

Name:

Date:

P6 - Test 4
WAVES
Intermediate

GCSE

PHYSICS

AQA - Combined Science

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1.

Infrared and microwaves are two types of electromagnetic radiation.

(a) State **one** example of the use of each type of radiation for communication.

Infrared: _____

Microwaves: _____

(2)

(b) Some of the properties of infrared and microwaves are the same.

State **two** of these properties.

1. _____

2. _____

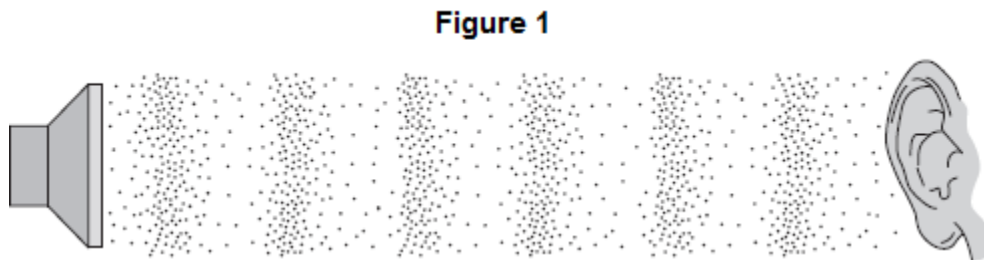
(2)

(Total 4 marks)

2.

A sound wave is an example of a longitudinal wave.

(a) **Figure 1** shows the air particles in a sound wave as the wave travels from a loudspeaker to an ear.



Write a letter **R** on **Figure 1** to show an area of rarefaction.

(1)

(b) Complete the sentence about longitudinal waves.

The vibrations of the air particles are _____ to the direction of energy transfer.

(1)

(c) A stationary car horn emits a sound wave of frequency 400 Hz.

The wavelength of the wave is 0.85 m.

Calculate the speed of sound.

Use the correct equation from the Physics Equations Sheet.

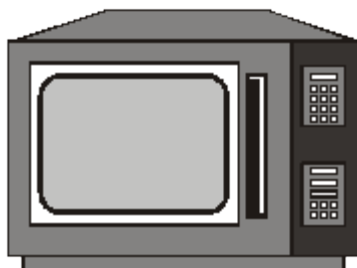
Speed of sound = _____ m / s

(2)

(Total 4 marks)

3.

Microwave ovens can be used to heat many types of food.



(i) Describe, in as much detail as you can, how microwaves heat food.

(2)

(ii) Microwaves have a frequency of 10 000 million Hz. Their wavelength is 0.03 m.

Calculate the speed of microwaves.

Show clearly how you work out your answer.

Speed of microwaves _____ m/s

(2)

(Total 4 marks)

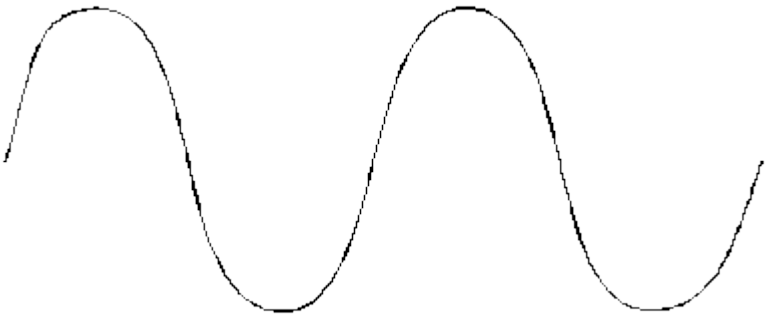
4.

Explain fully why pregnant women should not normally have X-rays of the lower body.

(Total 4 marks)

5.

(a) On the wave drawn below, mark the amplitude and wavelength.



(2)

(b) A wave is said to have a frequency of 25 Hz.

Explain what the term *frequency* means.

(1)

(c) From the electromagnetic spectrum, give the name and use of a radiation of lower frequency than light.

Name _____

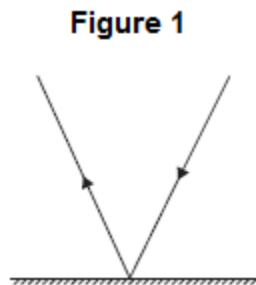
Use _____

(2)

(Total 5 marks)

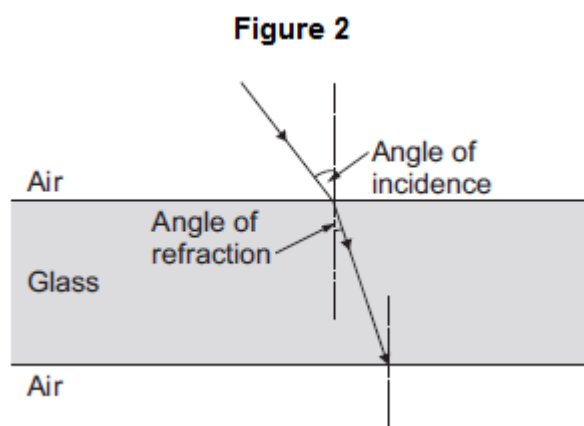
6. Light rays can be reflected and refracted.

Figure 1 shows how a plane mirror reflects a ray of light.



(a) Light is refracted when passing from air into glass.

Figure 2 shows a ray of light as it passes from air into a glass block.



(i) Draw a line on **Figure 2** to show the path of the ray as it leaves the glass block.

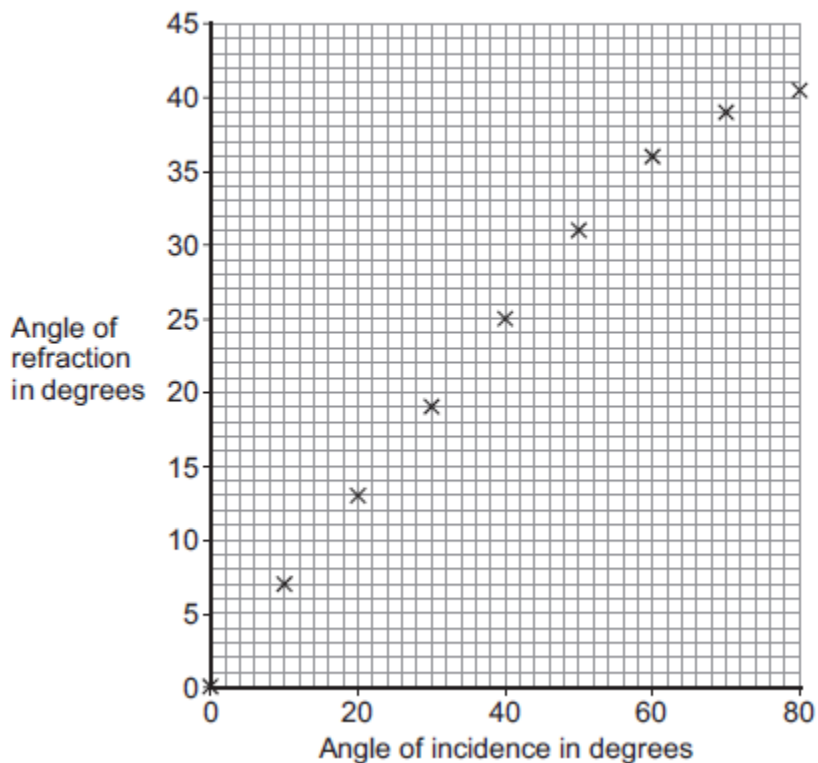
(1)

(ii) Name the dashed lines drawn at 90° to the glass in **Figure 2**.

(1)

- (b) A student investigated the relationship between the angle of incidence and the angle of refraction as light passes from air into glass. Her results are shown in **Figure 3**.

Figure 3



- (i) Draw a line of best fit on **Figure 3**.

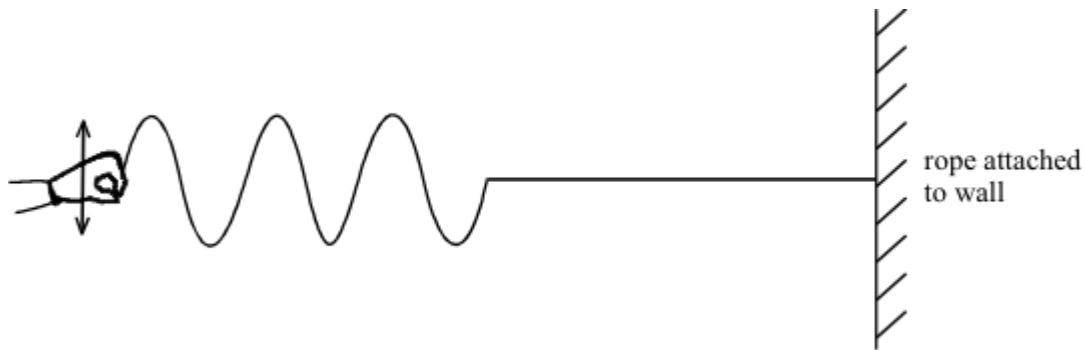
(1)

- (ii) Use **Figure 3** to describe the relationship between the angle of incidence and the angle of refraction.

(2)

(Total 5 marks)

7. The diagram shows some waves travelling along a rope.



(a) Show on the diagram

(i) the wavelength of one of the waves

(2)

(ii) the amplitude of one of the waves

(2)

(b) The waves shown on the diagram were produced in two seconds.

What is the frequency of the waves?

(2)

(Total 6 marks)

8. (a) Some scientists think that there is a link between using a mobile phone and some types of illness. Other scientists disagree. They say that the evidence is limited and unreliable.

(i) Suggest what scientists could do to show a link between using a mobile phone and illness.

(1)

(ii) How could scientists improve the reliability of the evidence?

(1)

- (iii) Complete the following passage by drawing a ring around the word in the box that is correct.

There has been little or no experimental research into the health of children who use mobile phones.

This is partly because of the

economic
environmental
ethical

issues involved in using

children in scientific research.

(1)

- (b) Before being sold, new mobile phones must be tested and given a SAR value. The SAR value is a measure of the energy absorbed by the head while a mobile phone is being used.

The table gives the SAR value for three mobile phones made by different companies. To be sold in the UK, a mobile phone must have a SAR value lower than 2.0 W/kg.

Mobile phone	SAR value in W/kg
J	0.18
K	0.86
L	1.40

- (i) All companies use the same test to measure a SAR value.

Why is using the same test important?

(1)

- (ii) Would the companies that make the mobile phones, **J**, **K** and **L**, be correct to claim that these three phones are totally safe to use?

Answer yes or no. _____

Give a reason for your answer.

(1)

- (c) Devices designed to protect a mobile phone user from microwave radiation are now available.

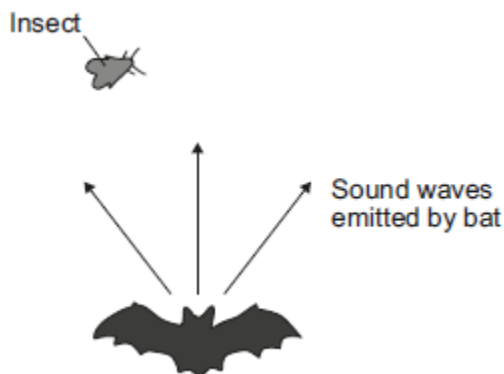
Why is it important that these devices are tested by scientists who are **not** working for the company that makes the devices?

(1)

(Total 6 marks)

9.

Bats use the reflection of high pitched sound waves to determine the position of objects. The image below shows a bat and an insect flying in front of the bat.



- (a) What determines the pitch of a sound wave?

Tick (✓) **one** box.

	Tick (✓)
amplitude	
frequency	
speed	

(1)

- (b) State the name given to reflected sound waves.

(1)

- (c) The bat emits a sound wave with a frequency of 25.0 kHz and a wavelength of 0.0136 metres.

Calculate the speed of this sound wave.

Speed = _____ m/s

(2)

- (d) Sound waves are longitudinal. Describe a longitudinal sound wave.

(2)

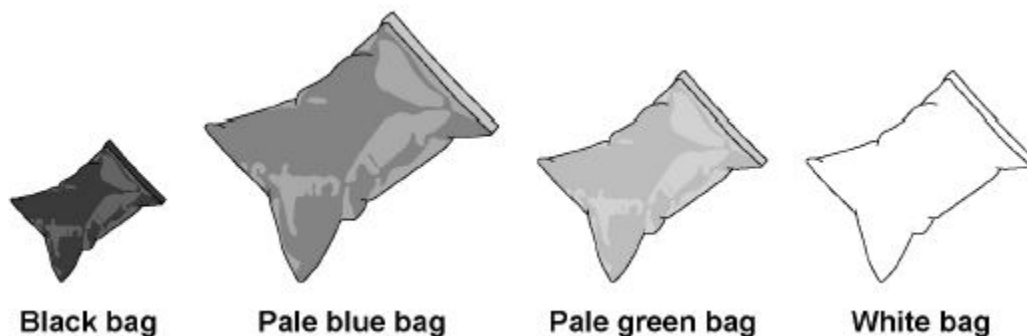
(Total 6 marks)

10.

A solar water bag can be used to heat water for an outdoor swimming pool.

A student wanted to find out if the colour of the solar water bag affects the temperature increase of the water inside the bag.

The diagram below shows some of the equipment used.



This is the method used.

1. Fill each bag with water.
2. Place the four bags on the ground outside.
3. After three hours, measure the temperature of the water inside each bag.
4. Repeat steps 1–3 on the next two days.

(a) Suggest three changes the student should make to this method to get valid results.

- 1. _____

- 2. _____

- 3. _____

(3)

The student repeated the investigation using an improved method.

The results obtained were valid.

The table below shows the results.

Colour of bag	Temperature increase in °C			
	Day 1	Day 2	Day 3	Mean
Black	44.0	31.4	43.4	39.6
Pale blue	38.5	23.6	38.1	33.4
Pale green	37.9	23.7	37.7	33.1
White	25.3	23.4	24.2	X

(b) The student used a thermometer to measure the temperature of the water inside each bag.

What was the resolution of the thermometer?

Resolution = _____ °C

(1)

(c) Suggest **one** reason why the temperatures increased less on Day 2 than on Day 1 and Day 3.

- _____
- _____

(1)

(d) Calculate the mean temperature increase for the white bag.

Mean temperature increase = _____ °C

(1)

(e) Which colour of bag would be best to use to heat water?

Give a reason for your answer.

Colour _____

Reason _____

(2)

(Total 8 marks)

11.

A note was played on an electric keyboard.

The frequency of the note was 440 Hz.

(a) (i) What does a frequency of 440 Hz mean?

(1)

(ii) The sound waves produced by the keyboard travel at a speed of 340 m / s.

Calculate the wavelength of the note.

Give your answer to **three** significant figures.

Wavelength = _____ metres

(3)

- (b) **Figure 1** shows a microphone connected to a cathode ray oscilloscope (CRO) being used to detect the note produced by the keyboard.

Figure 1

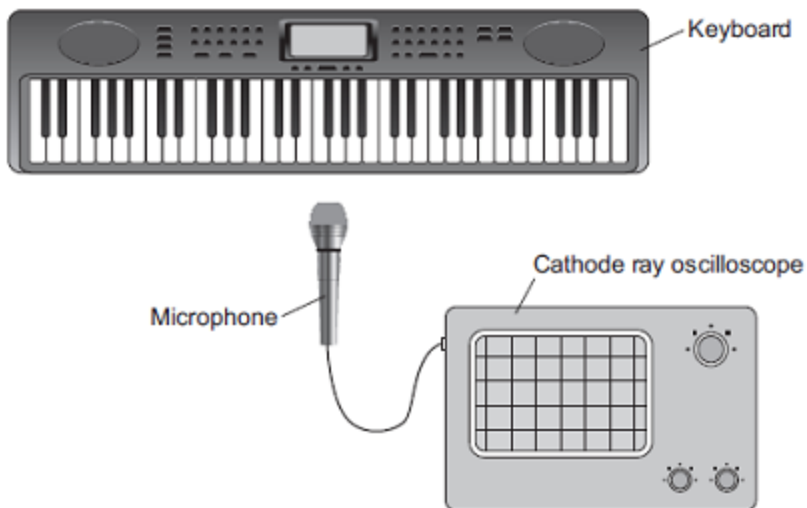
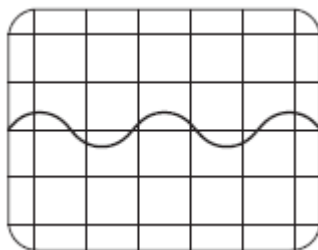


Figure 2 shows the trace produced by the sound wave on the CRO.

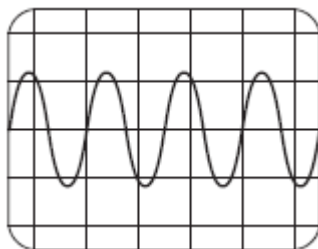
Figure 2



A second note, of different wavelength, was played on the keyboard.

Figure 3 shows the trace produced by the sound wave of the second note on the CRO.

Figure 3



The settings on the CRO were unchanged.

What **two** conclusions should be made about the **second** sound wave produced by the keyboard compared with the **first** sound wave?

Give a reason for each conclusion.

Conclusion 1 _____

Reason _____

Conclusion 2 _____

Reason _____

(4)

(Total 8 marks)

12.

A baby monitor has a sensor unit that transmits an image of the baby and the noises the baby makes to a monitor unit.

The monitor unit then displays an image of the baby and emits the noises the baby makes.

(a) Compare the properties of the waves that transmit images and noises from the monitor unit.

(4)

(b) The sensor unit can detect infrared and visible light.

Suggest **one** advantage of being able to detect infrared.

(1)

(c) Write down the equation that links frequency, wave speed and wavelength.

Equation _____

(1)

(d) The signals for the monitor unit are transmitted as electromagnetic waves with a wavelength of 0.125 m.

Wave speed of electromagnetic waves = 3×10^8 m / s

Calculate the frequency of the signal.

Frequency = _____ Hz

(3)

(Total 9 marks)