Past-paper walk-through

General properties of waves ▪ 3.1

eXercise

Questions in this set

- 0625/21 N25 Q18 ▪ 1 mark
- 0625/22 N25 Q17 ▪ 1 mark
- 0625/21 J25 Q17 ▪ 1 mark
- 0625/21 J24 Q16 ▪ 1 mark
- 0625/41 J24 Q5 ▪ 8 marks
- 0625/21 N23 Q17 ▪ 1 mark
- 0625/21 N23 Q18 ▪ 1 mark
- 0625/21 J23 Q17 ▪ 1 mark

Reading the mark scheme

- **B1** a mark that stands on its own – the point is either made or not.
- **M1** a *method* mark: the right approach, even if the number is wrong.
- **A1** an *answer* mark, and it usually needs its M mark first.
- **C1** a working mark on the way to the answer.
- // separates answers the examiner accepts equally.
- **ecf** = error carried forward: a later part is marked on your own earlier answer.
- **owtte** = "or words to that effect" – the wording need not match.

Question 18

0625/21 N25 ▪ Q18 ▪ 1 mark

18 Parallel waves in a ripple tank are diffracted as they pass through a gap in a barrier.

Three changes that can be made to this arrangement are listed.

1 Decrease the wavelength of the waves.

2 Increase the amplitude of the waves.

3 Decrease the size of the gap.

Which changes will cause the shape of the diffracted waves to be less curved?

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

Solution 18

Answer: **C**

Why

- A wave spreads most at a gap when its wavelength is close to the gap width.
- So the spreading increases if the wavelength is made *larger* or the gap is made *narrower*.
- Decreasing the wavelength, or widening the gap, both reduce the diffraction.

Question 17

0625/22 N25 ▪ Q17 ▪ 1 mark

17 An earthquake-monitoring station records the arrival of 16 complete wavelengths of an earthquake wave in a time of 20 s.

The speed of the earthquake wave is 6.0 km / s.

What is the wavelength of the earthquake wave?

A 1.3×10^{-4} m **B** 2.1×10^{-4} m **C** 4.8×10^{3} m **D** 7.5×10^{3} m

Solution 17

Answer: **D**

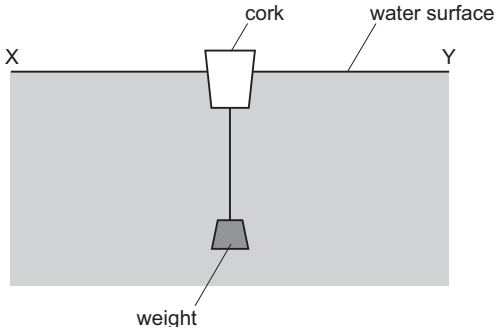
Why

- 16 complete waves arriving in 20 s gives $f = 16/20 = 0.80$ Hz.
- $\lambda = v/f$, with $v = 6.0$ km/s $= 6000$ m/s.
- $\lambda = 6000/0.80 = 7500$ m, that is 7.5 km.

Question 17

0625/21 J25 ▪ Q17 ▪ 1 mark

17 The diagram shows a cork with a weight attached so that the cork floats upright in water.



Question 17

Transverse waves travel across the water from X to Y.

In which direction do the waves make the cork move?

A $\rightarrow \leftarrow$ right and left

B $\uparrow\downarrow$ up and down

C $\rightarrow$ only to the right

D $\leftarrow$ only to the left

Solution 17

Answer: **B**

Why

- In a transverse wave the particles oscillate at right angles to the direction of travel.
- The waves travel horizontally, from X to Y.
- So the cork bobs vertically, up and down – it does not travel across with the wave.

Question 16

0625/21 J24 ▪ Q16 ▪ 1 mark

16 Which statement about waves is correct?

A Waves do not transfer either energy or matter.

B Waves transfer both energy and matter.

C Waves transfer energy without transferring matter.

D Waves transfer matter without transferring energy.

Solution 16

Answer: **C**

Why

- A wave carries energy from one place to another.
- The particles of the medium oscillate about fixed positions but do not travel with the wave.
- So a wave transfers energy without transferring matter.

Question 5

0625/41 J24 ▪ Q5 ▪ 8 marks

5 **(a)** Describe how a longitudinal wave differs from a transverse wave.

Question 5

(b) Fig. 5.1 represents a seismic wave produced by an earthquake.

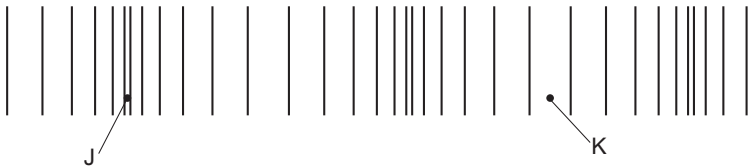


Fig. 5.1

(i) State whether this seismic wave is a P-wave (primary) or an S-wave (secondary). Justify your choice.

Question 5

(ii) The wave represented in Fig. 5.1 has a wavelength of 1.2×10^4 m.

Calculate the actual distance between point J and point K.

Question 5

(iii) The wave in **(ii)** travels through the ground at a speed of 4600 m / s.

As the wave passes a certain point, the ground completes 5 oscillations.

Calculate the time that it takes for the wave to pass. Show your working.

Question 5

[Total: 8]

Solution 5

(a) Mark scheme

- any two from:
- ▪
- (longitudinal) vibration / oscillation in wave parallel to propagation direction / direction of travel
- ▪
- transverse wave vibrates / oscillates perpendicular to propagation direction / direction of travel
- ▪

Solution 5

- (longitudinal) consists of compressions and rarefactions
- ▪
- transverse wave consists of crests / peaks and troughs
- ▪
- (longitudinal) needs a medium (to travel)

Solution 5

(b)(i)

Mark scheme

- P-wave AND it is longitudinal

(b)(ii)

Mark scheme

- 1.8×104 m OR 18 km
- 1.5 OR $1.5 \times 1.2 \times 104$ OR 1.8×10N

Solution 5

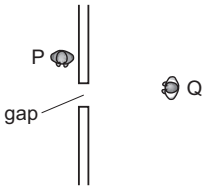
(b)(iii) Mark scheme

- v = f OR v= / t OR (t =) / v OR f =
- 4
- 4600 / 1.2
- 10
- ×
- OR (t / 5 =) 1.2 × 104 / 4600 OR (t =) 6(.0) × 104 / 4600
- 13 s
- t = 1 / f OR (time for one wave =) 2.6 (s)

Question 17

0625/21 N23 ▪ Q17 ▪ 1 mark

17 Two men, P and Q, stand close to a gap in a wall, as shown. Man P cannot see man Q but man P can hear man Q speaking.



Which statement explains this?

A Light waves do not diffract at all because they are electromagnetic waves.

B Light waves have a range of frequencies but sound has just one frequency.

Question 17

C Sound waves are of a higher frequency than light waves.

D Sound waves diffract a lot because their wavelength is a similar size to the width of the gap.

Solution 17

Answer: **D**

Why

- Both light and sound diffract at a gap, so “light does not diffract at all” is wrong.
- How much a wave spreads depends on its wavelength compared with the gap width.
- Sound’s wavelength is comparable to the gap so it spreads widely; light’s is far smaller, so it barely spreads.

Question 18

0625/21 N23 ▪ Q18 ▪ 1 mark

18 Which quantities relating to a wave on the surface of water can **both** be measured in metres?

A amplitude and frequency

B amplitude and wavelength

C amplitude and wave speed

D frequency and wavelength

Solution 18

Answer: **B**

Why

- Amplitude is a distance – the height of a crest above the middle.
- Wavelength is also a distance – from one crest to the next.
- So both are measured in metres; frequency is in hertz and wave speed in m/s.

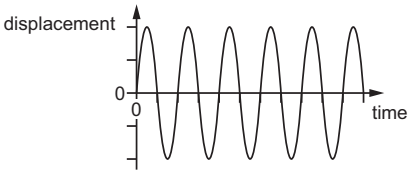
Question 17

0625/21 J23 ▪ Q17 ▪ 1 mark

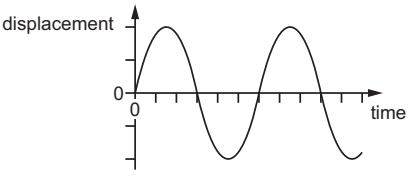
17 The diagrams show graphs of displacement against time for four waves. All the graphs are drawn to the same scale.

Which wave has the largest amplitude and the highest frequency?

A



B



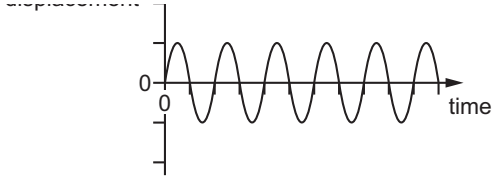
C

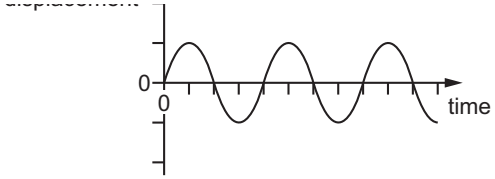
displacement

D

displacement

Question 17





Solution 17

Answer: **A**

Why

- Amplitude is the height from the middle line up to a crest.
- Frequency is how many complete cycles fit into the same time, so more cycles means a higher frequency.
- All four graphs share one scale, so pick the tallest wave that also fits the most cycles across.