Q1.(a) Explain what ultrasound is.

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(2)

(b) Ultrasound is used for pre-natal scanning. This is much safer than using X-rays. However, doctors were only sure ultrasound was safe after experiments on mice.

Do you think the ultrasound experiments on mice were justified?

Explain your answer.

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(2)

(c) Explain what scientists should do if they find evidence that ultrasound may be harmful to human health.

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(2)
(Total 6 marks)

Q2.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?

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(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.

.....

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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

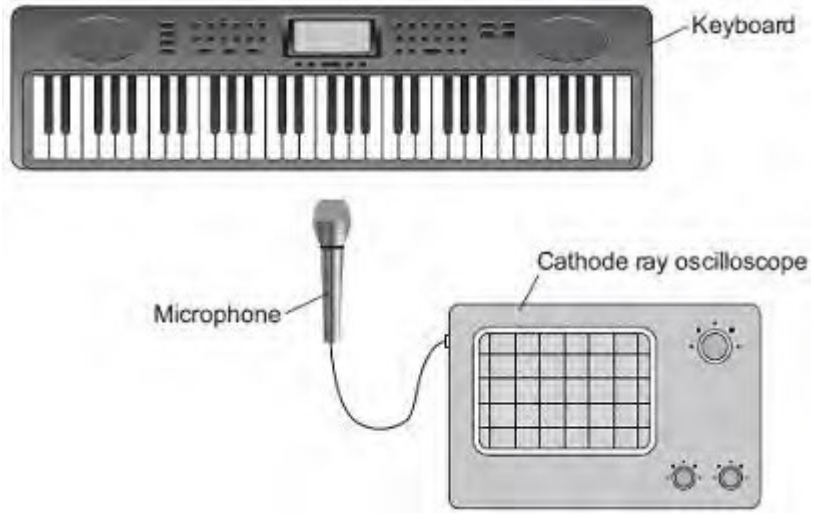
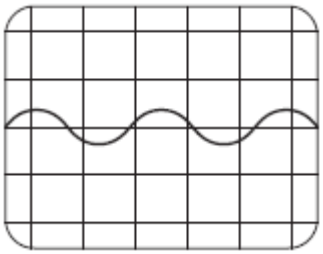


Figure 2 shows the trace produced by the sound wave on the CRO.

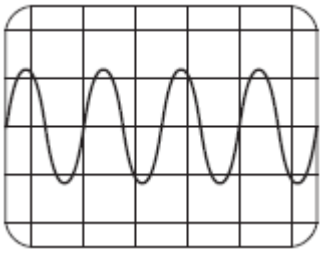
Figure 2



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 .....

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Reason .....

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Conclusion 2 .....

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Reason .....

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(4)
(Total 8 marks)

Q3. Ultrasound and X-rays are waves used in hospitals to create images of the inside of the

human body. To produce the images below, the waves must enter the human body.

Ultrasound scan of an unborn child **X-ray of a broken bone**

© Isabelle Limbach/Thinkstock © itsmejust/iStock

(a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate*.

Describe the features of ultrasound and X-rays, and what happens to each type of wave after it has entered the human body.

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(6)

(b) It would **not** be safe to use X-rays to produce an image of an unborn child.

Explain why.

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(2)

(c) Ultrasound can be used for medical treatments as well as for imaging.

Give **one** use of ultrasound for medical treatment.

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(1)

(Total 9 marks)

Q4.(a) Light waves transfer energy.

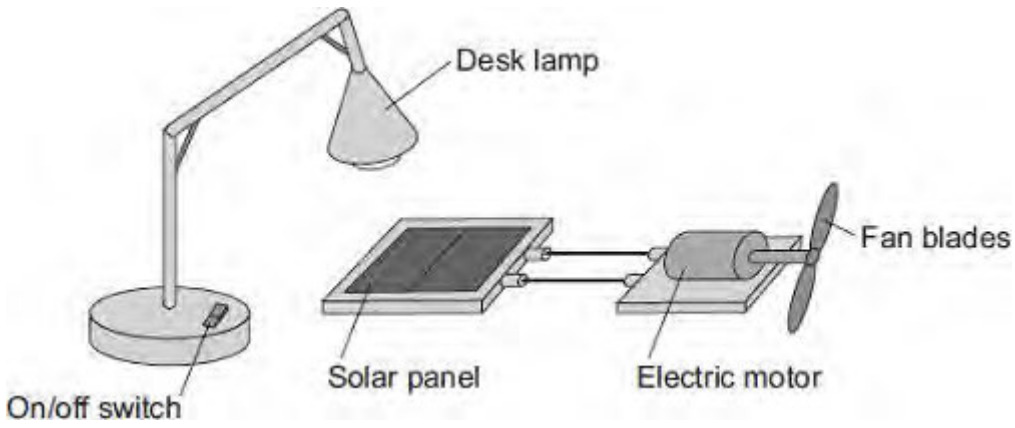
(i) Complete the following sentence.

The oscillations producing a light wave are
.....

to the direction of the energy transfer by the light wave.

(1)

(ii) The apparatus in the diagram shows that light waves transfer energy.



Describe how switching the desk lamp on and off shows that light waves transfer energy.

You do **not** need to describe the energy transfers.

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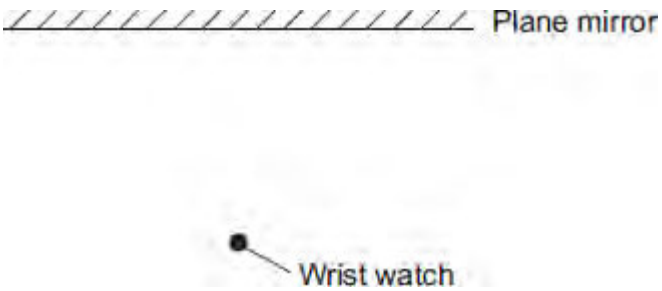
(2)

(b) A student holds a wrist watch in front of a plane mirror. The student can see an image of the wrist watch in the mirror.

The diagram shows the position of the wrist watch and the mirror.



Draw a ray diagram showing how the image of the wrist watch is formed.

Mark the position of the image.

(4)

(c) The image of the wrist watch seen by the student is virtual.

What is a virtual image?

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(1)

(Total 8 marks)

Q5. Waves may be longitudinal or transverse.

(a) Describe the differences between longitudinal waves and transverse waves.

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(3)

(b) Radio waves are electromagnetic waves.

Describe how radio waves are different from sound waves.

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(4)
(Total 7 marks)

Q6.(a) Human ears can detect a range of sound frequencies.

(i) Use the correct answers from the box to complete the sentence.

2	**20**	**200**	**2000**	**20 000**

The range of human hearing is from about ..... Hz to ..... Hz.

(2)

(ii) What is ultrasound?

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(1)

(iii) Ultrasound can be used to find the speed of blood flow in an artery.

State **one** other medical use of ultrasound.

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(1)

(b) The speed of an ultrasound wave in soft tissue in the human body is 1.5×10^3 m / s and the frequency of the wave is 2.0×10^6 Hz.

Calculate the wavelength of the ultrasound wave.

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Wavelength = ... m

(2)

(c) When ultrasound is used to find the speed of blood flow in an artery:

- an ultrasound transducer is placed on a person's arm

- ultrasound is emitted by the transducer
- the ultrasound is reflected from blood cells moving **away** from the transducer
- the reflected ultrasound is detected at the transducer.

Describe the differences between the ultrasound waves emitted by the transducer and the reflected waves detected at the transducer.

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(2)
(Total 8 marks)

Q7.(a) What is ultrasound?

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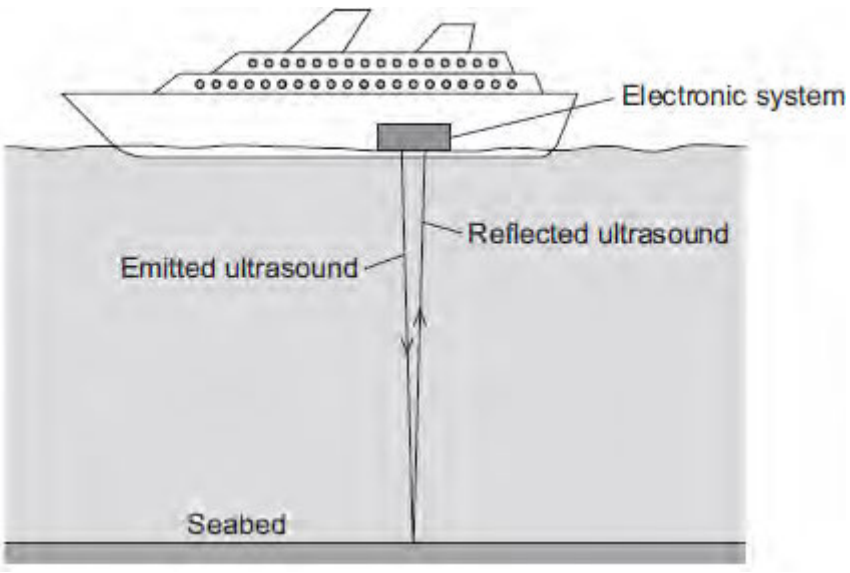
(1)

(b) **Figure 1** shows how ultrasound is used to measure the depth of water below a ship.

Figure 1



A pulse of ultrasound is sent out from an electronic system on-board the ship.

It takes 0.80 seconds for the emitted ultrasound to be received back at the ship.

Calculate the depth of the water.

Speed of ultrasound in water = 1600 m / s

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Depth of water = ... metres

(3)

(c) Ultrasound can be used in medicine for scanning.

State **one** medical use of ultrasound scanning.

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(1)

(d) Images of the inside of the human body can be made using a Computerised Tomography (CT) scanner. The CT scanner in **Figure 2** uses X-rays to produce these images.

Figure 2

monkeybusinessimages/iStock/Thinkstock

State **one** advantage and **one** disadvantage of using a CT scanner, compared with ultrasound scanning, for forming images of the inside of the human body.

Advantage of CT scanning .....

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.....

Disadvantage of CT scanning .....

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(2)
(Total 7 marks)