

Exercise walk-through

14.1

Properties of Wave Pulses and Waves

AP Physics 2

Periodic waves and polarization

The wave equation

$$v = f\lambda, \quad f = \frac{1}{T}$$

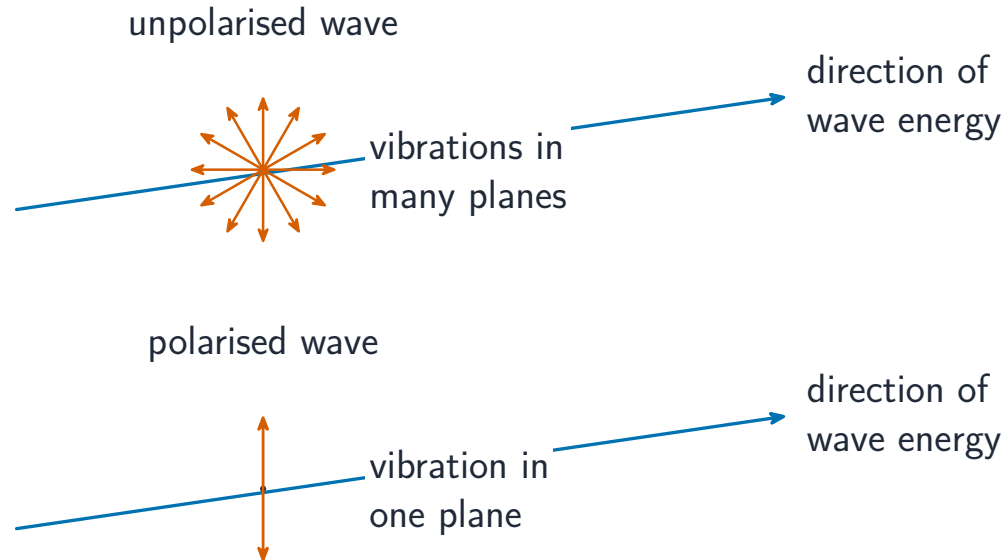
Speed is set by the **medium**: raise f and λ shrinks.

170 Hz at 340 m/s: $\lambda = 2$ m.

Polarization works only on **transverse** waves – a filter passes one plane of vibration. Sound cannot be polarized.

Reflecting off a denser medium flips a wave over (inverted).

Boundary Behavior and Polarization



Unpolarised waves vibrate in many planes; a polarised wave vibrates in one

Intensity, beats, and thin films

intensity

the average power a wave delivers **per unit area** over one period, in W/m^2

through a polarizer

$I = I_0 \cos^2 \theta$ – unpolarised light loses **half** its intensity at the first polarizer

beats

two waves of **slightly different** frequency drift in and out of step, so the sound swells loud and soft at $|f_1 - f_2|$

a thin film

light reflecting off the top and bottom of a soap bubble or oil slick interferes with **itself**

what decides the colour

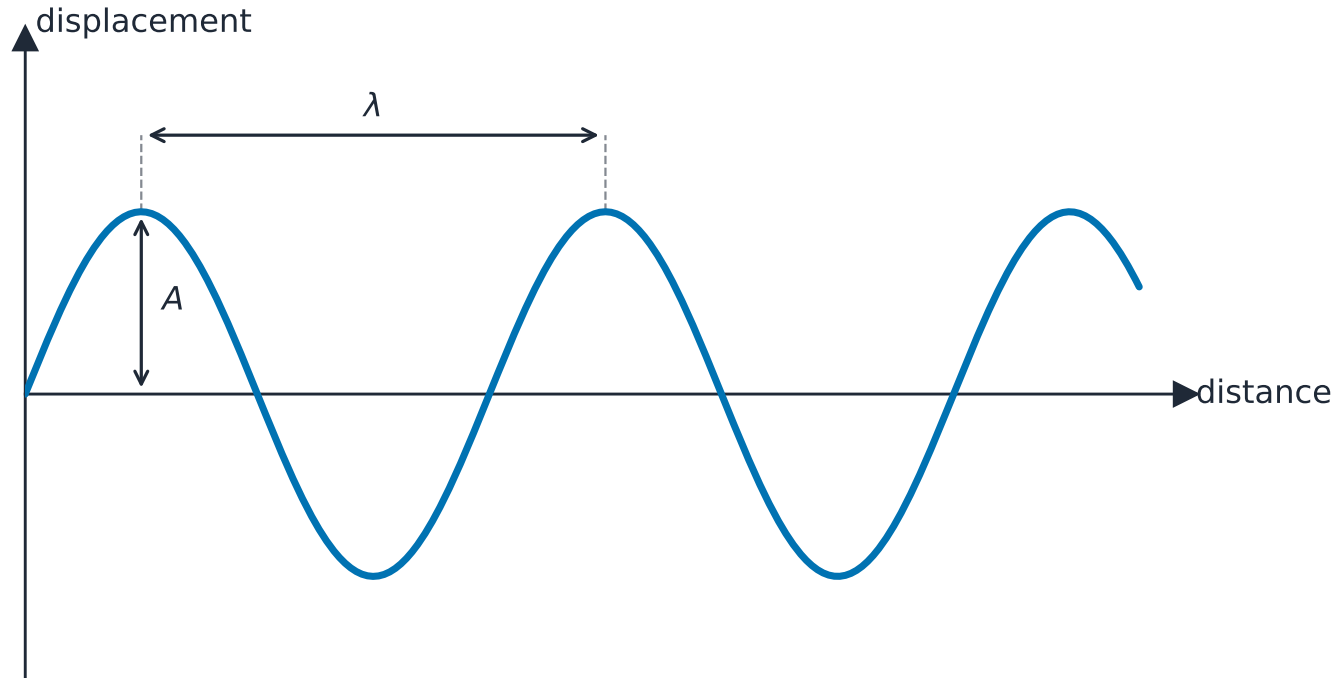
the film's **thickness** and the wavelength – which is why the colours shift as the film thins

an antireflection coating

the same physics used deliberately: a layer that makes the two reflections cancel

A reflection off a **denser** medium adds a half-wavelength shift. Counting that extra half is what turns a thin-film question from guesswork into arithmetic.

Periodic Waves



A displacement-distance graph shows the amplitude and wavelength

The quantities that describe a periodic wave

wavelength λ

the distance between two successive identical points

period T

the time for one complete oscillation

frequency f $1/T$ – oscillations per second, in hertz**amplitude A** the maximum displacement from equilibrium – it sets the **energy**, not the speed**the wave equation**

$$v = f\lambda$$

what sets v the **medium**, not the source – so changing f changes λ , and never v

When a wave crosses into a new medium, **frequency is conserved** and wavelength changes. Getting that the wrong way round inverts every refraction answer.

Exercises 2.1-2.3

2.1 State what a wave transfers and what it does **not** transfer. [2]

2.2 Give one example each of a transverse and a longitudinal wave. [2]

2.3 Define the amplitude of a wave. [1]

Exercises 2.1-2.3

2.1 State what a wave transfers and what it does **not** transfer. [2]

2.1

- it transfers energy; it does not transfer matter
-

2.2 Give one example each of a transverse and a longitudinal wave. [2]

2.2

- transverse: a wave on a string (or light); longitudinal: sound
-

2.3 Define the amplitude of a wave. [1]

2.3

- the maximum displacement of a particle from its rest position

Exercises 3.1-3.2

3.1 A wave transfers

[1]

☐

A matter only

B energy without matter

C both matter and energy equally

D neither

3.2 Sound is an example of a

[1]

☐

A transverse wave

B longitudinal wave

C electromagnetic wave

D standing wave

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3.1 B

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- longitudinal wave.

Exercise 3.3 (a)

3.3 A wave travels along a rope, with the rope moving up and down as the wave moves sideways.

(a) Name this type of wave.

[1]

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[1]

(a)

- a transverse wave

Exercise 3.3 (b)

3.3 A wave travels along a rope, with the rope moving up and down as the wave moves sideways.

(b) State the direction of vibration relative to the direction of travel. [1]

Exercise 3.3 (b)

3.3 A wave travels along a rope, with the rope moving up and down as the wave moves sideways.

(b) State the direction of vibration relative to the direction of travel. [1]

(b)

- perpendicular to the direction of travel

Exercise 3.3 (c)

3.3 A wave travels along a rope, with the rope moving up and down as the wave moves sideways.

(c) Name the quantity equal to the maximum displacement.

[1]

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3.3 A wave travels along a rope, with the rope moving up and down as the wave moves sideways.

(c) Name the quantity equal to the maximum displacement.

[1]

(c)

- the amplitude