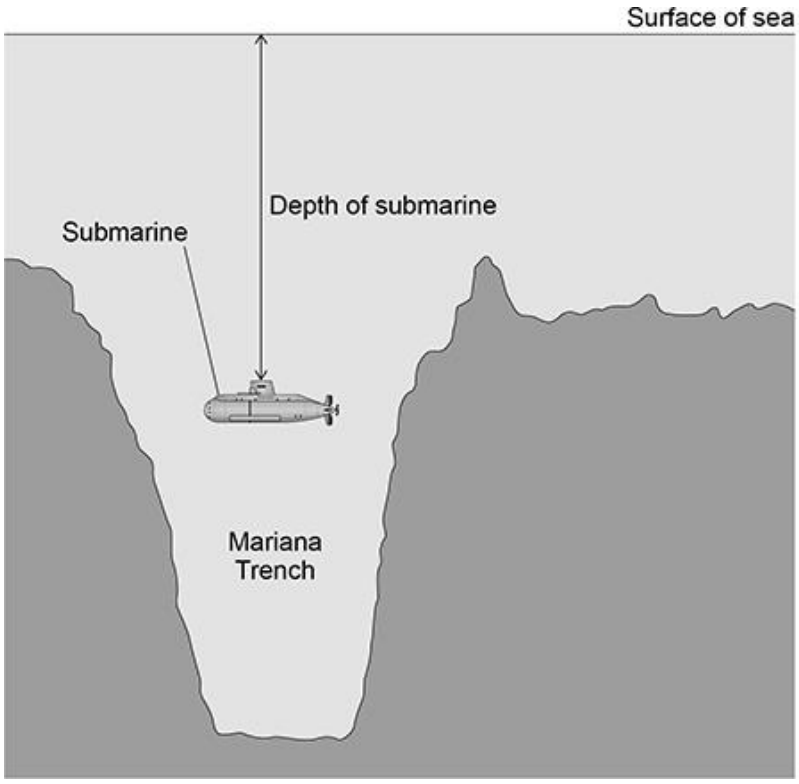
Questions are for separate science students only

Q1.

The Mariana Trench is the deepest part of the Pacific Ocean. **(HT only) (Physics only)**

Figure 1 shows a submarine going to the bottom of the Mariana Trench.

Figure 1



Earthquakes often occur at the Mariana Trench.

P-waves and S-waves are produced by earthquakes.

(a) Which statement describes P-waves and S-waves?

Tick (✓) **one** box.

Both P-waves and S-waves are longitudinal. ☐

Both P-waves and S-waves are transverse. ☐

P-waves are longitudinal and S-waves are transverse. ☐

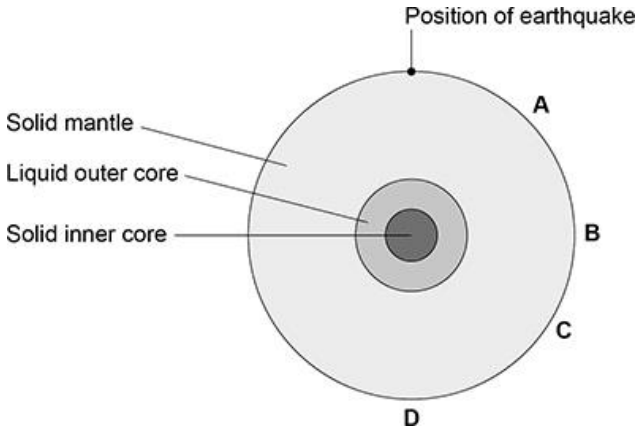
P-waves are transverse and S-waves are longitudinal. ☐

(1)

(b) **Figure 2** shows the layers inside the Earth.

An earthquake occurs at the position shown.

Figure 2



Which letter shows the position where **only** P-waves will be detected?

Give a reason for your answer.

Tick (✓) **one** box.

Yes ☐ No ☐

Reason _____

_____

(2)

(c) An S-wave has a frequency of 3.6 Hz.

The S-wave has a speed of 4.5 km/s.

Calculate the wavelength of this S-wave.

Use the Physics Equations Sheet.

Wavelength = _____ m

(3)

(d) A seismometer is a device that detects earthquakes.

P-waves travel at a known speed between an earthquake and a seismometer.

S-waves travel at a slower speed than P-waves.

A P-wave and an S-wave from the earthquake arrive at the seismometer at different times.

Describe the relationship between the distance from the earthquake to the seismometer and the time between the P-wave and the S-wave arriving.

(2)

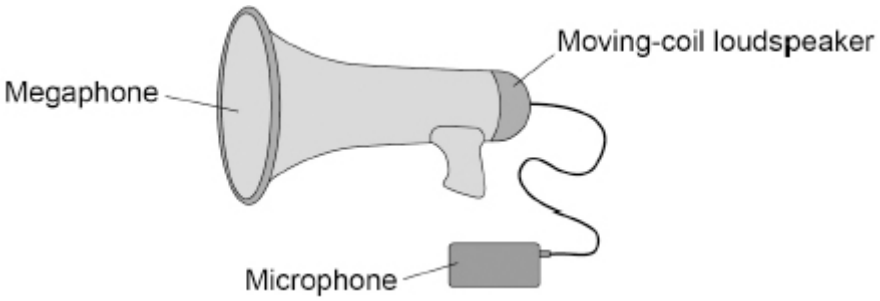
(Total 8 marks)

Q2.

A megaphone uses a loudspeaker to amplify sounds that are detected by a microphone. **(HT only) (Physics only)**

Figure 1 shows a megaphone and microphone.

Figure 1



(a) Complete the sentence.

The microphone is used to convert the pressure variations in sound waves into variations in _____.

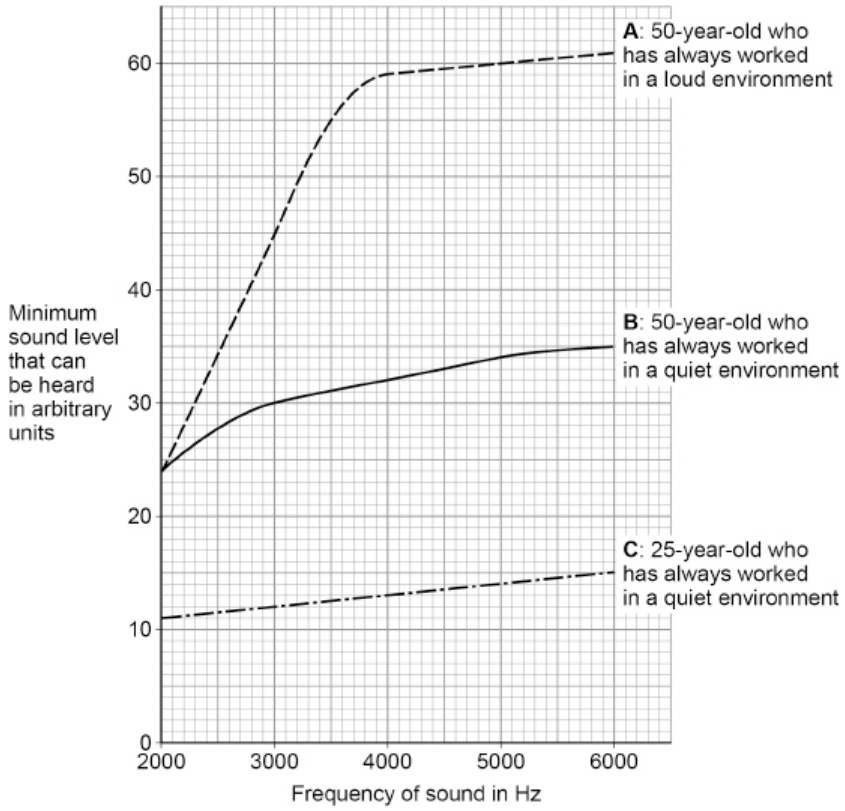
(1)

(b) Megaphones can produce very loud sounds.

A person's hearing can be affected by age and by working in a loud environment.

Figure 4 shows how frequency affects the minimum sound level that can be heard by three different people, **A**, **B** and **C**.

Figure 4



Compare how different factors affect the minimum sound level that these people can hear.

(4)

(Total 5 marks)

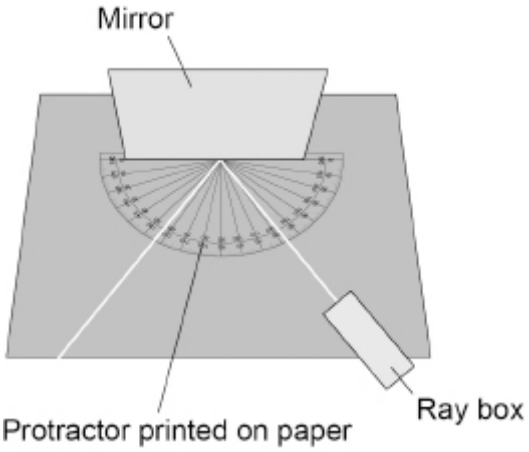
Q3.

A student investigated the behaviour of light. **(Physics only)**

The student used a mirror with a smooth surface to investigate reflection.

Figure 1 shows the equipment used.

Figure 1



(a) What name is given to reflection from a smooth surface?

_____

(1)

The student measured the angle of reflection for different angles of incidence.

The table below shows the results.

Angle of incidence in degrees	Angle of reflection in degrees			
	Test 1	Test 2	Test 3	Mean
10	8	10	11	10
20	20	21	20	20
30	28	29	32	30
40	39	41	41	40
50	49	50	52	50

(b) What conclusion can be made from the results in the table above?

_____

_____

(1)

(c) What type of error caused the variation in the results for the angle of reflection?

Suggest **one** cause of this error.

Type of error _____

Cause of error _____

_____

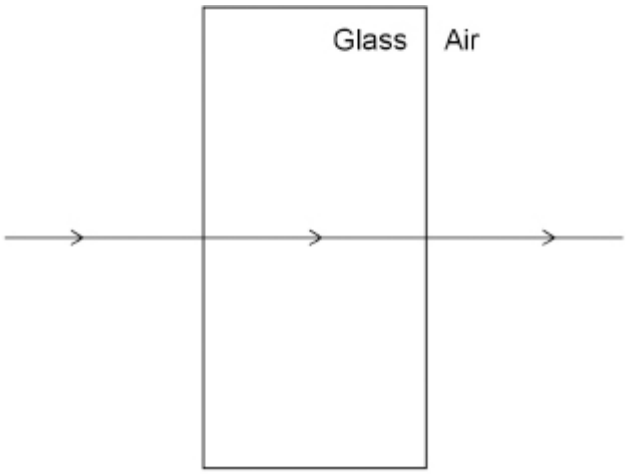
_____

(2)

The student also investigated the refraction of light.

(d) **Figure 2** shows the path of a ray of light through a glass block.

Figure 2



Why has refraction **not** occurred?

_____

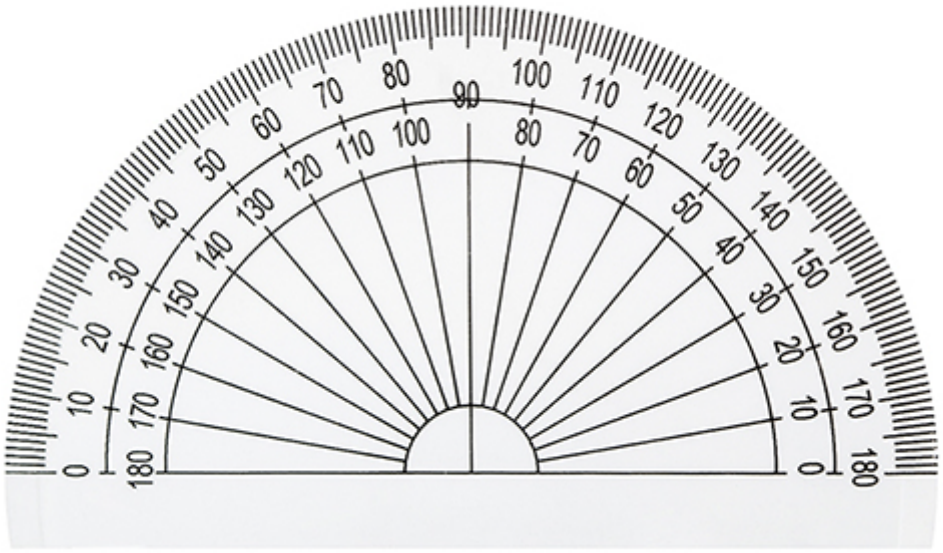
_____

(1)

(e) The student measured the angle of refraction for different angles of incidence.

Figure 3 shows the protractor used.

Figure 3



When the angle of incidence was 10° the student measured the angle of refraction four times.

The student recorded the measurements as:

6.0° 6.3° 6.4° 5.8°

Explain why the student should **not** have recorded these results when using the protractor in **Figure 3** to make the measurements.

_____

_____

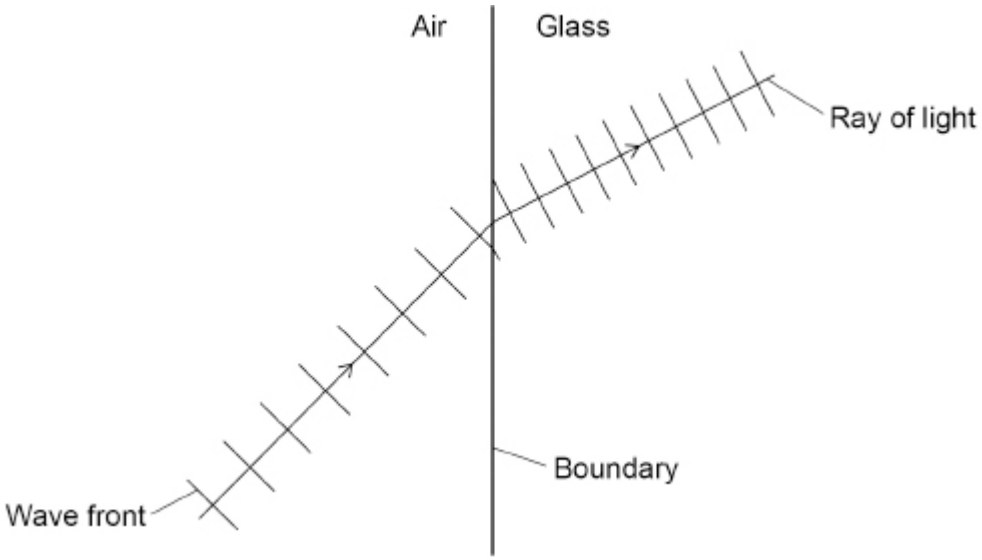
_____

_____

(2)

(f) **Figure 4** shows what happens to wave fronts as they pass across the boundary between air and glass.

Figure 4



Explain in terms of the wave fronts, why refraction happens at the boundary between air and glass. **(HT only)**

(3)

(Total 10 marks)