



Essential Pre-Uni Physics D5.5



You must give a unit in all of your numeric answers in order to obtain the mark.

Part A Distance from nodes to antinodes

Two waves of amplitude 4.0 cm and frequency 14 Hz are moving in opposite directions at 5.6 m s^{-1} along a stretched string. If a standing wave were formed, how far apart would you expect the antinodes to be from the nodes on either side of them?

Part B Minimum length of the string

If the string had two fixed ends, what is the minimum length it must be in order for a standing wave to be possible?

Part C A string of length 0.70 m

If the string had two fixed ends and was 0.70 m long, why would no standing wave be formed?

- ☐ Both ends cannot be nodes as the internodal distance is 0.20 m, so no standing wave can form.
- ☐ The wavelength of the standing wave is greater than 0.70 m.
- ☐ If the string was 0.70 m long then both ends would be antinodes, which is not possible if both ends are fixed.



Essential Pre-Uni Physics D5.6

A Level



You must give a unit in all of your numeric answers in order to obtain the mark. The speed of sound in air is 330 m s^{-1} .

Part A Lowest frequency

A wind instrument is 60 cm long, and can be modelled as a tube with one closed end and one open end. What is the lowest frequency that can be played on this instrument?

Part B Second-lowest frequency

If a note of the second-lowest possible frequency were played on the instrument, state the positions of the nodes (measured as distances from the closed end of the tube).

- ☐ One at the closed end, another 40 cm from the closed end.
- ☐ One 20 cm from the closed end, another 40 cm from the closed end.
- ☐ One at the closed end, another 20 cm from the closed end and another 40 cm from the closed end.

Part C Third-lowest frequency

State the positions of the nodes if a note of the third-lowest possible frequency were played.

- ☐ One at closed end, another 24 cm from the closed end and the last 48 cm from the closed end.
- ☐ One at 30 cm from the closed end.
- ☐ One at closed end, another 20 cm from the closed end and the last 40 cm from the closed end.



Essential Pre-Uni Physics D8.8



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Refractive index of crown glass: 1.51

Refractive index of flint glass: 1.61

Refractive index of water: 1.34

Refractive index of cubic zirconia: 2.16

Refractive index of diamond: 2.42

Take the refractive index of air to be 1.00.

The critical angle for light passing from flint glass into ethanol is 57.6° . Calculate the refractive index of ethanol. Give your answer to three significant figures.



Essential Pre-Uni Physics D3.1



Calculate the values indicated in the table. The speed of sound in air is 330 m s^{-1} . All phases should be given as $< 360^\circ$ and path differences should be < 1 wavelength.

| Wavelength | Path difference | Phase difference | Fully constructive interference (Y/N) | Fully destructive interference (Y/N) |
|------------|-----------------|------------------|---------------------------------------|--------------------------------------|
| 320mm | 160mm | (a) | (b) | (c) |

Part A Phase difference

a) What is the phase difference in degrees?

Part B Fully constructive interference

b) Fully constructive interference?

☐ Yes

☐ No

Part C Fully destructive interference

c) Fully destructive interference?

☐ Yes

☐ No



Essential Pre-Uni Physics D1.7

GCSE A Level



Part A Light intensity at 12 m

The light from a bulb shines equally in all directions. If 20 W of light is given off, what will the intensity be 12 m from the lamp to 2 significant figures? (Consider the shape of the region illuminated if the light hits this surface after travelling 12 m in all directions.)

Part B Light intensity at 24 m

What would the answer be at a distance of 24 m, to 2 significant figures?



Essential Pre-Uni Physics D4.4



A slide looks like it has one fine transparent line ruled on a black background. In fact there are two lines very close together. When red light (633 nm) is shone through it, and a screen is placed 5.0 m away from the slits, ten fringe-spacings measure 5.3 cm . Calculate the separation of the slits on the slide.



Essential Pre-Uni Physics D3.8

A Level



Two speakers are set up 13.5 m apart in an auditorium, pointing at each other. A pure sound of frequency 256 Hz is being played through them. You may assume that the phase difference of the signals as they arrive at the speakers is 0° . A person is standing on the line joining the speakers, 0.25 m from the mid point.

The speed of sound in air is 330 m s^{-1} .

Part A Phase difference

Calculate the phase difference as it would be detected by the person.

Part B Silence

The person moves to the mid point between the speakers (where the sound is loudest due to constructive interference), and then walks towards one speaker until the sound waves cancel out. How far do they walk until they find this point of near silence?



Essential Pre-Uni Physics D8.2



Physical constants which may be necessary to answer the problems on this page can be found within the hint tabs.

Refractive index of crown glass: 1.51

Refractive index of flint glass: 1.61

Refractive index of water: 1.34

Refractive index of cubic zirconia: 2.16

Refractive index of diamond: 2.42

Take the refractive index of air to be 1.00.

Complete the table to show the missing angles. In some cases, refraction is impossible. **In these cases give your answer as "99" with the unit "none".**

Consider all angles to have been given to 2 significant figures.

| Light passing from ... | | ...to | |
|------------------------|------------------------|-------------|-------------------------|
| Material | Angle of Incidence / ° | Material | Angle of Refraction / ° |
| Crown Glass | 50 | Air | (a) |
| Crown Glass | 40 | Water | (b) |
| Crown Glass | 50 | Flint Glass | (c) |

Part A Crown glass to air

| Light passing from ... | | ...to | |
|------------------------|------------------------|----------|-------------------------|
| Material | Angle of Incidence / ° | Material | Angle of Refraction / ° |
| Crown Glass | 50 | Air | (a) |

a) What is the angle of refraction in degrees?

Part B Crown glass to water

| Light passing from ... | | ...to | |
|------------------------|------------------------|----------|-------------------------|
| Material | Angle of Incidence / ° | Material | Angle of Refraction / ° |
| Crown Glass | 40 | Water | (b) |

b) What is the angle of refraction in degrees?

Part C Crown glass to flint glass

| Light passing from ... | | ...to | |
|------------------------|------------------------|-------------|-------------------------|
| Material | Angle of Incidence / ° | Material | Angle of Refraction / ° |
| Crown Glass | 50 | Flint Glass | (c) |

c) What is the angle of refraction in degrees?



Essential Pre-Uni Physics D4.2



Complete the questions in the table:

| Wavelength | Slit separation | Order of interference n | Angle to 'straight through direction' |
|---------------------------------|-----------------|---------------------------|---------------------------------------|
| 633 nm | 0.10 mm | 2 | (a) |
| 530 nm | 600 lines/mm | 1 | (b) |
| (c) | 1000 lines/mm | 1 | 10° |
| $1.0 \times 10^{-11} \text{ m}$ | (d) | 3 | 20° |

Part A Angle

| Wavelength | Slit separation | Order of interference n | Angle to 'straight through direction' |
|------------|-----------------|---------------------------|---------------------------------------|
| 633 nm | 0.10 mm | 2 | (a) |

a) Angle to 'straight through' direction to 2 significant figures?

Part B Angle

| Wavelength | Slit separation | Order of interference n | Angle to 'straight through direction' |
|------------|-----------------|---------------------------|---------------------------------------|
| 530 nm | 600 lines/mm | 1 | (b) |

b) Angle to 'straight through' direction to 3 significant figures?

Part C Wavelength

| Wavelength | Slit separation | Order of interference n | Angle to 'straight through direction' |
|------------|-----------------|---------------------------|---------------------------------------|
| (c) | 1000 lines/mm | 1 | 10° |

c) Wavelength?

Part D Slit separation

| Wavelength | Slit separation | Order of interference n | Angle to 'straight through direction' |
|---------------------------------|-----------------|---------------------------|---------------------------------------|
| $1.0 \times 10^{-11} \text{ m}$ | (d) | 3 | 20° |

d) Slit separation in m?



Essential Pre-Uni Physics D2.2



For each polariser, the angle given is the one for which light is transmitted and is given clockwise from the vertical.

Unpolarised light of intensity 4.0 W m^{-2} is incident on a polariser placed at 15° to the vertical. State the intensity of the transmitted light.
