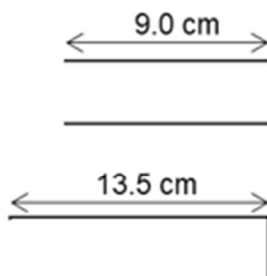


- 1 Two tubes of different length are used for an experiment. The 9.0 cm tube has both ends open while the 13.5 cm tube has one end open and one end closed as shown.



Sound is projected into both tubes. Assuming sound travels at 330 m s^{-1} , at which frequency will resonance occur in both tubes?

- A** 5.50 kHz **B** 7.33 kHz **C** 7.94 kHz **D** 11.0 kHz

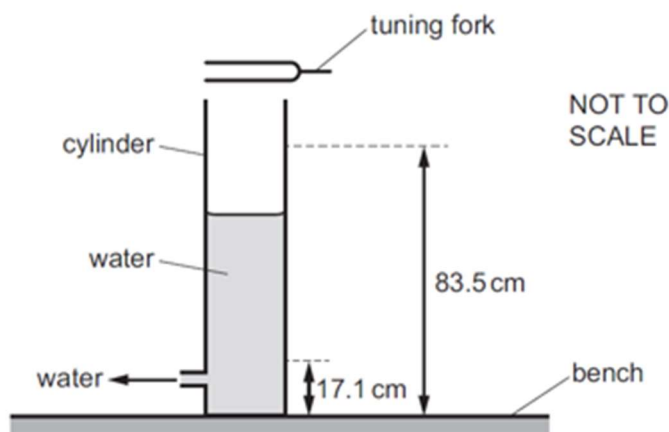
- 2 Monochromatic light of wavelength λ is incident on a diffraction grating of x lines per millimetre.

Which row will produce the largest number of maxima emerging from the grating?

	λ / nm	x
A	400	200
B	400	500
C	650	200
D	650	500

-
- 3 The interference patterns from a diffraction grating and a double slit are compared.
- Using the diffraction grating, yellow light of the first order is seen at 30° to the normal to the grating.
- The same light produces interference fringes on a screen 1.0 m from the double slit. The slit separation is 500 times greater than the line spacing of the grating.
- What is the fringe separation on the screen?
- A** 2.5×10^{-7} m
- B** 1.0×10^{-5} m
- C** 1.0×10^{-3} m
- D** 1.0×10^{-1} m
- 4 A double star is at a distance of 20 light years from the Earth. A telescope with a diameter of 3.0 m is used to view the star.
- (A light year is the distance light travels in a vacuum in one year. This is 9.5×10^{15} m.)
- What is the approximate minimum separation between the two stars of the double star that can be detected by the telescope?
- A** 5.0×10^8 m
- B** 1.0×10^9 m
- C** 3.0×10^{10} m
- D** 3.0×10^{11} m
-

- 5 A vibrating tuning fork is held above a glass cylinder filled to the top with water. The water level is steadily lowered. A loud sound is first heard when the water level is 83.5 cm above the bench. The next loud sound is heard when the water level is 17.1 cm above the bench.



Given that the speed of sound in air is 340 m s^{-1} , what is the frequency of the tuning fork?

- | | |
|-----------------|-----------------|
| A 128 Hz | B 256 Hz |
| C 384 Hz | D 512 Hz |

9

A beam of monochromatic light of wavelength 500 nm is incident normally on a diffraction grating. The diffraction grating is placed 1.2 m away from the screen and the horizontal distance between the two second-order maxima is 1.5 m.

What is the number of lines per millimeter of the grating?

- A** 530 lines per mm
- B** 625 lines per mm
- C** 1250 lines per mm
- D** 1740 lines per mm

10

A musical instrument is made using a long tube with a mouthpiece at one end. The other end is open and flared, as shown.

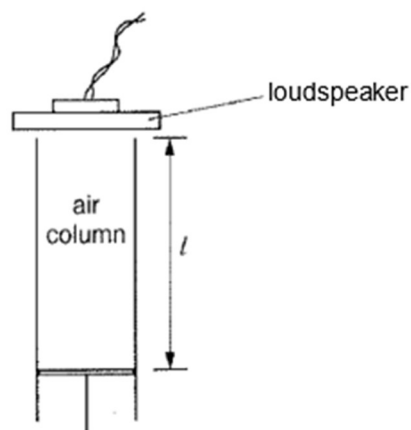


A musician maintains stationary sound waves with a node at the mouthpiece and an antinode at the other end. The lowest frequency of sound that the instrument can produce is 80 Hz.

Which different frequencies of sound can be produced by the instrument?

- A** 80 Hz, 160 Hz, 240 Hz
- B** 80 Hz, 160 Hz, 320 Hz
- C** 80 Hz, 240 Hz, 400 Hz
- D** 80 Hz, 240 Hz, 480 Hz

- 11 A sound wave of a constant wavelength is continuously transmitted from a loudspeaker into an air column. The length l of the air column is slowly increased from zero.

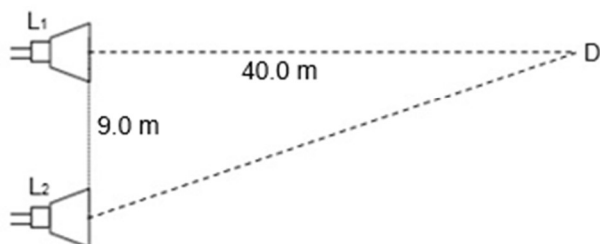


When l reaches certain values, the sound heard from the air column increases greatly. l is found to be 15 cm when the sound increases greatly for the third time.

Assume that the end correction is negligible, what is the wavelength of the sound wave?

- A** 7.5 cm **B** 10 cm **C** 12 cm **D** 20 cm
- 12 Two loudspeakers L_1 and L_2 , placed 9.0 m apart, as shown in the diagram, are driven by a common oscillator.

As the frequency of the oscillator increases from zero, the detector at D, placed 40.0 m directly in front of L_1 , recorded a series of maximum and minimum signals.



If the speed of sound is 330 m s^{-1} , at what frequency is the first minimum detected?

- A** 165 Hz **B** 330 Hz **C** 495 Hz **D** 660 Hz

13

A space shuttle orbits at a height of 330 km above the surface of the Earth. It carries two panels separated by a distance of 24 m. The panels reflect light of wavelength 500 nm towards a telescope on the Earth's surface, which has an aperture diameter of 85 mm.

Which of the following is correct?

	Can the two images be resolved in the telescope?	Angular separation of two sources as measured from aperture / rad
A	Yes	5.9×10^{-6}
B	Yes	7.3×10^{-5}
C	No	5.9×10^{-6}
D	No	7.3×10^{-5}

14

Jupiter's moon Europa is an ideal candidate in the solar system to harbour life. It is at an average distance of 6.3×10^8 km from Earth.

An astronomer builds an optical telescope with a limit of resolution that will allow him to see if there are living creatures on Europa. He estimates that creatures on Europa, should they exist, would have linear dimension of about one metre.

The wavelength of light averages 600 nm.

What is the diameter of the aperture of such a telescope?

- A 3.8×10^{-1} m B 3.8×10^2 m C 3.8×10^5 m D 3.8×10^8 m

15

A strip of wet cardboard is placed inside a microwave oven. The microwave oven is turned on for a short time. When the card is removed, a pattern of dry spots is observed on the cardboard. This is because a standing wave set up inside the oven.

The dry spots are measured and found to occur at 14 mm, 84 mm, 152 mm, 221 mm and 292 mm from one end of the strip.

From this information, what is the frequency of the microwaves?

- A 2.2 GHz B 2.6 GHz C 4.3 GHz D 5.1 GHz

16

Monochromatic light of wavelength 600 nm diffracts through a single slit of width 0.01 mm.

What is the angular width of the central maximum of the diffraction pattern?

- A 0.0034° B 0.0069° C 3.4° D 6.9°

17

In a double-slit interference experiment a pair of slits 0.45 mm apart were placed 0.70 m from the screen. When monochromatic light from a laser was incident normally on the slits, an interference pattern was formed on the screen. The distance between the central bright fringe and the 10th dark fringe was found to be 7.5 mm.

What was the wavelength of the incident light?

- A** 4.6×10^{-7} m **B** 4.8×10^{-7} m **C** 5.1×10^{-7} m **D** 4.8×10^{-6} m

18

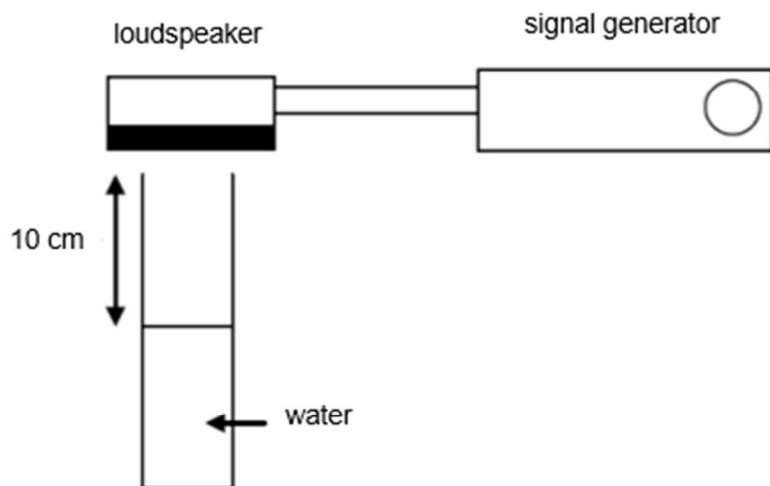
Monochromatic light of wavelength 633 nm is passed through a diffraction grating with 500 lines per mm.

What is the maximum number of intensity maxima that can be observed?

- A** 3 **B** 4 **C** 6 **D** 7

19

The figure below shows an experiment to produce a stationary wave in an air column. A loudspeaker connected to a signal generator, is placed above the column. The frequency of the signal generator is increased gradually from 3000 Hz and two consecutive resonances occur when the frequency of the signal generator is set to 3875 Hz and 5425 Hz respectively. The length of the air column is kept constant at 10 cm throughout the experiment.



Assuming the effects of end correction are negligible, what is the speed of sound in air?

- A** 300 m s^{-1} **B** 310 m s^{-1}
C 330 m s^{-1} **D** 340 m s^{-1}

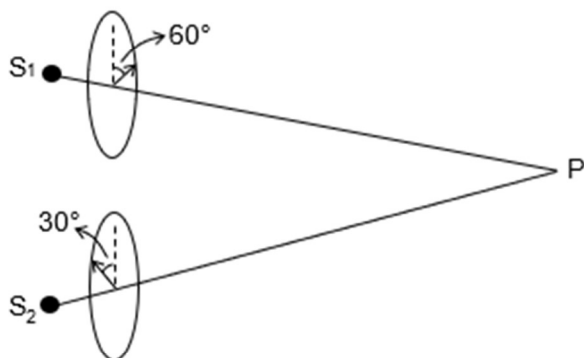
- 20 Which of the following statements about two consecutive antinodes in a stationary wave is false?

- A Their oscillations are in phase with each other.
- B Both particles at the antinodes will pass through their equilibrium positions with same speed.
- C The acceleration of the particles are always equal in magnitude and opposite in direction.
- D Both have maximum energies since the amplitudes of oscillations are maximum.

- 21 S_1 and S_2 produce waves in phase of amplitude A and intensity I that are polarized vertically. S_1P is equal to S_2P .

Waves from S_1 is made to pass through a polariser rotated 60° clockwise.
Waves from S_2 is made to pass through a polariser rotated 30° anticlockwise.

The 2 waves meet at point P.

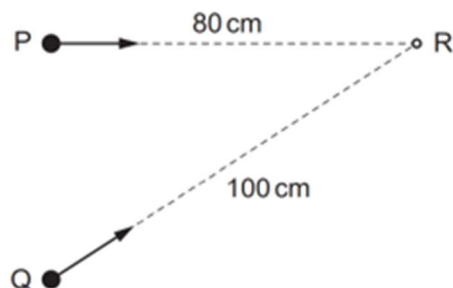


What is the amplitude and intensity of the resultant wave at P?

	resultant amplitude	resultant intensity
A	0	0
B	A	I
C	$1.37 A$	$1.87 I$
D	$2.0 A$	$4.0 I$

22

Two identical waves are produced by sources at points P and Q. The waves travel along different paths to reach point R, as shown.



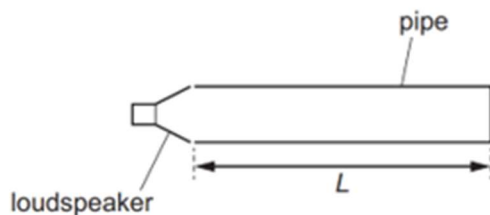
Both waves have a wavelength of 6.0 cm. The waves are in phase at point R.

What is the phase difference between the waves as they leave points P and Q?

- A** 0° **B** 60° **C** 90° **D** 120°

23

A pipe of length L is open at one end and closed at the other end. A loudspeaker is at the open end and emits a sound wave into the pipe.



When a stationary wave is formed, there is an antinode at the open end of the pipe.

Which wavelength of sound could be used to produce a stationary wave?

- A** $\frac{2L}{3}$ **B** L **C** $\frac{4L}{3}$ **D** $2L$

24

To be able to resolve a grain of green colour sand of radius 50 μm , the maximum distance that your eye can be positioned is 19 cm away from the grain.

What is the maximum distance for your eye to be able to resolve a blue colour grain of sand?

- A** The new distance is smaller than 19 cm.
B The distance remains the same.
C The new distance is larger than 19 cm.
D The blue grain of sand cannot be resolved.

25

A satellite orbiting at a height of 500 km above the surface of the Earth, has two reflecting panels separated by a distance of 5.00 m. The panels reflect light of wavelength 500 nm towards an observer on the Earth's surface.

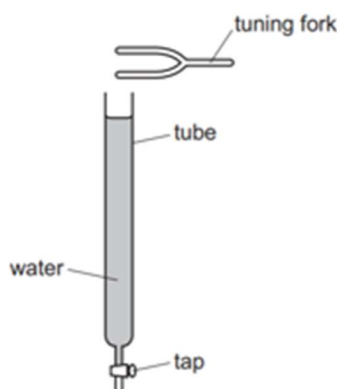
The observer views the panels with a telescope that has an aperture diameter of 10.0 cm. Assume that the panels act as point sources of light for the observer.

Which of the following is correct?

Will the two images seen by the observer be resolved?	Angular separation of two sources as measured from aperture / rad
A Yes	2.50×10^{-6}
B Yes	1.00×10^{-5}
C No	2.50×10^{-6}
D No	5.00×10^{-6}

26

A long tube, filled with water, has a tap fitted at its base, as shown. A tuning fork is sounded above the tube and the water is allowed to run gradually out of the tube.



A loud sound is heard at intervals as water runs out of the tube. The change in water level between loud sounds is 32 cm. What is the wavelength of the sound in the tube?

- A 16 cm B 32 cm C 64 cm D 128 cm

27

Light of wavelength λ is incident normally on a diffraction grating for which the slit spacing is 3.9λ . What is the maximum number of diffracted images?

- A 3 B 6 C 7 D 9

H2 Physics Revision

Topic : Superposition

Multiple Choice Questions

Name: _____