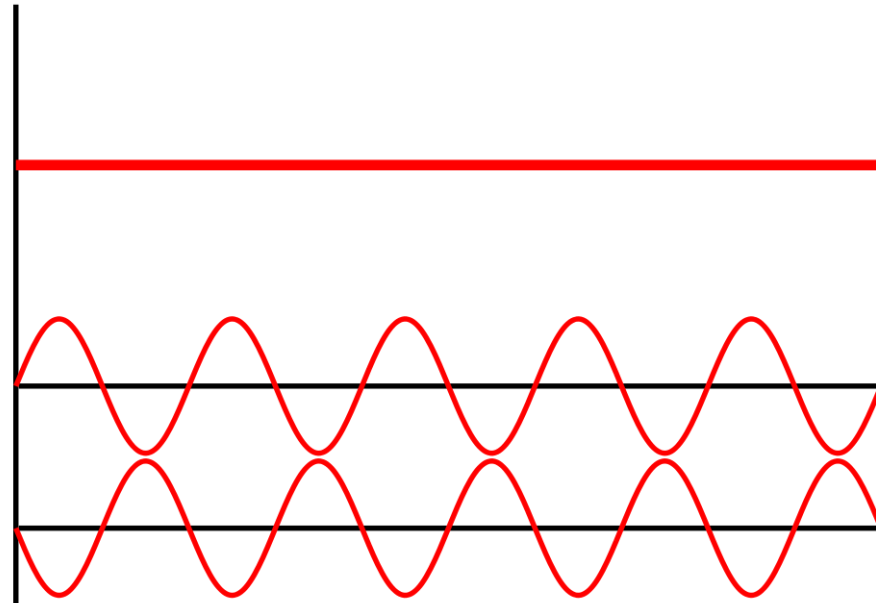
What do you think happens when these two waves meet?

Hint:



Stationary Waves

What do you think happens when these two waves meet?

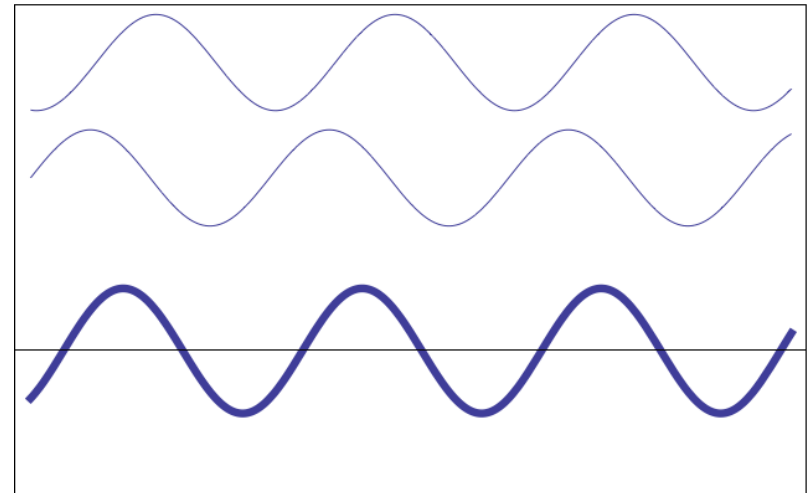
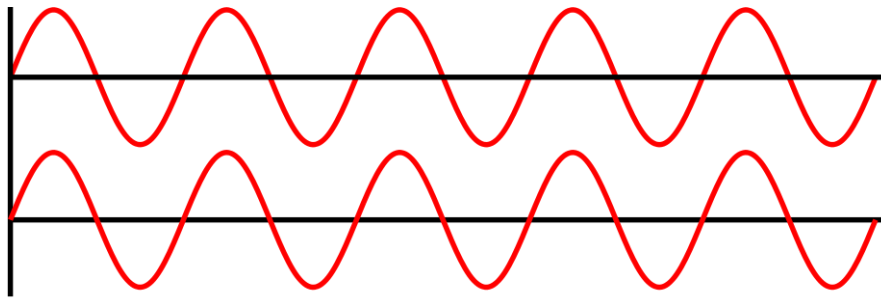


The waves cancel out so the amplitude is zero.
This is called **destructive interference**.

Stationary Waves

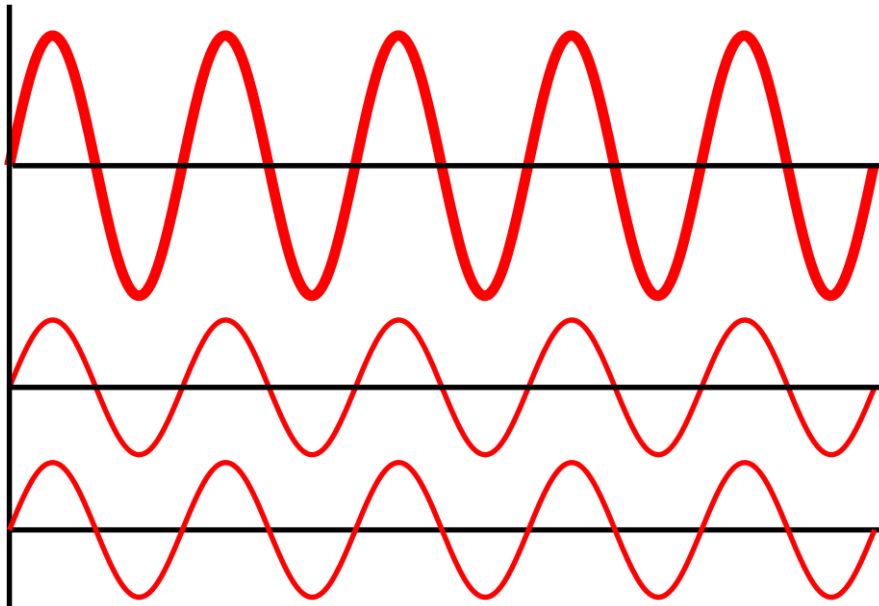
What do you think happens when these two waves meet?

Hint:



Stationary Waves

What do you think happens when these two waves meet?



This is how we can form stationary waves!

The overall amplitude is doubled. This is called **constructive interference**.

Vibrating strings

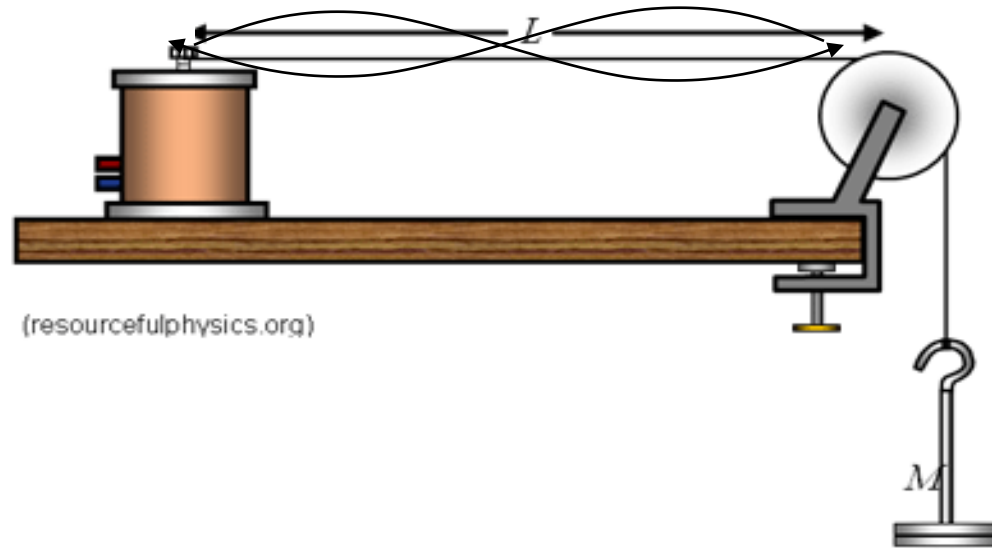
- If a string is plucked it vibrates, and a wave travels along the string (transverse wave)



A stationary wave is formed when:

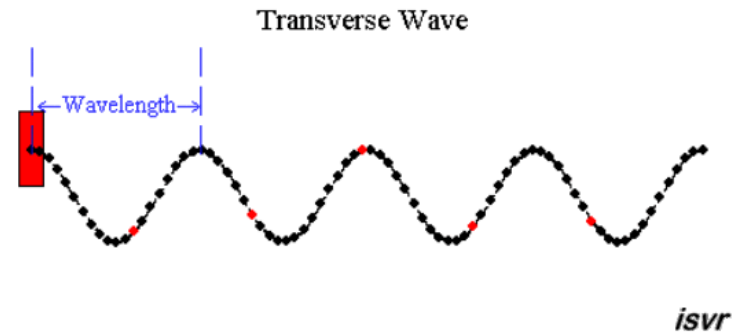
- The wave reflects with the same **frequency**, travelling in the opposite direction.
- The two waves **interfere** and produce a stationary wave.

Stationary wave demonstration



What are the differences between stationary wave and progress ('normal') waves?

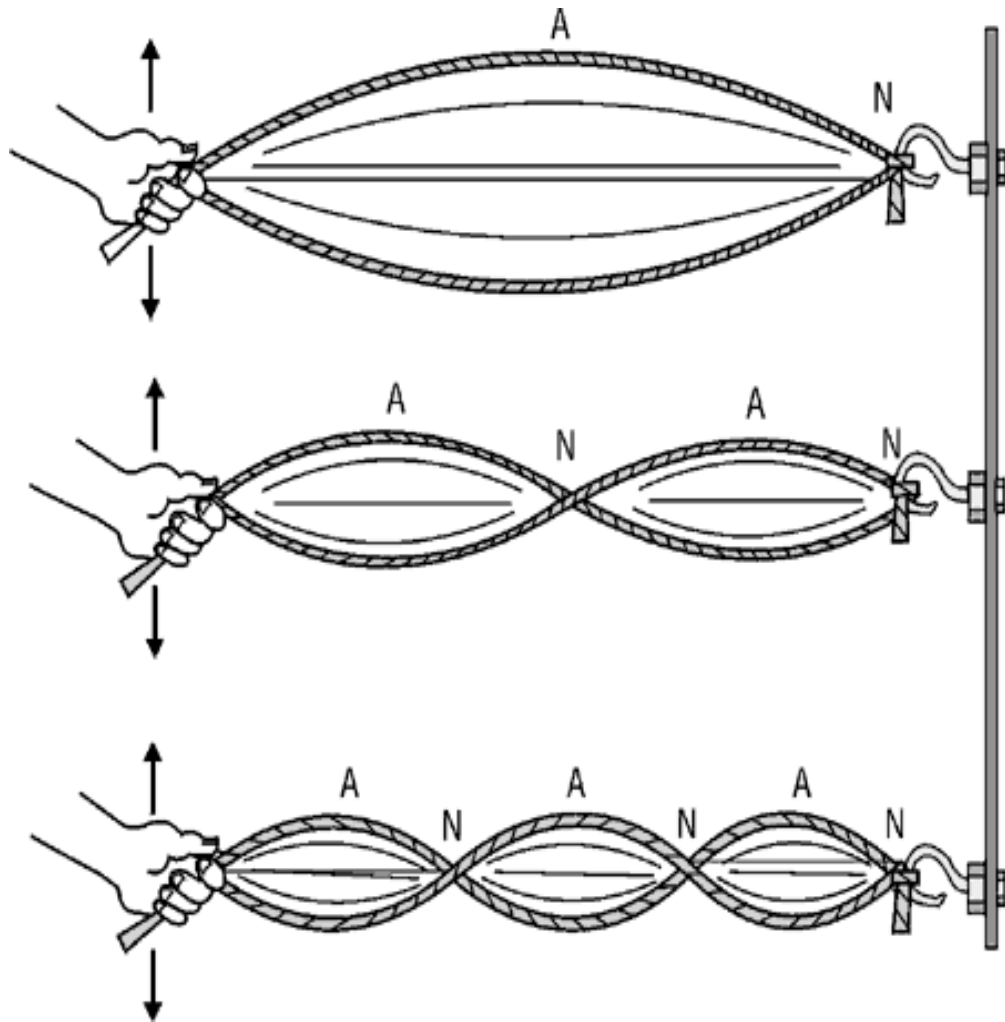
- In a progressive wave all the particles oscillate with the same amplitude



- In a stationary wave there are points when the displacement is perma



Stationary Waves - characteristics



1st Harmonic

(Also called the *fundamental frequency*)

There are two points where the string is not vibrating - these points are called **Nodes**.

The **Antinode** is in the middle of the string is where there is maximum displacement.

2nd Harmonic

This is *twice* the frequency of the fundamental frequency.

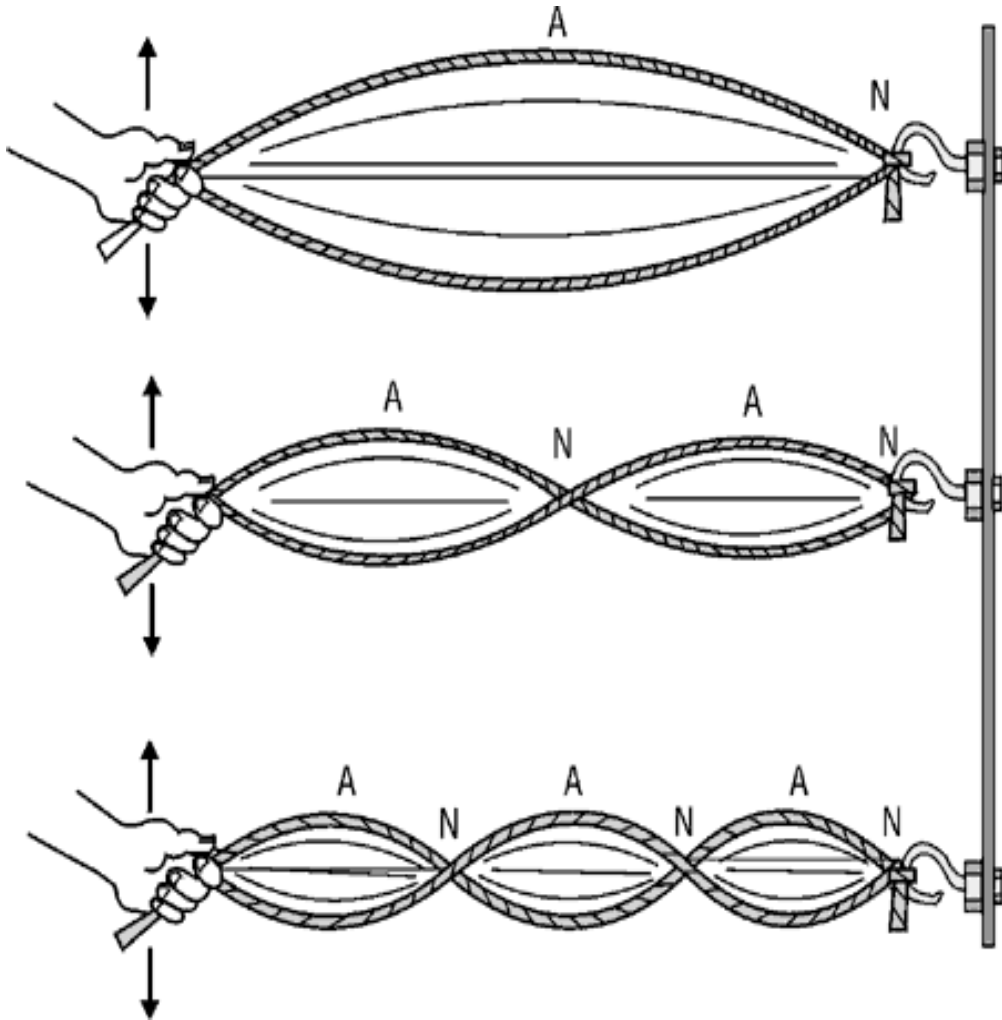
There are 3 **Nodes** and 2 **Antinodes**.

3rd Harmonic

This is *3 times* the fundamental frequency.

Note that there are 4 **nodes** here and 3**Antinodes**.

Stationary Waves - characteristics

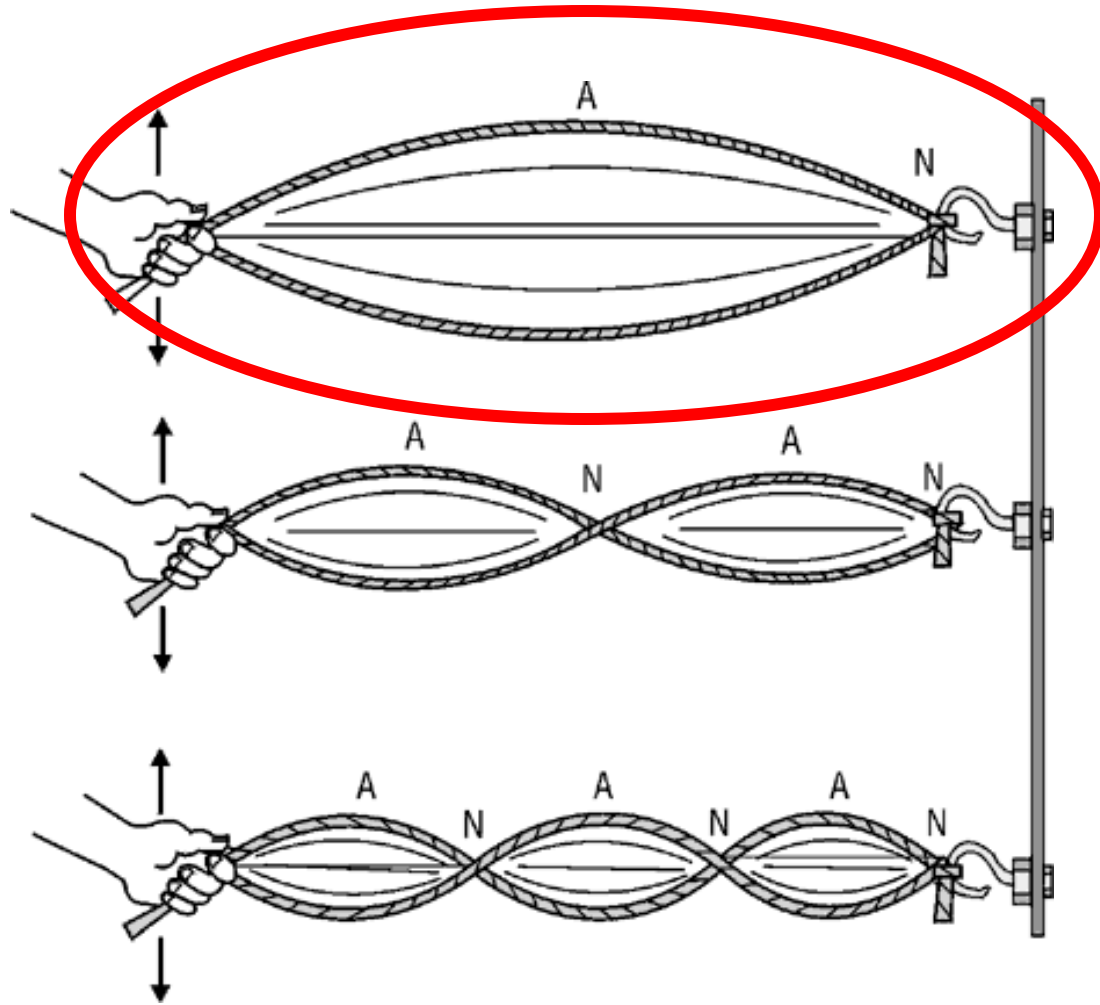


1st harmonic = $\frac{1}{2}$ a wavelength

2nd harmonic = 1 wavelength

3rd harmonic = 1.5 wavelengths

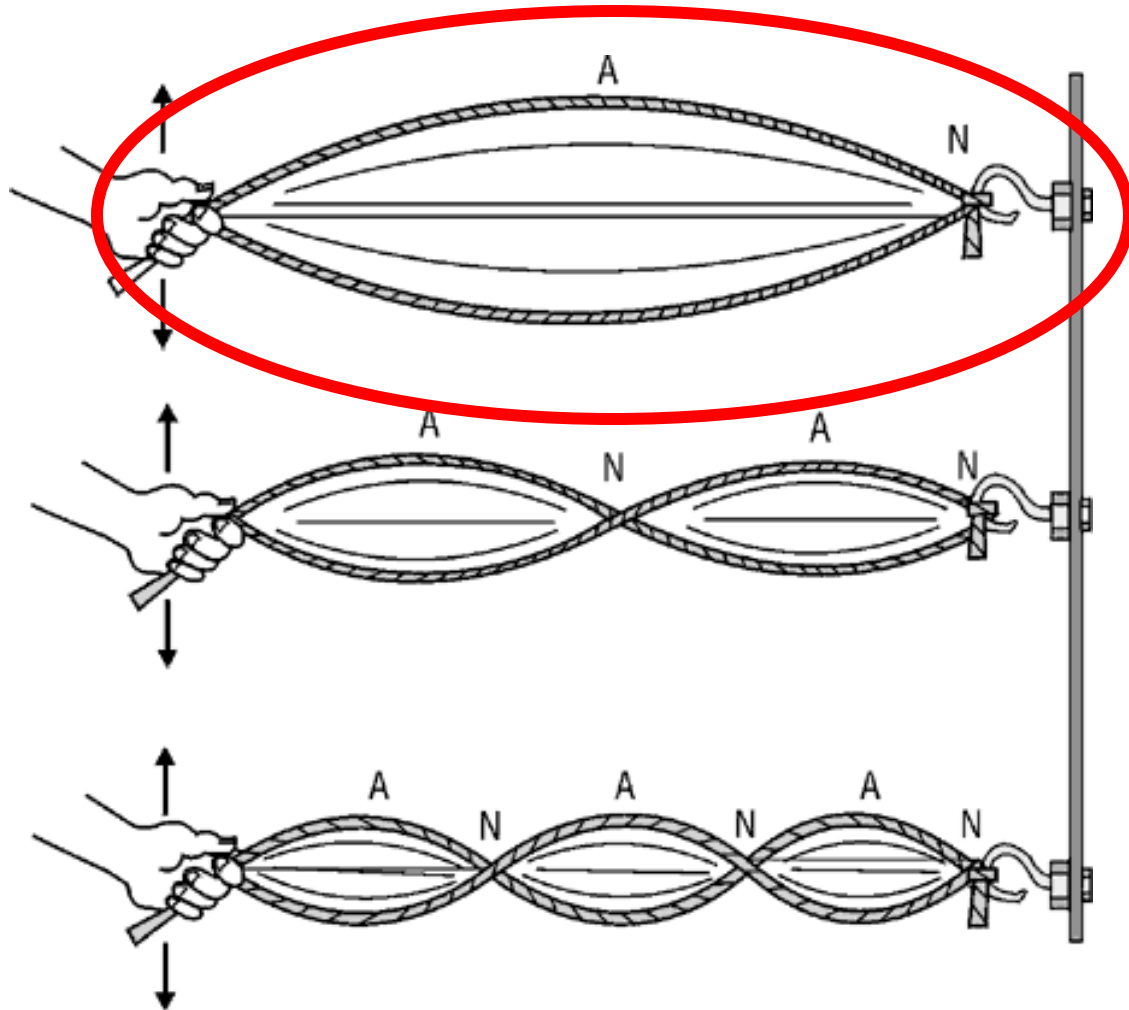
Question 1



$$v = f \lambda$$

A frequency of 560 Hz produces a stationary wave at the fundamental frequency. If the length of the string is 35 cm, what is the wavelength and what is the speed of the wave?

Question 1



A frequency of 560 Hz produces a stationary wave at the fundamental frequency.

At the fundamental frequency, half a wavelength (35cm) is on the string. Therefore the wavelength is $(35 \times 2) = 70 \text{ cm}$

$$c = f \lambda$$

$$= 560 \times 0.7 = \underline{392 \text{ ms}^{-1}}$$

Question 2 - A Guitar

1. A note at the fundamental frequency is played is played on a guitar string that is 0.6m in length. The pitch is a B^b, around 350Hz.

– Calculate the wave speed on the string?

$$- C = 350 \times (0.6 \times 2) = \underline{420 \text{ms}^{-1}}$$

2. The fret board is now pressed so that the plucked string is 0.25m in length.

– Calculate the new frequency?

$$- f = c / \lambda = 420 / (0.25 \times 2) = \underline{840 \text{ Hz}}$$

Physics taster lesson 1

- Stationary Waves

Learning Objectives:

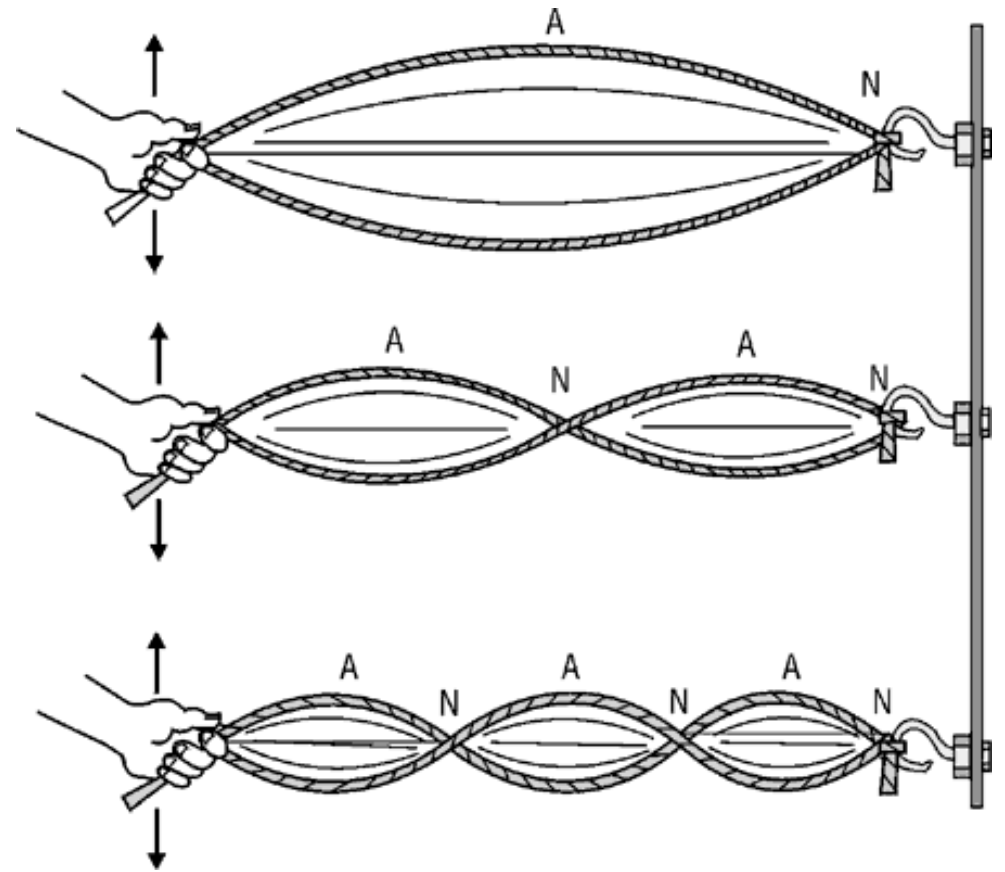
- Observe and describe a stationary wave in terms of 'nodes' and 'antinodes'
- Describe key differences between stationary and progressive waves
- Investigate what factors affect the fundamental frequency on a string

Quick Quiz

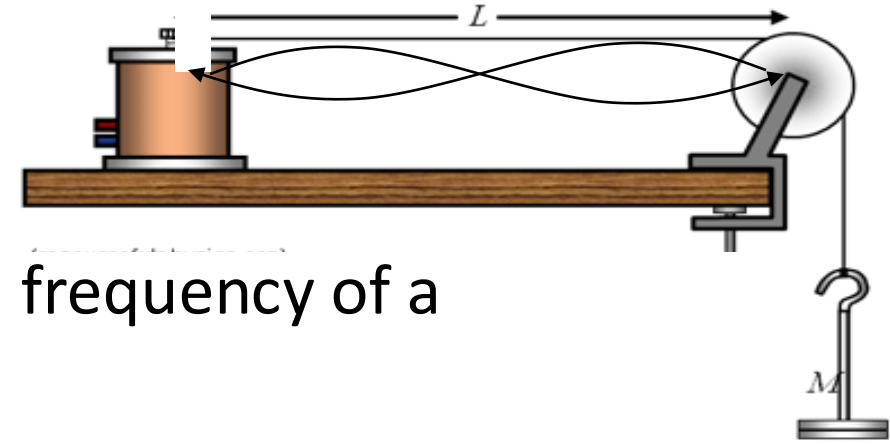
1) How are stationary waves formed?

2) What are nodes?

3) What are antinodes?



Stationary waves - practical



Aim: To find out how length affects the fundamental frequency of a piece of string

1. What are your:
Independent variable?
Dependent variable?
Control variables?

Extension: Carry out an experiment to find out how the tension on the string affects its fundamental frequency

2. Make a table of results

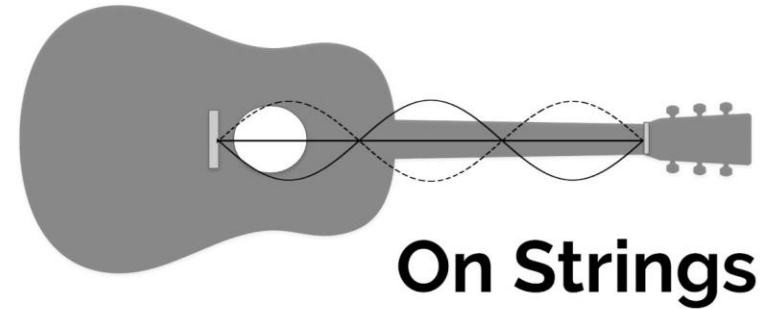
3. Write a conclusion after your experiment

Length (cm)	1 st Harmonic (Hz)	2 nd Harmonic (Hz)	3 rd Harmonic (Hz)

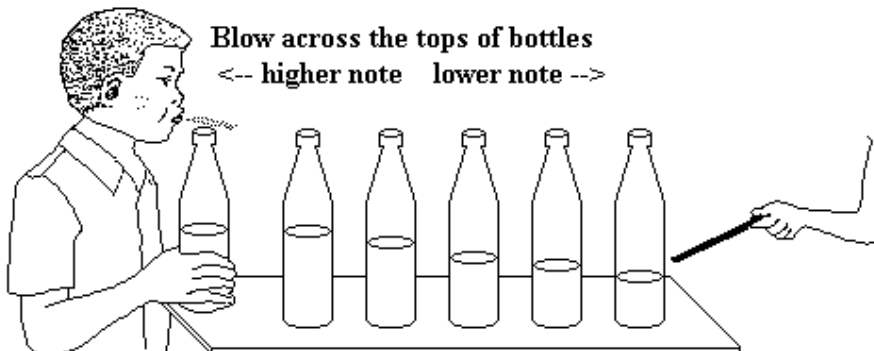
Other applications of stationary waves:

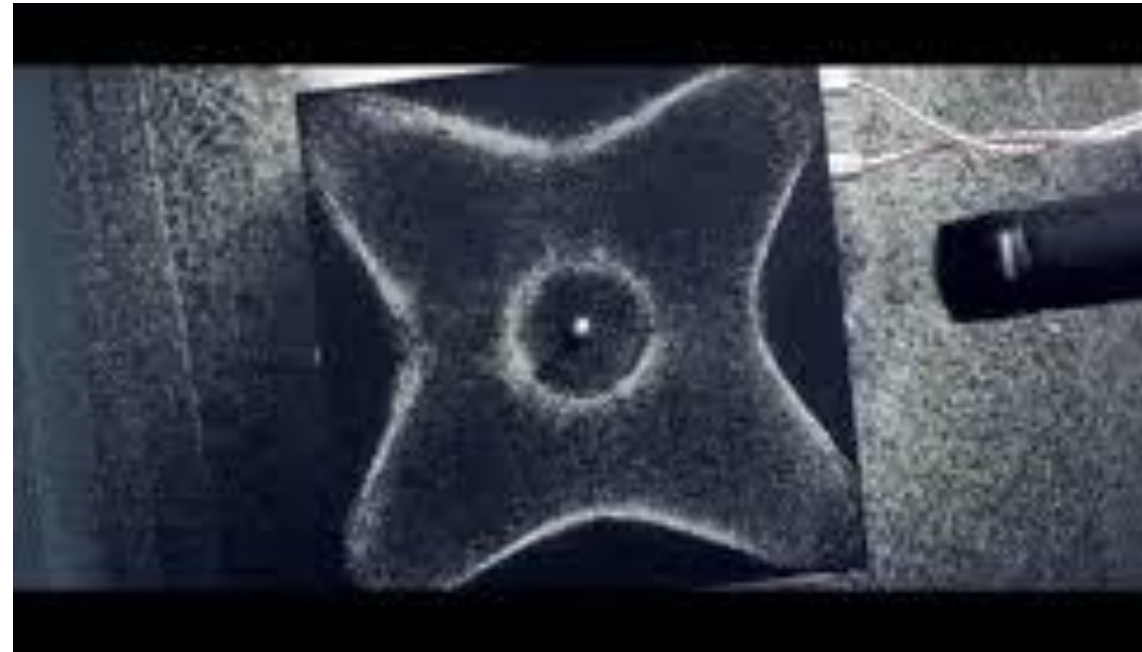
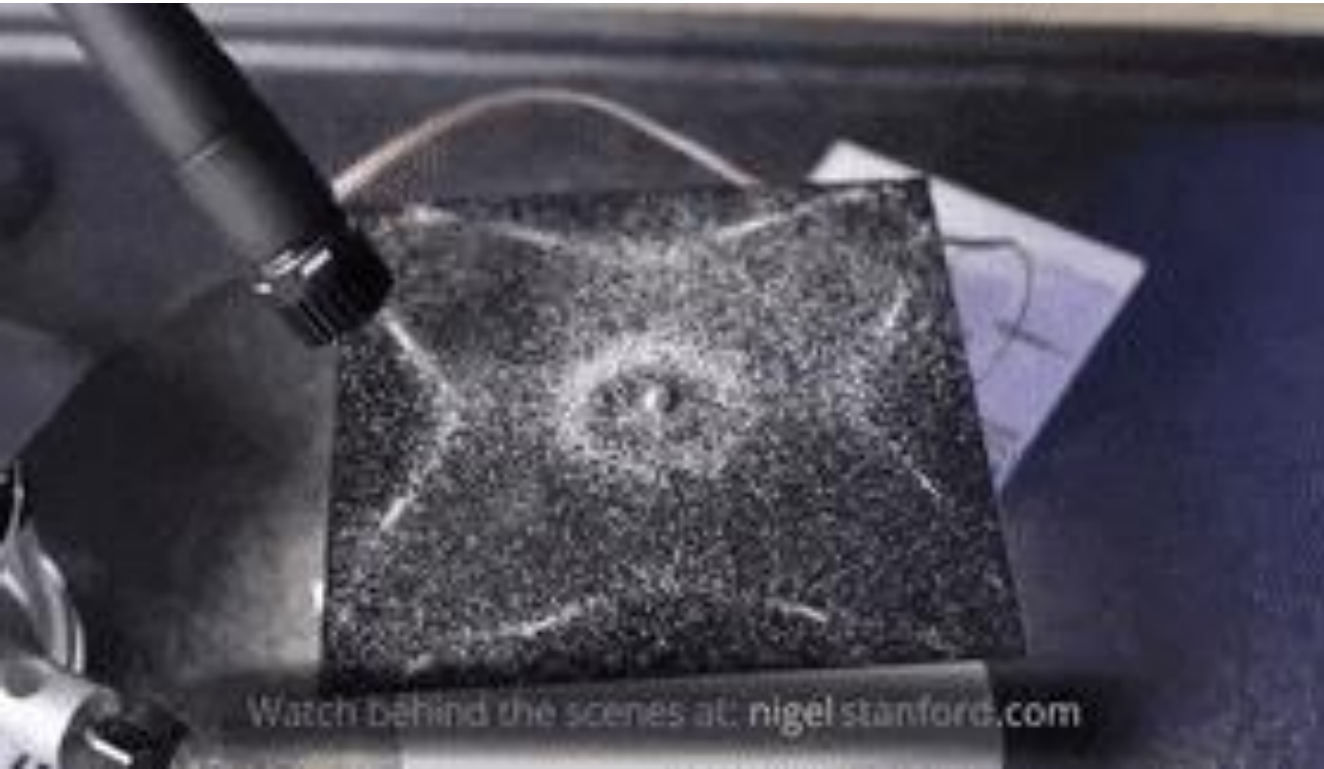
- Microwaves
- Noise-cancelling headphones
- Stringed musical instruments
- Woodwind instruments
- Smashing glass...

Standing Waves

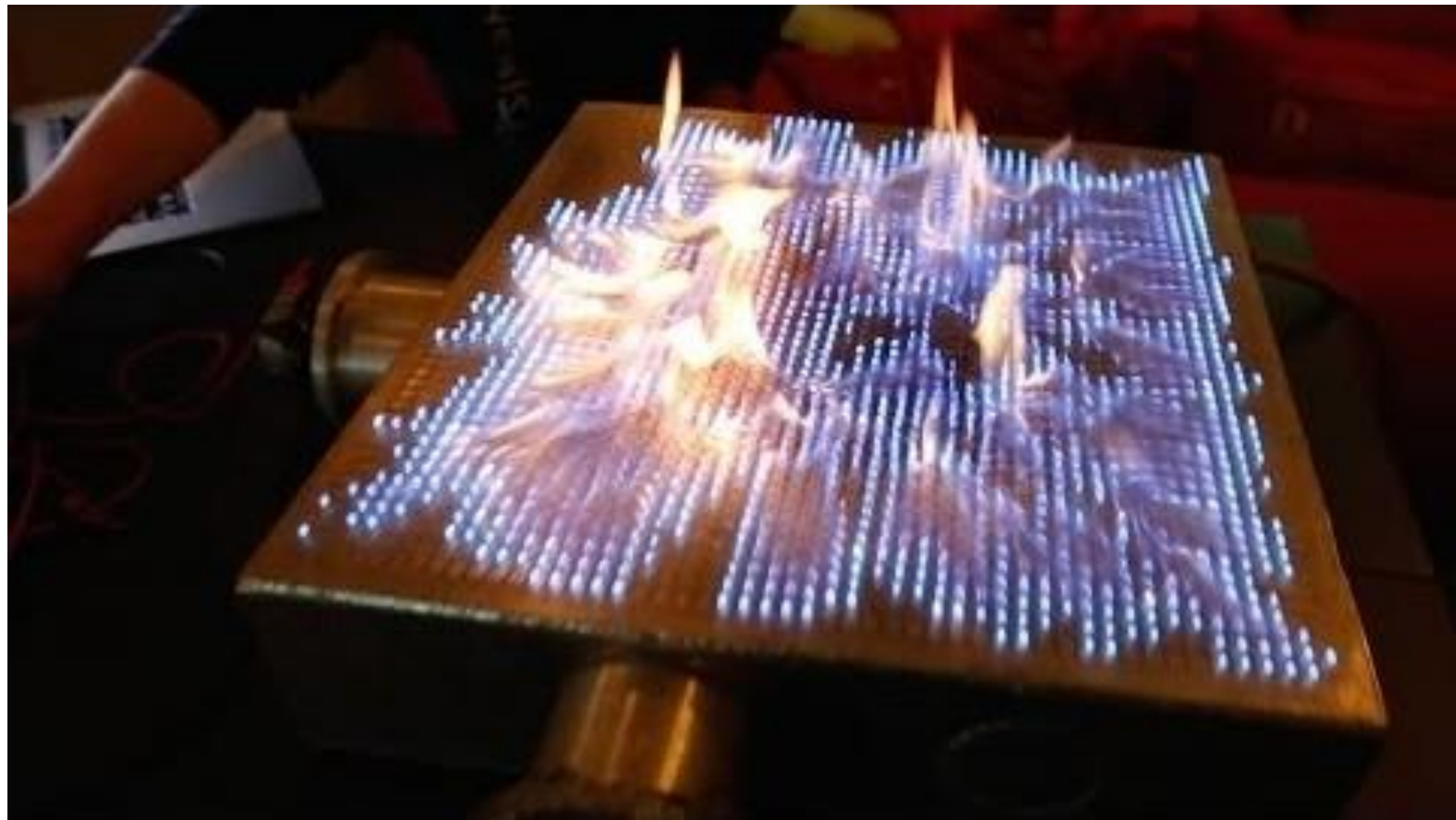


26.3.1.6 Bottle sounds



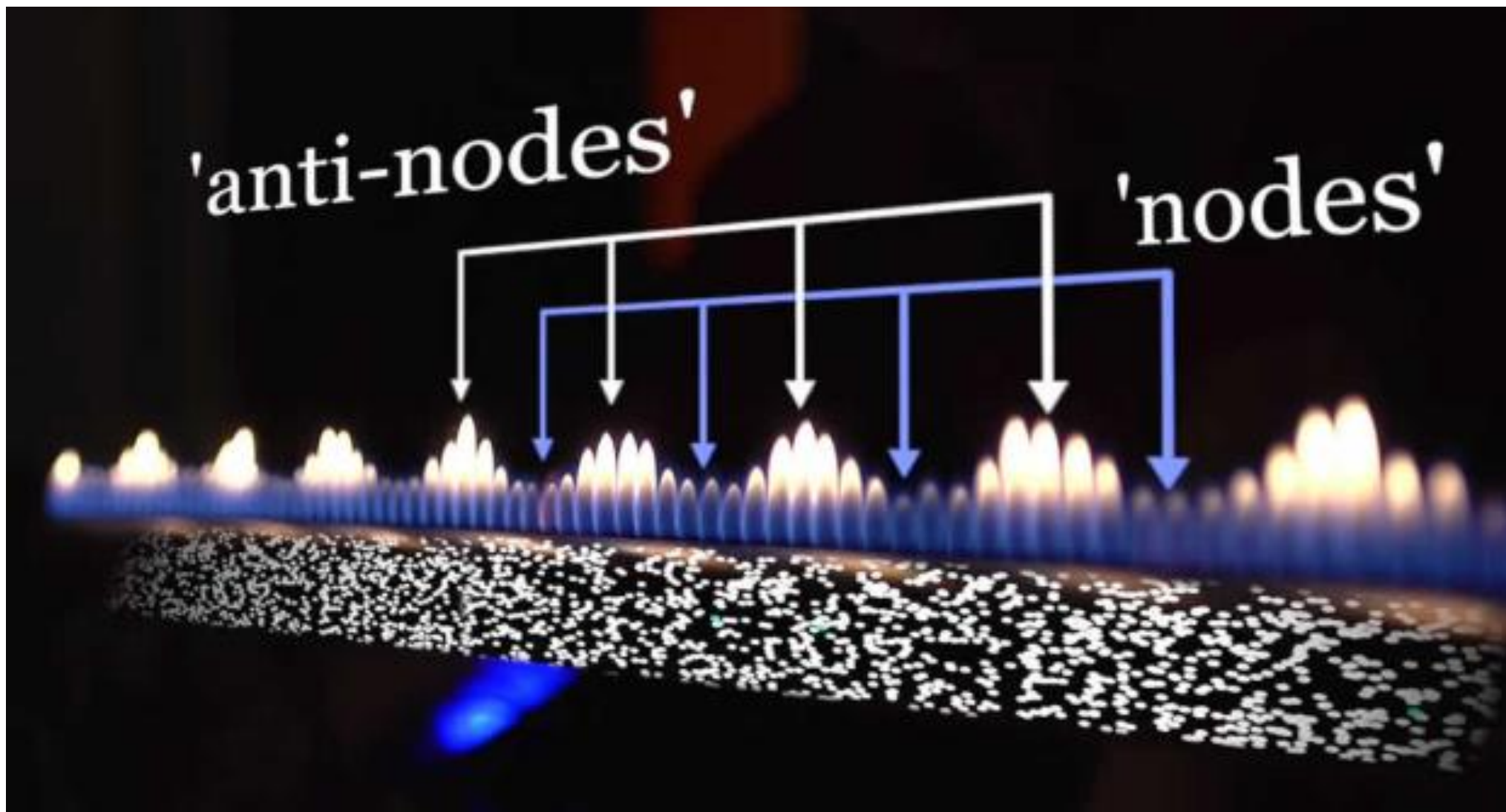


Additional examples: <https://www.youtube.com/watch?v=Q3oltpVa9fs>



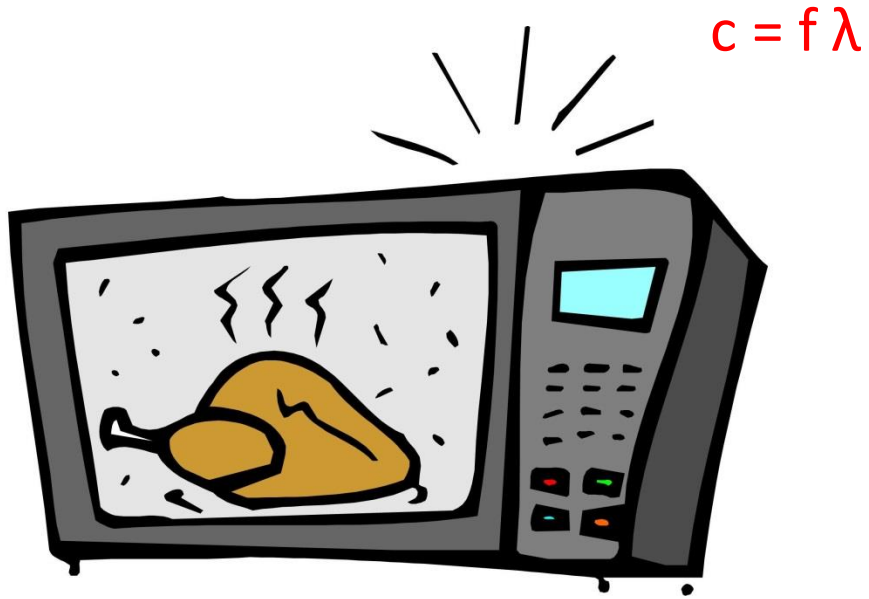
'anti-nodes'

'nodes'



Speed of a microwave?

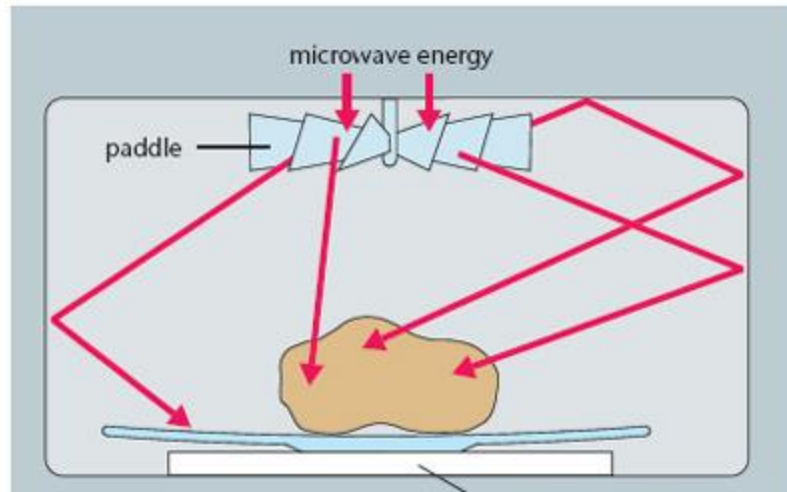
- How could we calculate the speed of microwaves using these two pieces of 'equipment'?



Hint: Microwaves use stationary waves...

Speed of a microwave?

- Microwaves use stationary waves to heat and cook food.
- If we can measure the distance between anti-nodes (melty choc), we can find the wavelength...
- Then use $\text{wavespeed} = \text{freq} \times \text{wavelength}$



How to use stationary waves to find the speed of microwaves



Stringed instruments

All things have frequencies at which they naturally vibrate.
- this is called the **fundamental** frequency.

This is true of all objects – and is why some things vibrate more than others at certain frequencies



Extra examples...

Can you link what you have seen over the last two lessons to a glass smashing with the right sound?



Short

- <https://www.youtube.com/watch?v=17tqXgvCN0E>

Long:

- <https://www.youtube.com/watch?v=BE827gwnnk4>

What affects the pitch or fundamental frequency of a vibrating string?

- Mass of the string
- Tension in the string
- Length

$$f = \frac{1}{2l} \sqrt{\frac{T}{\mu}}$$

f is the fundamental frequency (Hz)

T is the tension in string (N),

μ is the mass per unit length (kg m^{-1}),

l is the length of string (m)

Example problems

1. Calculate the fundamental frequency for a string 0.45 m long, of mass 0.5 gm/metre and a tension of 75 N.
2. What is the tension needed to give a note of 1kHz using a string of length 0.5 m and mass 0.75 gm. Mass/ metre = 1.5×10^{-3} kg

Example problems

1. $f = 1/2L\sqrt{T/m} = 1/0.9\sqrt{75/[0.5 \times 10^{-3}]} = 430 \text{ Hz}$

2. Tension = $f^2 \times 4L^2 \times m = 1000^2 \times 4 \times 0.5 \times 1.5 \times 10^{-3} = 3000 \text{ N} = 3 \text{ kN}$

Questions...?

