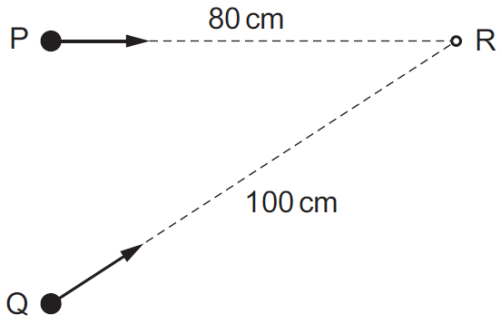
Waves – 2021 AS

1. June/2021/Paper_11/No.21

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?

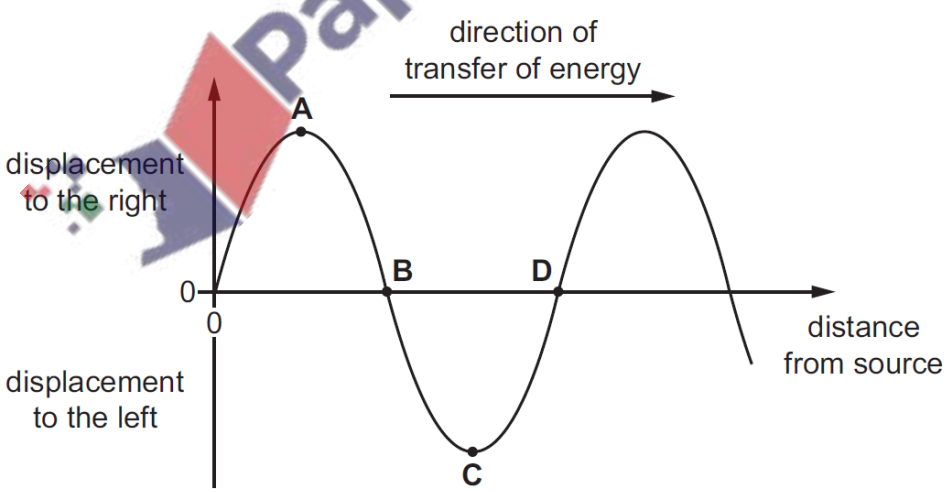
A 0° **B** 60° **C** 90° **D** 120°

2. June/2021/Paper_11/No.22

A longitudinal wave travelling from left to right has vibrations parallel to the direction of transfer of energy by the wave.

The wave can be represented on a graph showing the variation with distance of the displacement of the particles from their equilibrium positions at one instant.

Which point on the graph is the centre of a compression?



3. June/2021/Paper_11/No.24

An ambulance has a siren that emits sound of a constant frequency. The ambulance is moving directly towards a stationary observer.

The ambulance decelerates as it is approaching the observer and then accelerates after it has passed the observer.

How does the frequency of the sound heard by the observer change as the ambulance is approaching and as it is moving away from the observer?

	approaching observer	moving away from observer
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

4. June/2021/Paper_11/No.25

Microwaves in a vacuum travel at speed X and have wavelength of order of magnitude Y.

What are the speed and a possible order of magnitude of wavelength of X-rays in a vacuum?

	speed	wavelength
A	X	$10^{-8}\,Y$
B	X	$10^{-4}\,Y$
C	$10^{4}\,X$	Y
D	$10^{8}\,X$	Y

5. June/2021/Paper_12/No.21

Two lasers emit light in a vacuum. One laser emits red light and the other emits green light.

Which property of the light from the two lasers **must** be different?

A amplitude

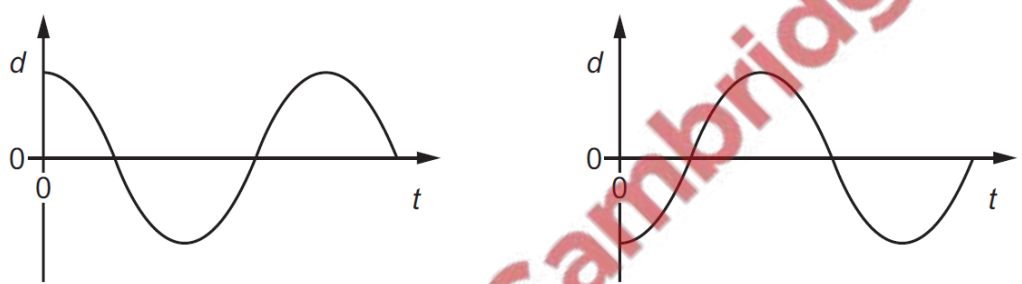
B frequency

C intensity

D speed

6. June/2021/Paper_12/No.22

Two particles in a progressive wave are a distance 10 cm apart. The two graphs show the variation with time *t* of the displacement *d* of the two particles.



What could be represented by the two graphs?

A particles in a longitudinal wave with a compression and the nearest rarefaction separated by 10 cm

B particles in a longitudinal wave with a compression and the nearest rarefaction separated by 20 cm

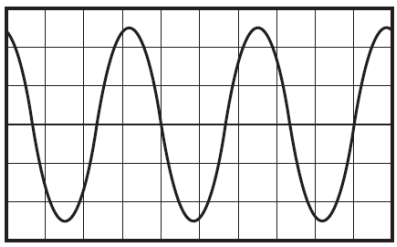
C particles in a transverse wave with a peak and the nearest trough separated by 20 cm

D particles in a transverse wave with two adjacent peaks separated by 10 cm

7. June/2021/Paper_12/No.23

A sound wave is detected by a microphone that is connected to a cathode-ray oscilloscope (CRO).

The screen of the CRO displays a waveform, as shown.



The time-base is set to 20 μs div^{-1}.

What is the frequency of the sound wave?

A 15 Hz **B** 15 000 Hz **C** 20 000 Hz **D** 30 000 Hz

8. June/2021/Paper_12/No.24

A person stands at the side of a straight railway track. A train moves towards the person and emits sound from its whistle. The person hears a sound of frequency 1690 Hz as the train approaches him.

The person then hears sound of frequency 1500 Hz as the train moves away from him. The speed of sound in air is 340 m s^{-1}.

What is the speed of the train?

A 20 m s^{-1} **B** 38 m s^{-1} **C** 41 m s^{-1} **D** 43 m s^{-1}

9. June/2021/Paper_12/No.25

Which list shows electromagnetic waves in order of decreasing frequency?

A gamma-rays → infrared → ultraviolet → radio waves

B gamma-rays → ultraviolet → infrared → radio waves

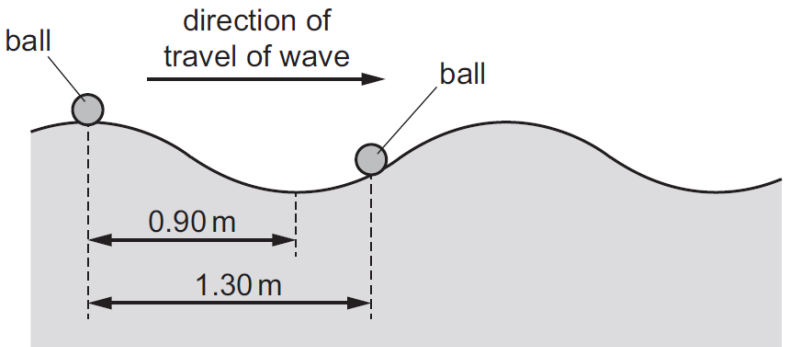
C radio waves → infrared → ultraviolet → gamma-rays

D radio waves → ultraviolet → infrared → gamma-rays

10. Nov/2021/Paper_11/No.21

Two balls float on the surface of the sea. The balls are separated by a distance of 1.30 m.

A wave travels on the surface of the sea so that the balls move vertically up and down.



NOT TO SCALE

The distance between a crest and an adjacent trough of the wave is 0.90 m.

What is the phase difference between the two balls?

A 55° **B** 110° **C** 160° **D** 260°

11. Nov/2021/Paper_11/No.22

Which statement about transverse or longitudinal waves is **not** correct?

A Longitudinal waves can be used to demonstrate diffraction.

B Longitudinal waves can travel in a vacuum.

C Transverse waves can form stationary waves.

D Transverse waves can transfer energy.

12. Nov/2021/Paper_11/No.24

With which waves can the Doppler effect be observed?

A all waves including sound and light

B light waves only

C sound and light waves only

D sound waves only

13. Nov/2021/Paper_11/No.25

Which radiation could consist of waves of wavelength 0.5 nm?

A γ-rays

B ultraviolet

C visible light

D X-rays

14. Nov/2021/Paper_12/No.23

The table contains descriptions and examples of waves.

Which row is correct?

	description of wave	example
A	oscillations are parallel to the direction of energy transfer	gamma-rays
B	oscillations are parallel to the direction of energy transfer	ultraviolet waves
C	oscillations are perpendicular to the direction of energy transfer	sound waves
D	oscillations are perpendicular to the direction of energy transfer	X-rays

15. Nov/2021/Paper_12/No.25

A train travels in a straight line at a constant speed of 30 m s^{-1}. The train's horn continuously emits sound of frequency 2400 Hz.

A stationary observer stands next to the train track. The train approaches the stationary observer, passes him and then moves away.

The speed of sound is 340 m s^{-1}.

What is the maximum difference in the frequencies of the sound heard by the stationary observer?

A 190 Hz **B** 230 Hz **C** 430 Hz **D** 460 Hz

16. Nov/2021/Paper_12/No.26

Electromagnetic waves of frequency 30 THz are in a vacuum.

In which region of the electromagnetic spectrum are the waves?

A infrared

B microwave

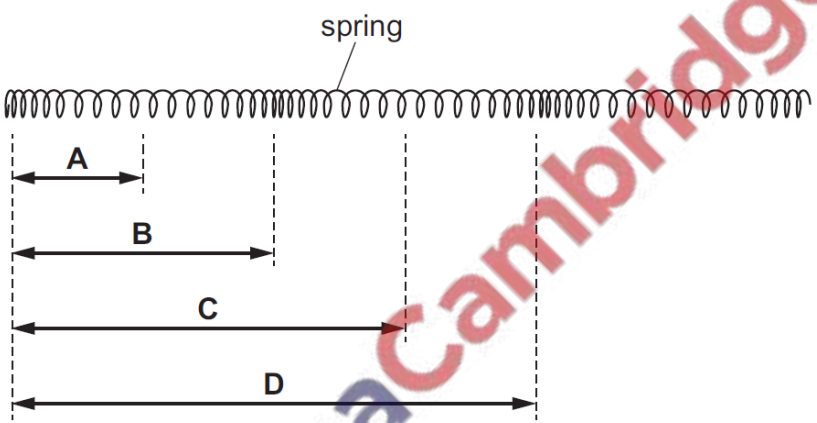
C ultraviolet

D visible light

17. Nov/2021/Paper_13/No.22

A longitudinal wave travels through a long spring. The spring is shown at one instant.

What is the wavelength of the wave?



18. Nov/2021/Paper_13/No.23

Which statement about waves is correct?

A Both longitudinal and transverse waves can travel through a vacuum.

B Both longitudinal and transverse waves transfer matter.

C Longitudinal progressive waves consist of alternate nodes and antinodes.

D The particles of a transverse wave vibrate perpendicular to the direction of energy propagation.

19. Nov/2021/Paper_13/No.25

A train travels at constant speed along a straight track. The train's horn emits sound of frequency 500 Hz.

A person standing by the side of the track hears sound of frequency 450 Hz.

The speed of sound in air is 340 $m\,s^{-1}$.

What is the speed of the train and in which direction is it travelling relative to the person?

	speed / $m\,s^{-1}$	direction
A	34	away from the person
B	34	towards the person
C	38	away from the person
D	38	towards the person

20. Nov/2021/Paper_13/No.26

A smooth surface has bumps on the surface that are smaller than the wavelength of visible light.

What is the approximate maximum size of the largest bumps on the surface?

A 20 nm **B** 350 nm **C** 720 nm **D** 5.0 μm