

Past-paper walk-through

Transverse and longitudinal waves ■ 7.2

eXercise

Questions in this set

- 9702/11 N25 Q24 ■ 1 mark
- 9702/11 N25 Q25 ■ 1 mark
- 9702/12 N25 Q24 ■ 1 mark
- 9702/11 J25 Q25 ■ 1 mark
- 9702/12 J25 Q25 ■ 1 mark
- 9702/12 J25 Q28 ■ 1 mark
- 9702/14 J25 Q21 ■ 1 mark

Question 24

9702/11 N25 ■ Q24 ■ 1 mark

24 Which row is correct for sound waves?

	can travel in a vacuum	can be polarised	can diffract through a gap
A	no	no	yes
B	yes	no	no
C	no	yes	no
D	no	yes	yes

Question 24



Solution 24

Answer: **A**

Why

- Sound needs a medium, so it cannot cross a vacuum.
- It is longitudinal, so it cannot be polarised.
- Diffraction happens for every wave, which is why you can hear round a corner.

Question 25

9702/11 N25 ■ Q25 ■ 1 mark

A source emits a progressive sound wave in the horizontal direction. The wave travels away from the source in a direction towards the right.

The graph shows the variation of the displacement of the particles from their equilibrium positions with distance from the source at a particular instant in time.

Displacements to the right of the equilibrium positions are shown as positive.

Position Y represents the displacement of a particle in the sound wave at a particular distance from the source at this instant.

Which statement about the motion of this particle is correct?

[1]

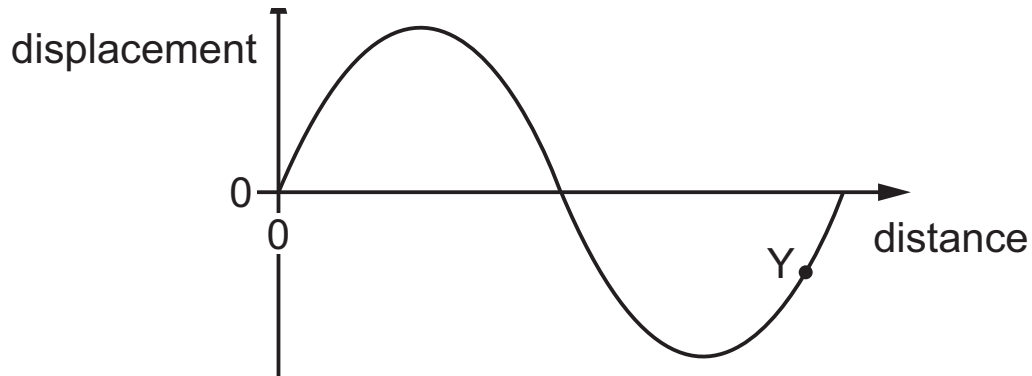
A The particle is moving away from the source.

B The particle is moving towards the source.

Question 25

- C** The particle is moving upwards.
- D** The particle is moving downwards.

Question 25



Solution 25

- A The particle is moving away from the source.
- B The particle is moving towards the source. 
- C The particle is moving upwards.
- D The particle is moving downwards.

Why

- Sound is longitudinal, so the particles move back and forth along the direction of travel – never up or down, which rules out C and D.
- The wave moves away from the source, so each particle next takes the displacement currently held by the particle behind it.
- At Y that makes the displacement more negative, so the particle is heading back towards the source.

Question 24

9702/12 N25 ■ Q24 ■ 1 mark

24 Which row describes a progressive longitudinal wave?

	transfers energy in a direction parallel to the oscillations	requires a medium to travel through	always travels at the same speed
A	false	false	true
B	false	true	true
C	true	false	false
D	true	true	false

Question 24



Solution 24

Answer: **D**

Why

- In a longitudinal wave the oscillations are along the direction of travel, so the energy does travel parallel to them – true.
- Sound is longitudinal and needs a medium; there is no longitudinal wave in free space – true.
- The speed depends on the medium, much faster in steel than in air, so the third statement is false.

Question 25

9702/11 J25 ■ Q25 ■ 1 mark

Which statement about longitudinal and transverse wave motion for a progressive wave is correct? [1]

- A** All transverse and longitudinal waves require a medium for propagation.
- B** All transverse waves travel at the same speed, but longitudinal waves can travel at different speeds.
- C** In both transverse waves and longitudinal waves, a particle with zero displacement has a maximum speed.
- D** In a longitudinal wave there is a net movement of particles in the direction of travel of the wave, but there is no net movement of particles in a transverse wave.

Solution 25

- A** All transverse and longitudinal waves require a medium for propagation.
- B** All transverse waves travel at the same speed, but longitudinal waves can travel at different speeds.
- C** In both transverse waves and longitudinal waves, a particle with zero displacement has a maximum speed. 
- D** In a longitudinal wave there is a net movement of particles in the direction of travel of the wave, but there is no net movement of particles in a transverse wave.

Why

- A particle at zero displacement is passing through its equilibrium position, where it moves fastest.
- That is true of any oscillating particle, transverse or longitudinal.
- A fails for electromagnetic waves, B is simply false, and in a wave there is no *net* movement of particles.

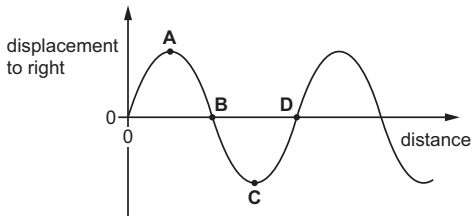
Question 25

9702/12 J25 ■ Q25 ■ 1 mark

25 A sound wave travels from the left to the right.

The graph shows the variation of the displacement to the right of particles in the sound wave with distance, at one instant.

Which letter represents the centre of a compression?



Question 25

Solution 25

Answer: **B**

Why

- A compression is where the particles crowd together: those behind it are displaced forwards and those ahead are displaced backwards.
- On a graph of displacement-to-the-right that is a zero crossing running from positive down to negative.
- The peaks and troughs of the curve are where particles are furthest from equilibrium, not where the air is densest.

Question 28

9702/12 J25 ■ Q28 ■ 1 mark

Which statement compares the behaviour of transverse and longitudinal waves? [1]

A Only longitudinal waves can be diffracted.

B Only longitudinal waves can travel in free space.

C Only transverse waves can be coherent.

D Only transverse waves can be polarised.

Solution 28

- A Only longitudinal waves can be diffracted.
- B Only longitudinal waves can travel in free space.
- C Only transverse waves can be coherent.
- D Only transverse waves can be polarised.



Why

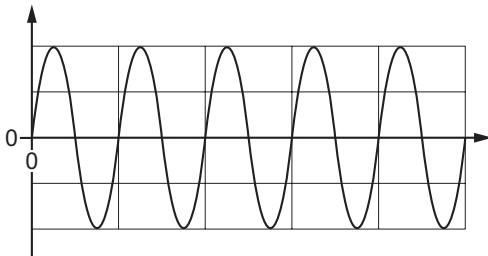
- Polarisation confines the oscillation to one plane, which only means something if the oscillation is across the direction of travel.
- Longitudinal oscillations are along the direction of travel, so there is no plane to restrict.
- Diffraction and interference occur for both, and it is light – transverse – that crosses free space.

Question 21

9702/14 J25 ■ Q21 ■ 1 mark

21 A progressive longitudinal wave is travelling horizontally from left to right.

A graphical representation of the wave at one instant in time is shown.



Question 21

Which row could give the correct labels for the x-axis and y-axis of this graph?

	x-axis	y-axis
A	distance	displacement of particles to the right
B	distance	displacement of particles upwards
C	time	displacement of particles to the right
D	time	displacement of particles upwards

Question 21

Solution 21

Answer: **A**

Why

- In a longitudinal wave the particles oscillate along the direction of travel, so their displacement is to the left or right.
- A snapshot “at one instant in time” is plotted against distance, not against time.
- So the axes are distance and displacement of particles to the right.