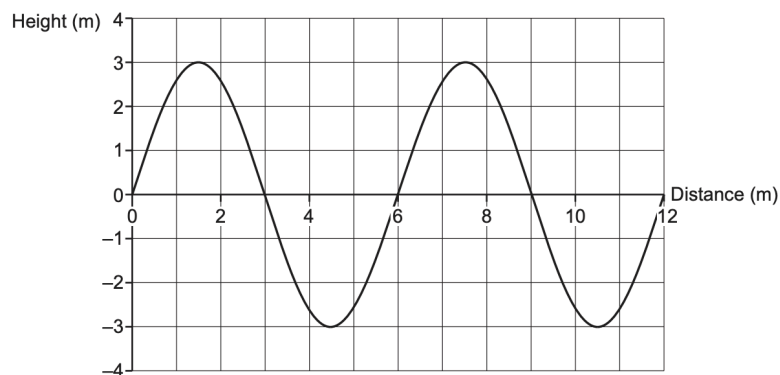


## Wave Behaviour

### Q1.a(2018)

The graph shows how the height of a water wave changes with distance.



(a) The water wave has a wavelength of 6 m.

Describe how the graph shows this.

.....  
..... [1]

### Q1.b(2018)

The frequency of the water wave is 0.5 Hz.

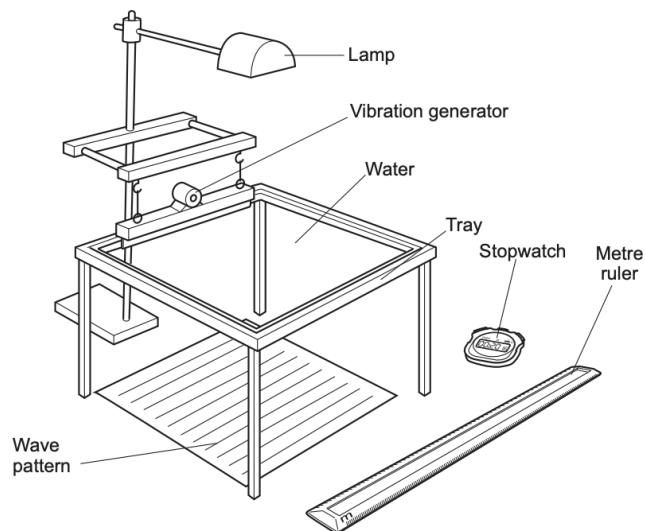
Calculate the speed of this water wave.

Answer = ..... m/s [3]

### Q2.(2018)

A group of students use a ripple tank, a metre ruler and a stopwatch.

They draw a diagram of this equipment.



Explain how this equipment is used to measure the frequency of water waves.

.....

.....

.....

..... [2]

### Q3.a(2019)

A student refracts light with a rectangular glass block.

He looks for a relationship between angle of incidence and angle of refraction.

(a) Suggest how the student completes this experiment and the apparatus he uses.

.....

.....

.....

..... [2]

### Q3.b(2019)

(b) The student needs to write a risk assessment for the experiment.

Complete the table to give **one** risk, the hazard it could cause and a control measure for the risk.

| Risk | Hazard | Control measure |
|------|--------|-----------------|
|      |        |                 |

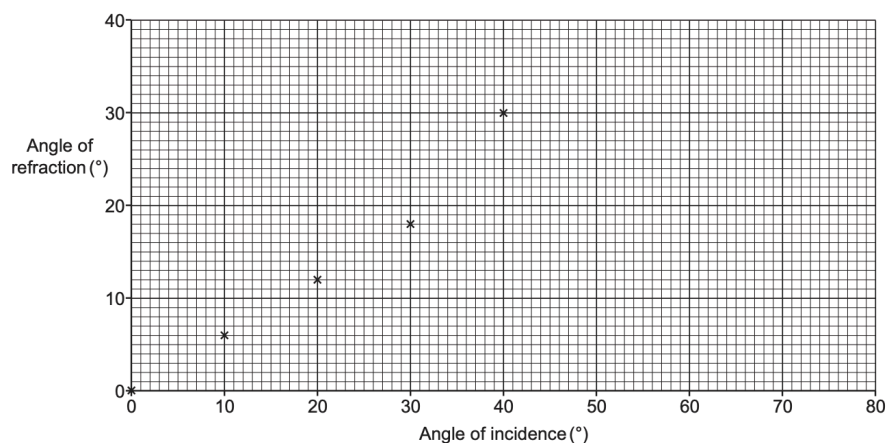
[2]

Q3.c(2019)

The table shows the results from the experiment.

| Angle of incidence (°) | Angle of refraction (°) |
|------------------------|-------------------------|
| 0                      | 0                       |
| 10                     | 6                       |
| 20                     | 12                      |
| 30                     | 18                      |
| 40                     | 30                      |
| 50                     | 28                      |
| 60                     | 32                      |
| 70                     | 35                      |

- (i) Plot the results from the table on the axes below and draw a curve of best fit.  
The first five points have already been plotted for you.



[2]

### Q3.d(2019)

What could the student conclude from the graph?

.....  
 .....  
 .....  
 ..... [2]

### Q3.e(2019)

The angle of refraction at  $40^\circ$  is incorrect.

Use the curve of best fit on the graph to estimate the actual angle of refraction at  $40^\circ$ .

..... [1]

### Q3.f(2019)

Another student uses red light in the experiment.

She then repeats the experiment with blue light.

Describe and explain the difference in the refraction of the red light and blue light.

.....  
 .....  
 .....  
 .....  
 ..... [2]

### Q4.(2020)

In glass, violet light refracts more than red light as it passes from air into glass.

Which statement explains why?

- A Red light has a shorter wavelength.
- B Red light slows down more than violet light.
- C Violet light has a longer wavelength.
- D Violet light slows down more than red light.

Your answer ☐

[1]

### Q5.(2020)

This question is about sound, light and water waves.

(a) State **one** difference between sound waves and light waves.

.....  
..... [1]

### Q6.a(2020)

In Fig. 13.1, a student makes waves in a tray of water. He places a cork at position A.

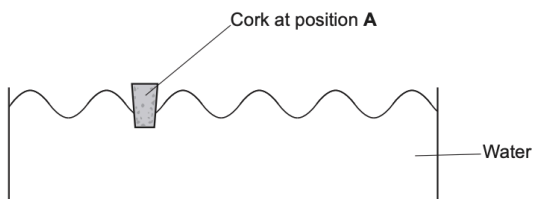


Fig. 13.1

(i) Fig. 13.2 shows a free-body force diagram for the cork.

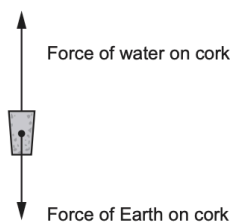


Fig. 13.2

At position A in Fig. 13.1, the cork starts to move up.

Use the free-body force diagram to explain why.

.....  
..... [1]

### Q6.b(2020)

Explain how this experiment shows that the wave travels but **not** the water.

.....

..... [1]

**Q7.a(2020)**

A teacher uses a signal generator to produce a sound wave.

**Fig. 13.3** shows the sound wave on the oscilloscope screen.

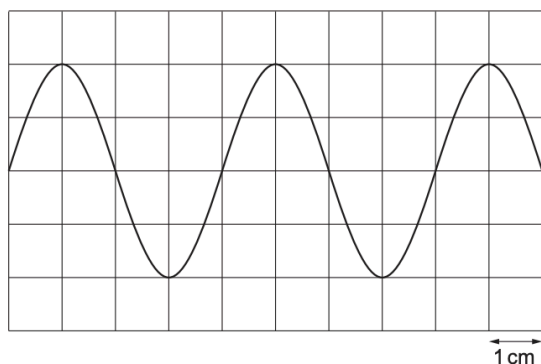


**Fig. 13.3**

1 cm represents 0.005 s on the horizontal scale.

(i) Calculate the period of the sound wave.

Period = ..... s [1]

**Q7.b(2020)**

Calculate the frequency of the sound wave.

Frequency = ..... Hz [3]

**Q7.c(2020)**

(d) Fig. 13.4 shows the experiment a teacher does to measure the speed of sound.

She uses two microphones and a speaker.

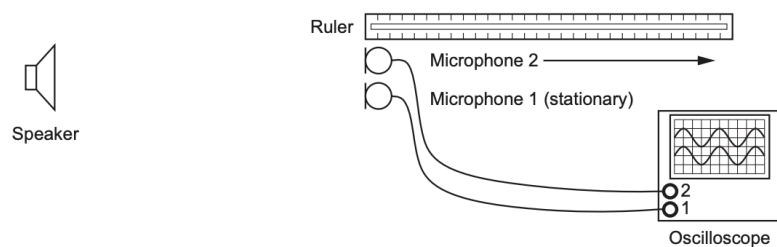


Fig. 13.4

- The speaker is connected to a signal generator.
- The speaker emits sound with a frequency of 1200 Hz.
- Microphone 2 is moved 0.29 m to the right of microphone 1.
- The traces on the oscilloscope screen are **one wavelength** apart.

(i) Calculate the wave speed of sound.

Wave speed = ..... m/s [3]

Q7.d(2020)

Suggest how this experiment can be improved.

.....  
..... [1]

Q7.e(2020)

The speed of sound can also be calculated using echoes and a large wall.

Explain how.

.....  
.....  
.....  
..... [3]

Q8.(2021)

Some waves are transverse. Some waves are longitudinal.

Which row in the table is correct?

|          | Transverse    | Longitudinal  |
|----------|---------------|---------------|
| <b>A</b> | light         | sound         |
| <b>B</b> | sound         | light         |
| <b>C</b> | sound         | water ripples |
| <b>D</b> | water ripples | light         |

Your answer ☐

[1]

### Q9.(2021)

The speed of sound is greater than the speed of a person walking.

Estimate how many times greater.

- A**  $10^2$
- B**  $10^4$
- C**  $10^6$
- D**  $10^8$

Your answer ☐

[1]

### Q10.a(2021)

Two students are making waves using a dripping tap.

The water droplets create waves in the water in a bowl.



(a) Describe the change in energy stores as a water droplet

- falls from the tap: .....
- lands in the water in the bowl: .....

[2]

### Q10.b(2021)

The students count the number of droplets hitting the water in the bowl.

In 20 seconds, 5 droplets hit the water in the bowl.

Calculate the frequency of the waves produced.

Frequency = ..... Hz [2]

Q10.c(2021)

How can the students tell that the water waves travel but the water does not?

.....

..... [1]

Q10.d(2021)

One of the students says, 'the temperature of the water in the bowl increases when the water drips into it'.

- 1 droplet of water transfers  $5.04 \times 10^{-4}$  J of energy as it lands in the bowl.
- The bowl contains 3 kg of water.
- The specific heat capacity of water is  $4200 \text{ J/kg } ^\circ\text{C}$ .

Calculate the temperature rise of the water in the bowl when 1 droplet of water lands in it.

Use an equation from the Data Sheet to help you.

Temperature rise = .....  $^\circ\text{C}$  [3]

Q11.(2022)

This is a picture of a longitudinal wave.

The wave is drawn to scale.



What is the wavelength of the wave?

- A 0.5 cm
- B 2.5 cm
- C 5.0 cm
- D 10 cm

Your answer

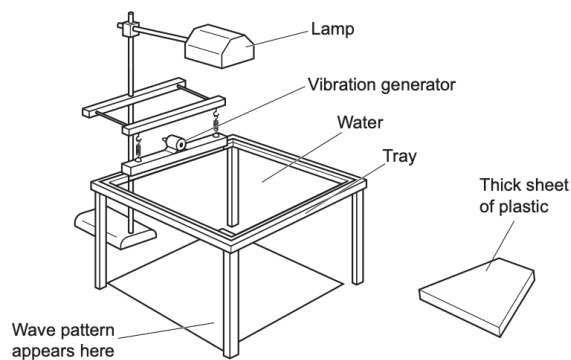
[1]

### Q12.a(2022)

A teacher uses a ripple tank to show refraction of water waves.

Fig. 14.1 shows a ripple tank.

Fig. 14.1



- (a) Explain how the ripple tank and a thick sheet of plastic can be used to show refraction of water waves.

.....

.....

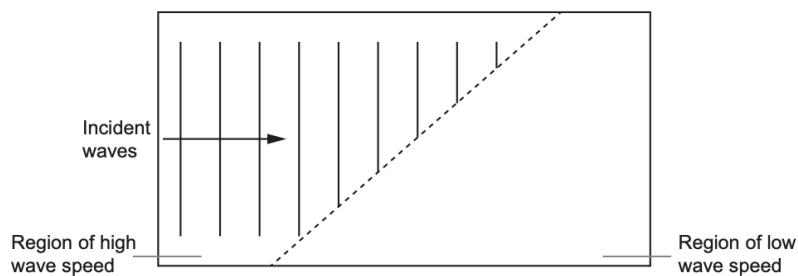
.....

..... [2]

### Q12.b(2022)

- (b) Complete Fig. 14.2 to show the wave pattern when the incident waves enter the region of low wave speed.

Fig. 14.2



[2]

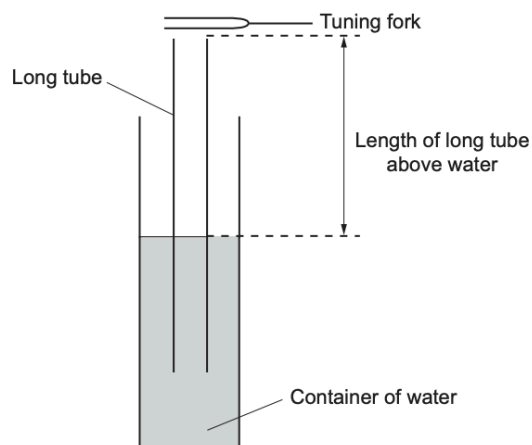
Q13.(2023)

Describe the motion of air particles in a sound wave.  
You may include a labelled diagram.

.....  
.....  
..... [2]

Q14.a(2023)

A group of students measure the speed of sound at a temperature of 20 °C using this equipment.



This is the method they follow:

- Place a long tube in a container of water.
- Hold a vibrating tuning fork over the top of the long tube.
- Pull the long tube out of the water slowly, until a loud sound is heard.
- Measure the length of the long tube above the water.

**Table 17.1** shows the results for one student.

**Table 17.1**

|                                |         |
|--------------------------------|---------|
| Length of tube above the water | 0.175 m |
| Frequency of tuning fork       | 480 Hz  |

The wavelength of the sound =  $4 \times$  the length of the tube above the water.

Calculate a value for the speed of sound using this student's results.

Use the Equation Sheet.

Speed of sound = ..... m/s [3]

Q14.b(2023)

Table 17.2 shows the results for the group of students.

Table 17.2

| Student | Speed of sound (m/s) |
|---------|----------------------|
| 1       | 314                  |
| 2       | 320                  |
| 3       | 330                  |
| 4       | 315                  |
| 5       | 321                  |

The quality of these results can be judged using percentage uncertainty.

The percentage uncertainty in an experimental value is given by the equation.

$$\text{percentage uncertainty} = \left( 0.5 \times \frac{\text{range}}{\text{mean value}} \right) \times 100 \%$$

Calculate the percentage uncertainty in the students' results from Table 17.2.

Percentage uncertainty = ..... % [3]

#### Q14.c(2023)

The speed of sound at 20 °C is 343 m/s.

Evaluate the **precision** and **accuracy** of the results in Table 17.2.

Precision .....

.....

Accuracy .....

.....

[2]

#### Q14.d(2023)

Which statement improves the **accuracy** of the results?

Tick (✓) **one** box.

Holding the tuning fork as close as possible to the end of the tube

☐

Measuring the volume of water in the container

☐

Using a tube with a shorter length

☐

Using a tuning fork with a higher frequency

☐

[1]

#### Q14.e(2023)

Which statement describes a **systematic** error in the experiment?

Tick (✓) **one** box.

Background noise in the laboratory

Changes in the temperature of the air

Measuring the length of the tube below eye level

Using a ruler with a zero error

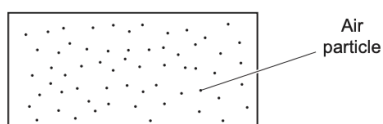
|  |
|--|
|  |
|  |
|  |
|  |

[1]

### Q15.(2024)

Fig. 12.1 shows air particles in a room.

Fig. 12.1



A scientist produces a sound wave in the room using a vibrating tuning fork.

Describe what happens to the air particles when the sound wave travels through the room as a longitudinal wave.

You can draw on Fig. 12.2 to support your answer.

Fig. 12.2



.....

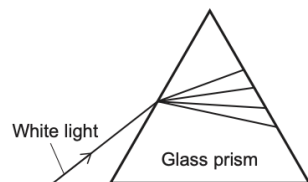
.....

.....

..... [2]

### Q16.(2024)

White light is made up of many different colours of light. The diagram shows the path of **four** of these colours of light in the prism.



The table shows the wavelengths and the speeds of these four different colours of light in the glass prism.

| Colour | Wavelength in glass prism (nm) | Speed in glass prism (m/s) |
|--------|--------------------------------|----------------------------|
| Red    | 640                            | $1.986 \times 10^8$        |
| Yellow | 589                            | $1.984 \times 10^8$        |
| Blue   | 486                            | $1.976 \times 10^8$        |
| Violet | 434                            | $1.971 \times 10^8$        |

- what the student sees when the light travels into the glass prism
- the relationship between the wavelengths of the four different colours of light and their speeds in the glass prism.

[6]