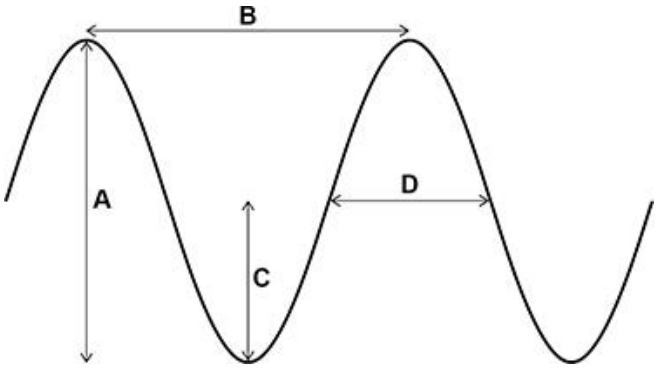
**Questions are for both separate science and combined science students unless indicated in the question**

## Q1.

**Figure 1** represents a transverse wave.

**Figure 1**




(a) Which arrow represents the amplitude of the wave?

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

**(1)**

(b) Which arrow represents the wavelength of the wave?

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐ **D** ☐

**(1)**

(c) A wave has a frequency of 5000 Hz.

Calculate the period of the wave.

Use the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

_____

_____

_____

Period = _____ s

**(2)**

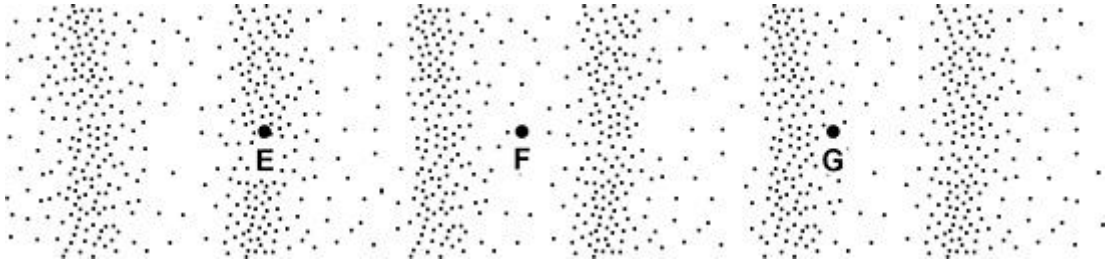
(d) Give **one** example of a transverse wave that can travel through a vacuum.
**(Physics only)**

_____

**(1)**

(e) **Figure 2** represents a longitudinal wave.

**Figure 2**




Which point is at the centre of a rarefaction?

Tick (✓) **one** box.

**E** ☐ **F** ☐ **G** ☐

**(1)**

(f) A sound wave has a frequency of 750 Hz.

speed of sound in air = 330 m/s

Calculate the wavelength of the sound wave.

Use the equation:

$$\text{wavelength} = \frac{\text{wave speed}}{\text{frequency}}$$

_____

_____

_____

Wavelength = _____ m

**(2)**

(g) Describe a method that could be used to determine the speed of sound in air.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

**(4)**

(h) When a sound wave moves from air into water, the speed of the wave increases. **(Physics only)**

The frequency of the sound wave does **not** change.

Complete the sentence.

Choose the answer from the box.

| | | |
|---|---|---|
| **decreases** | **stays the same** | **increases** |

When a sound wave moves from air into water its wavelength

_____ .

**(1)**

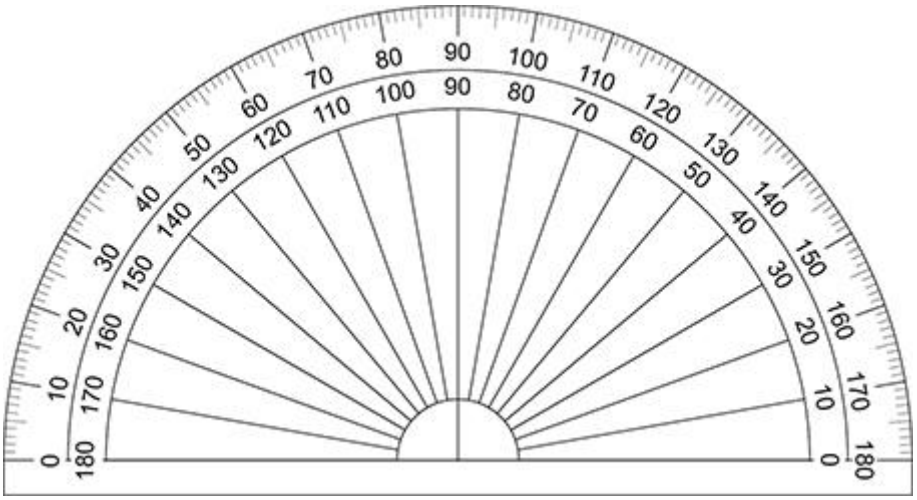
**(Total 13 marks)**

## Q2.

A student investigated the refraction of light by a glass block.

**Figure 1** shows the protractor used to measure the angles of incidence and the angles of refraction. **(Physics only)**

**Figure 1**




(a) What is the resolution of the protractor used to measure the angles?

Resolution = _____ °

**(1)**

**Table 1** shows the results.

**Table 1**

| Angle of incidence in degrees | Angle of refraction in degrees |
|---|---|
| 10 | 6 |
| 20 | 12 |
| 30 | 18 |
| 40 | 23 |
| 50 | 28 |
| 60 | 32 |

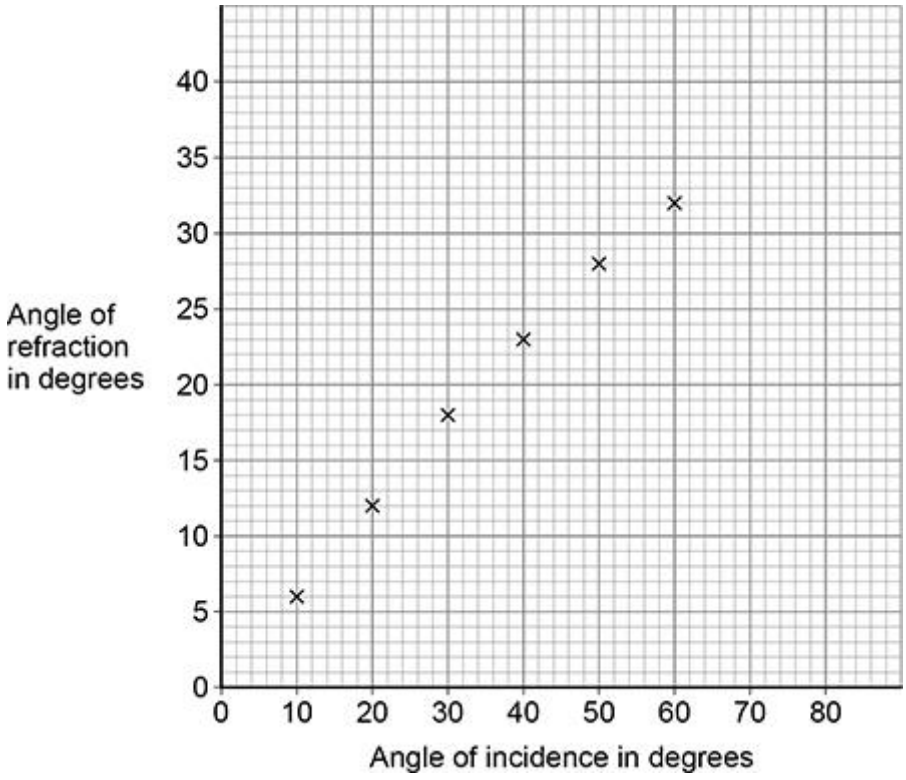
(b) Describe a method the student could have used to obtain the data in **Table 1**.

You may include a labelled diagram.

**(6)**

**Figure 2** shows some of the results.

**Figure 2**




The student measured the angles of refraction for two additional angles of incidence.

**Table 2** shows the additional results.

**Table 2**

| Angle of incidence in degrees | Angle of refraction in degrees |
|---|---|
| 70 | 35 |
| 80 | 37 |

(c) Complete **Figure 2**.

You should:

- plot the results from **Table 2**
- draw the line of best fit.

**(2)**

(d) How does **Figure 2** show that the angle of refraction is **not** directly proportional to the angle of incidence?

_____

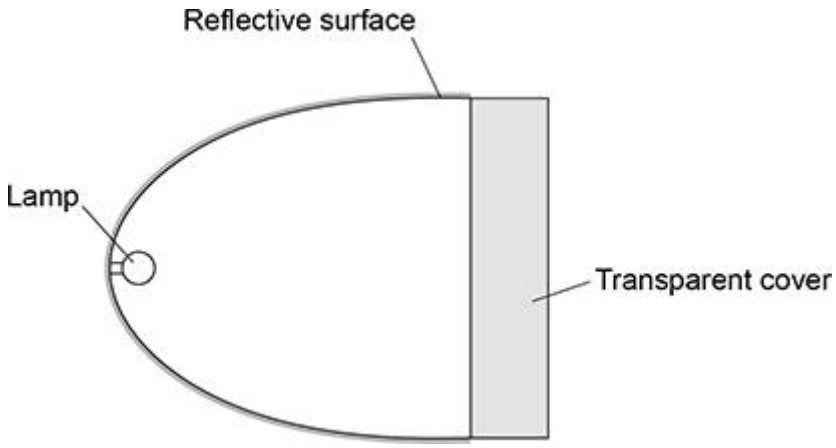
_____

**(1)**

**Figure 3** shows a diagram of a car headlight.

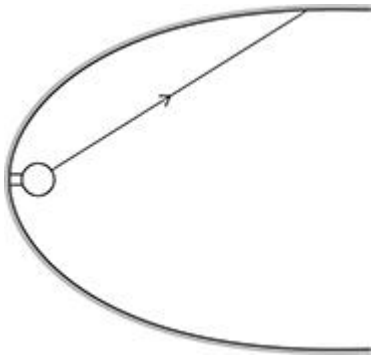
The headlight has a lamp, a reflective surface and a transparent cover.

**Figure 3**




(e) **Figure 4** shows a ray of light incident on the reflective surface.

**Figure 4**



Complete **Figure 4** to show the reflected ray of light.

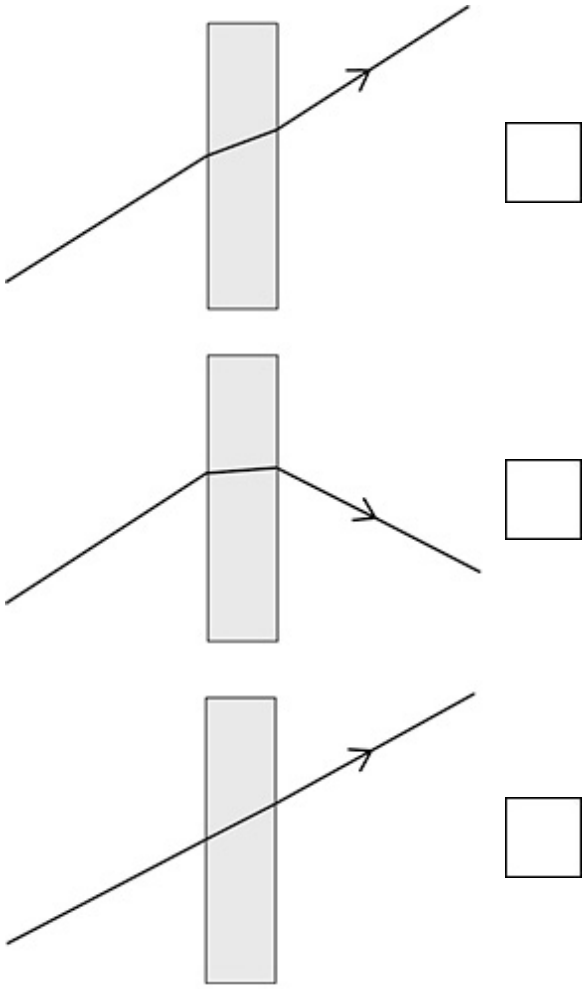
You should include the normal line at the point where the incident ray meets the reflecting surface.

**(2)**

(f) Rays of light pass through the transparent cover of the headlight.

Which diagram shows how a ray of light passes through the transparent cover?

Tick (✓) **one** box.



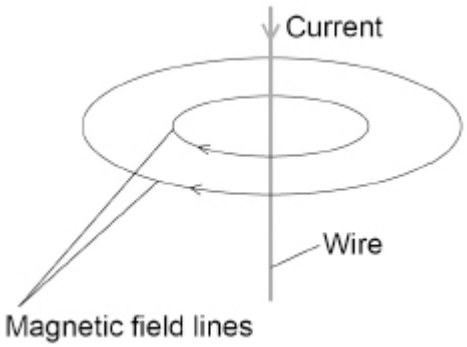
**(1)**

**(Total 13 marks)**

## Q3.

**Figure 1** shows the magnetic field pattern produced when there is a current in a wire.

**Figure 1**




(a) What do the arrows on the magnetic field lines represent?

_____

_____

**(1)**

(b) How could the strength of the magnetic field be increased?

Tick (✓) **one** box.

Change the direction of the current in the wire ☐

Increase the current in the wire ☐

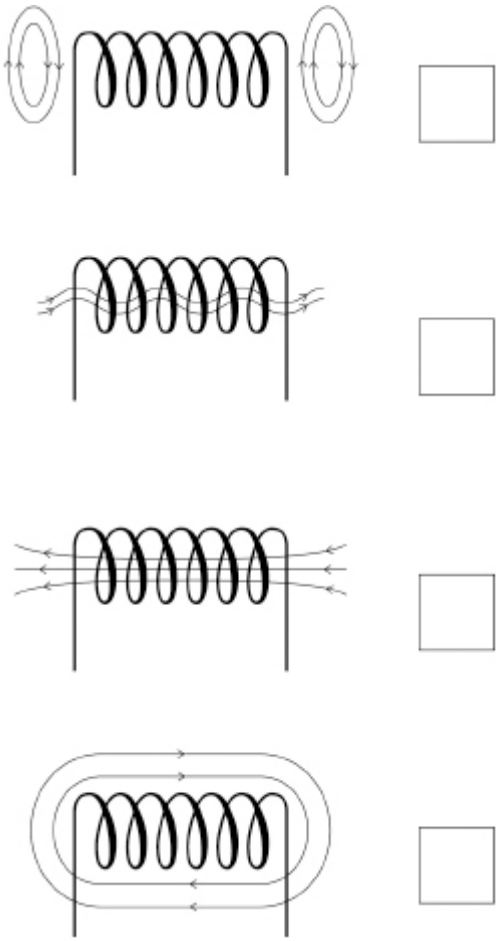
Increase the temperature of the wire ☐

**(1)**

(c) The wire is coiled to make a solenoid.

Which diagram in **Figure 2** shows the magnetic field pattern produced when there is a current in the solenoid?

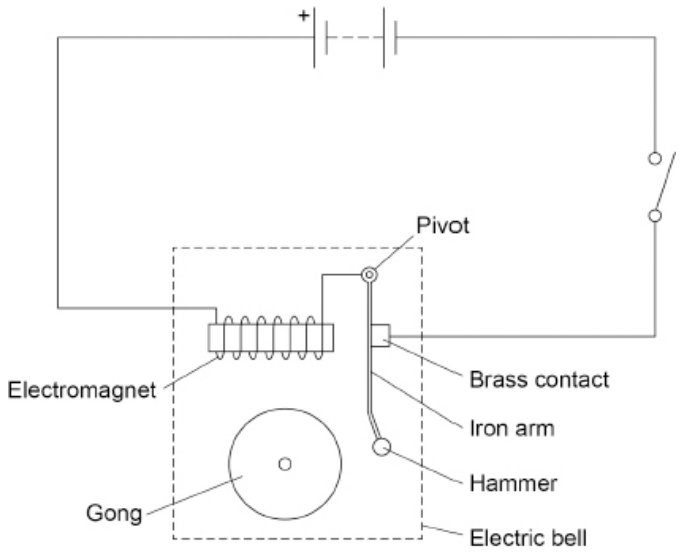
**Figure 2**



**(1)**

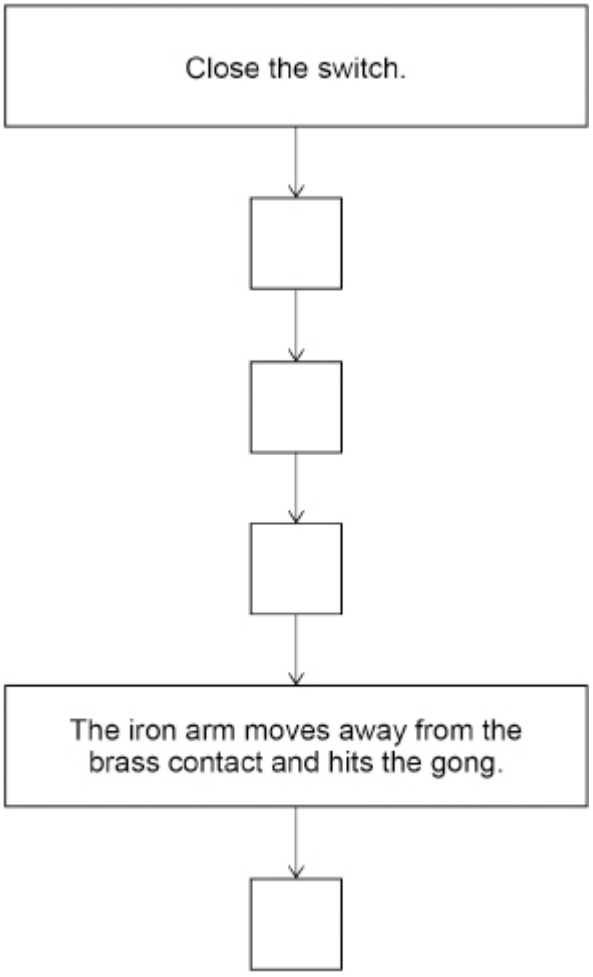
**Figure 3** shows the parts of an electric bell.

**Figure 3**




(d) **Figure 4** shows an incomplete sequence of how the bell works.

**Figure 4**



Write **one** letter in each box to show the correct sequence. **(Physics only)**

Use each letter once.

**A** A magnetic field is created around the electromagnet.

**B** A resultant force acts on the iron arm causing it to move towards the electromagnet.

**C** The iron arm returns to its original position.

**D** There is a current in the circuit.

**(2)**

(e) Which of the following would increase the resultant force on the iron arm? **(Physics only)**

Tick (✓) **one** box.

| | |
|---|---|
| Decrease the distance between the electromagnet and the iron arm | ☐ |
| Decrease the number of cells in the circuit | ☐ |
| Decrease the number of turns on the electromagnet | ☐ |

**(1)**

(f) The iron arm of the bell vibrates with a frequency of 6.25 Hz.

Calculate the period of the iron arm.

Use the equation:

$$\text{period} = \frac{1}{\text{frequency}}$$

_____

_____

_____

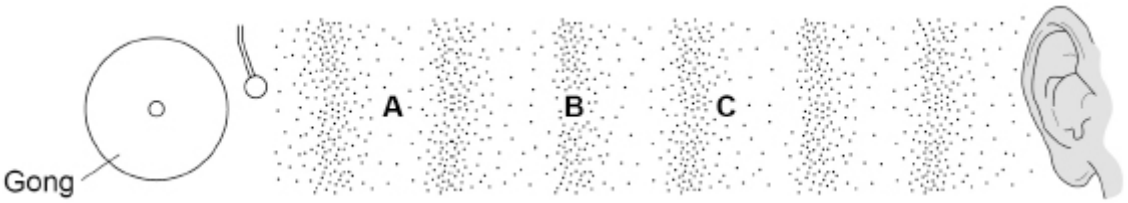
Period = _____ s

**(2)**

(g) The sound waves produced by the bell are longitudinal waves.

**Figure 5** shows the position of the air particles at one point in time as the sound waves travel through the air.

**Figure 5**




Which letter represents an area of compression?

Tick (✓) **one** box.

**A** ☐ **B** ☐ **C** ☐

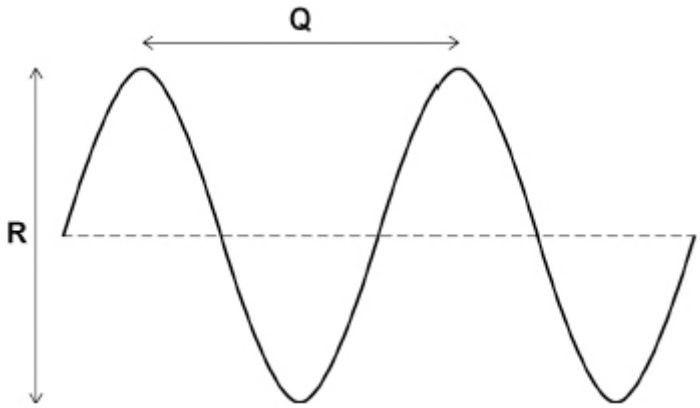
**(1)**

**(Total 9 marks)**

## Q4.

Electromagnetic waves are transverse.

The figure below represents a transverse wave.




(a) Which of the following gives the wavelength of the transverse wave?

Tick (✓) **one** box.

wavelength = $\frac{Q}{2}$ ☐

wavelength = Q ☐

wavelength = 2 Q ☐

**(1)**

(b) Which of the following gives the amplitude of the transverse wave?

Tick (✓) **one** box.

amplitude = $\frac{R}{2}$ ☐

amplitude = R ☐

amplitude = 2 R ☐

**(1)**

(c) Microwaves are electromagnetic waves used for mobile phone communications.

Which other type of electromagnetic wave is also used for communications?

Tick (✓) **one** box.

| | |
|---|---|
| Radio waves | ☐ |
| Ultraviolet | ☐ |
| X-rays | ☐ |

**(1)**

(d) Microwaves from a mobile phone take 0.000 009 s to reach a mobile phone mast.

speed of microwaves = 300 000 000 m/s

Calculate the distance between the mobile phone and the mobile phone mast.

Use the equation:

distance = speed × time

_____

_____

_____

Distance = _____ m

**(2)**

(e) Mobile phone communications is only one of the uses for microwaves.

Give **one** other use of microwaves.

_____

_____

**(1)**

**(Total 6 marks)**

## Q5.

Sound travels as longitudinal waves.

(a) Complete the sentences.

Choose the answers from the box.

| **amplitude** | **frequency** | **speed** | **wavelength** |
|---|---|---|---|

The distance between the centre of one compression of a sound wave and the centre of the next compression is called the _____.

The number of waves passing a point each second is called the

_____.

**(2)**

(b) Complete the sentence.

Choose the answer from the box.

| **opposite** | **perpendicular** | **parallel** |
|---|---|---|

In a longitudinal wave, the oscillations are _____

to the direction of energy transfer.

**(1)**

(c) A sound wave has a frequency of 8.0 kHz.

Which of the following is the same as 8.0 kHz?

Tick (✓) **one** box.

0.0080 Hz ☐

8.0 Hz ☐

8000 Hz ☐

800 000 Hz ☐

**(1)**

(d) Calculate the period of a sound wave with a frequency of 8.0 kHz.

Use the Physics Equations Sheet.

_____

_____

Period = _____ s

**(2)**

(e) Calculate the wavelength of a sound wave with a frequency of 6600 Hz.

speed of sound = 330 m/s

Use the equation:

$$\text{wavelength} = \frac{\text{speed}}{\text{frequency}}$$

Choose the unit from the box.

| kg | m | N |
|---|---|---|

_____

_____

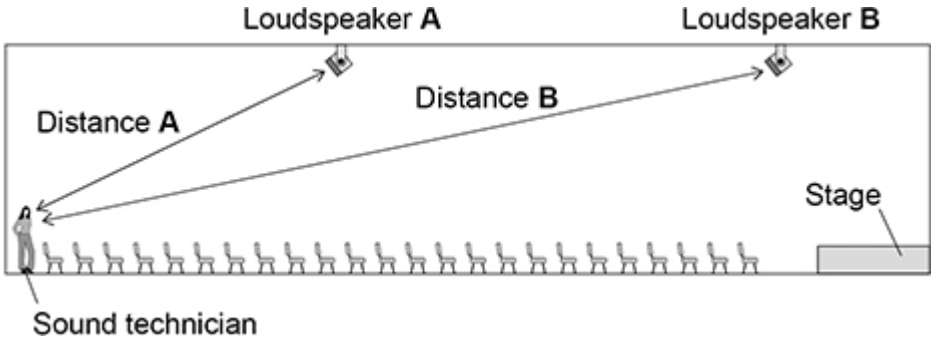
_____

_____

Wavelength = _____ Unit _____

**(3)**

The figure below shows the arrangement of two loudspeakers at a concert venue. **(Physics only)**




The loudspeakers in above diagram are tested by playing the same song through both loudspeakers.

A sound technician listens to the song.

Use the Physics Equations Sheet to answer parts (f) and (g).

(f) Write down the equation which links distance (*s*), speed (*v*) and time (*t*). **(Physics only)**

_____

**(1)**

(g) Distance **A** on above diagram is 13.2 m.

speed of sound = 330 m/s

Calculate the time taken for the sound to travel from loudspeaker **A** to the technician. **(Physics only)**

_____

_____

_____

_____

_____

Time taken = _____ s

**(3)**

(h) The sound from each loudspeaker travels at the same speed.

For the sound technician to hear the song clearly, the sound from loudspeaker **B** should be emitted slightly before the sound from loudspeaker **A**.

Explain why. **(Physics only)**

_____

_____

_____

_____

_____

_____

**(3)**

**(Total 16 marks)**

## Q6.

A student used a ray box to shine a ray of light through air into a glass block.

The student investigated how the angle of refraction varied with the angle of incidence.

The table below shows the results. **(Physics only)**

| Angle of incidence in degrees | Angle of refraction in degrees |
|---|---|
| 10 | 5 |
| 20 | 10 |
| 30 | 14 |
| 40 | 19 |
| 50 | 23 |
| 60 | 26 |
| 70 | 28 |
| 80 | 29 |

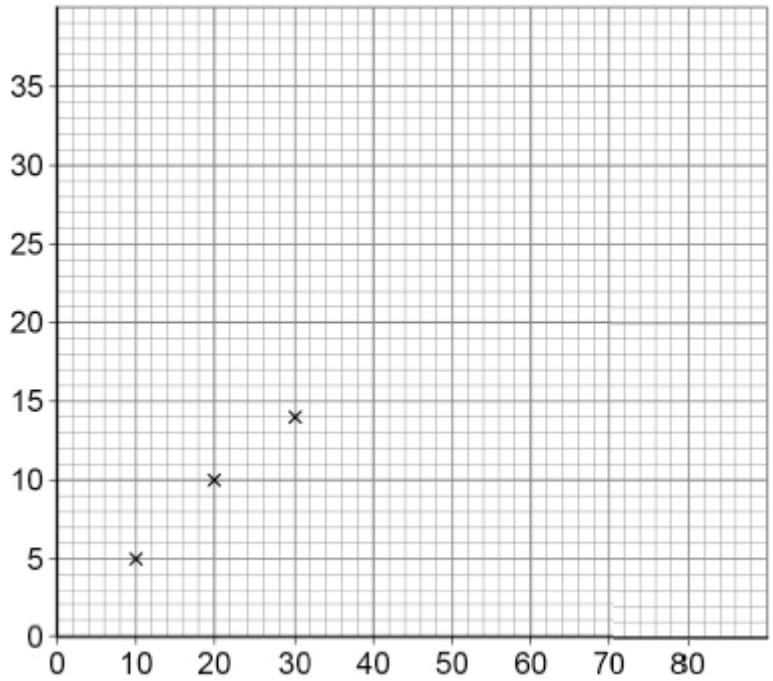
(a) Describe a method the student could have used to obtain the results in above table.

Your answer may include a labelled diagram.

**(6)**

(b) **Figure 1** is an incomplete graph of the results.

**Figure 1**




Complete **Figure 1** using data from above table.

- Label the axes.
- Plot the remaining data.
- Draw a line of best fit.

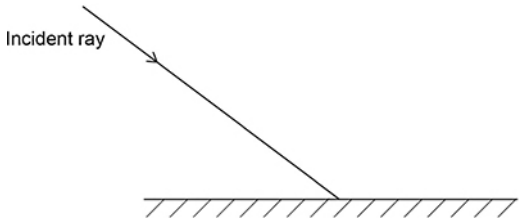
**(4)**

(c) Complete the ray diagram in **Figure 2** to show the reflection of light from the surface of a plane mirror.

You should:

- draw the normal line
- draw the reflected ray.

**Figure 2**

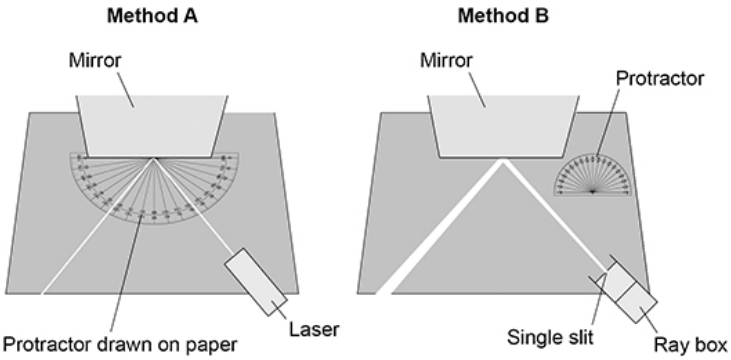



**(2)**

(d) Two students investigated the reflection of light by a plane mirror.

**Figure 3** shows the different equipment the students used.

**Figure 3**




Explain **two** ways that **Method A** is better than **Method B**.

1. _____

_____

_____

_____

2. _____

_____

_____

_____

**(4)**

**(Total 16 marks)**