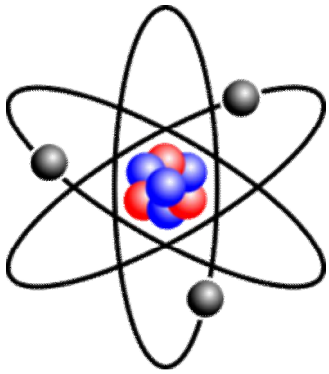
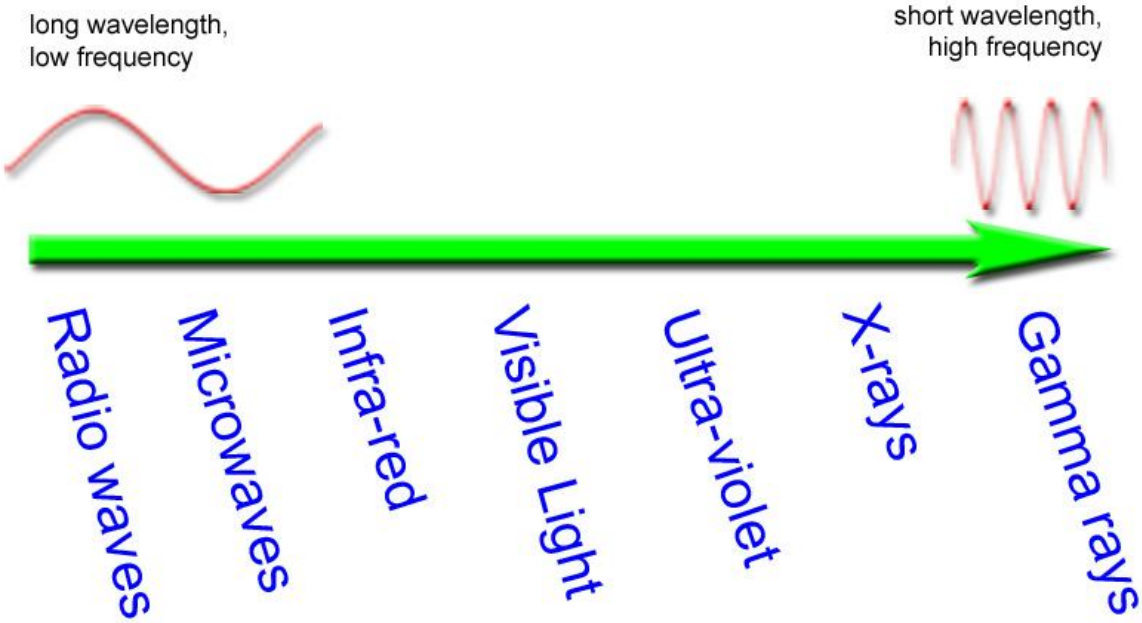


National 4

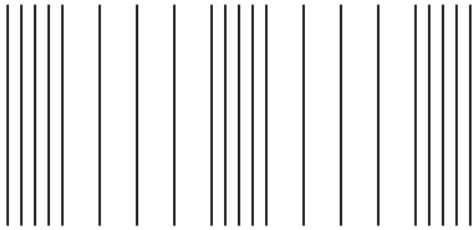
Waves and Radiation Homework



Homework 1: Waves

1. (a) What do all waves transfer?
(b) The diagrams below represent two different wave forms.

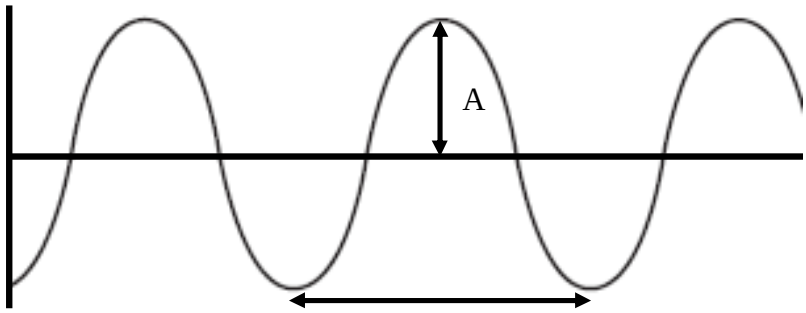
Wave A



Wave B

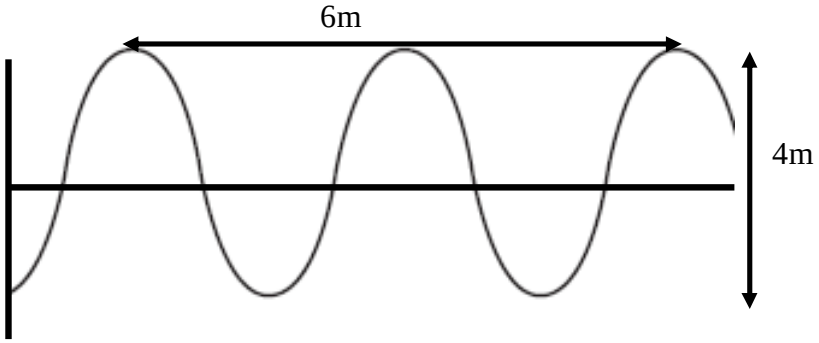
What are the names given to each of these waves?
(c) Give one example of each of these waves.

2. (a) Copy and complete the diagram correctly labelling A and B.



(b) What is the frequency of a wave?
(c) What is frequency measured in?

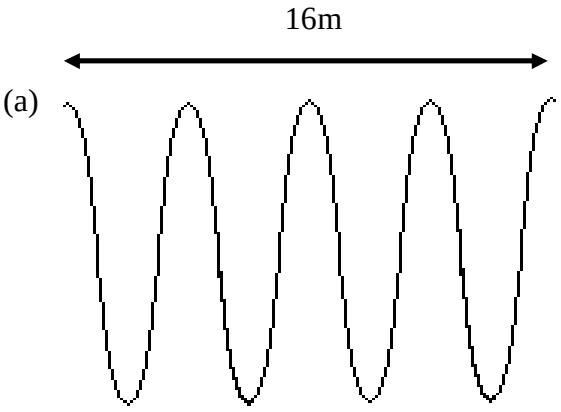
3. Using the information from the diagram, what is the value of one wavelength and what is the amplitude of the wave?



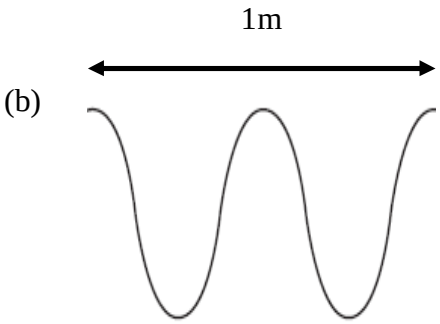
Homework 1 continued

4. What are the wavelengths of the following waves:

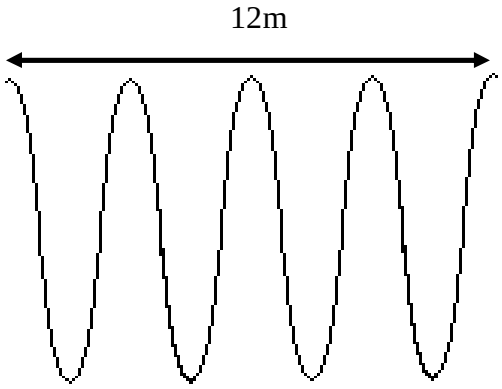
(a)



(b)



5. The following wave was produced in 8s. What is the wavelength and the frequency of the wave?



Homework 2: Wave Calculations

1. A wave travels a distance of 50m in a time of 10s. What is the speed of the wave?

2. A wave travels a distance of 50cm in a time of 0.05s. What is the speed of the wave?

3. A wave is travelling at 150m/s. How far will it travel in 3 minutes?

4. A man watches a wave which is 500m from the shore. If the wave is travelling at 20 m/s, how long will it take the wave to reach the shore?

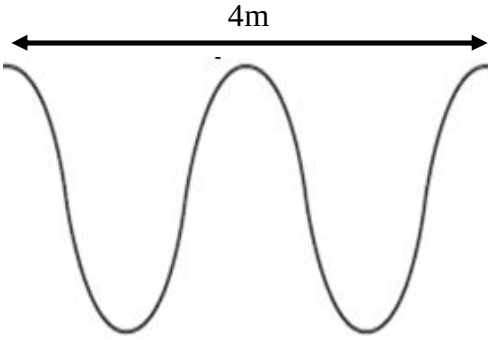
5. A wave has a wavelength of 3m. Calculate the speed of the wave if the frequency is 6Hz?

6. A wave has a frequency of 10kHz. Calculate the speed of the wave if the wavelength is 20m.

7. A wave is travelling at a speed of 30m/s. Calculate the wavelength of the wave if the frequency is 2Hz.

8. A wave is travelling at a speed of 50m/s. Calculate the frequency of the wave if the wavelength is 0.02m.

9. The two waves shown in the diagram below pass a point in 4s.



(a) What is the frequency of the waves?
(b) Using the information in the diagram, find the wavelength.
(c) Calculate the wavespeed.

Homework 3: Sound Waves

1. Waves can be split into two categories - transverse and longitudinal. To which of these categories do sound waves belong ?

2. (a) State the speed of light in air.
   (b) Give an example that shows that light travels faster than sound.

3. Describe a method to measure the speed of sound in air. You must mention:

   - the measurements taken
   - the equipment used
   - any equations used.

   You may also draw a diagram to help with your description.

4. The table below shows the speed of sound in different materials. The speed of sound in air is missing.

Material	Speed of Sound (m/s)
Air	
Water	1500
Concrete	3000
Carbon Dioxide	250
Rubber	150

   (a) In air, a sound wave travels a distance of 6.8m in a time of 0.02s.Use this information to calculate the speed of sound in air.

   (b) A sound wave travels through a material which is 3m long in a time of 0.001s. Which material is the sound wave travelling through?

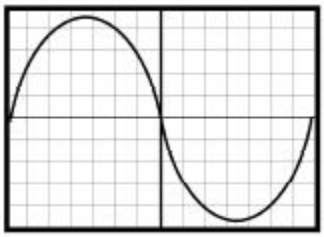
5. A sound wave is sent through a solid steel beam, which is 3km long. If the wave passes through the beam in 0.5s, what is the speed of sound in steel?

6. A student is 2100 metres from a fireworks display. He hears the bang from an exploding firework 7 seconds after seeing the flash.
   Calculate the speed of sound in air.

Homework 4: Sound Waves 2

1. A sound wave has a wavelength of 2.5m and a frequency of 300Hz. Calculate the speed of the wave.

2. The following diagram shows the trace of a wave on an oscilloscope:



(a) Copy the wave and then re-draw it showing what it will look like if the volume had decreased.
(b) Copy the wave and then re-draw it showing what it will look like if the pitch had been increased.

3. Two men are playing their guitars at the same time:

Guitar A

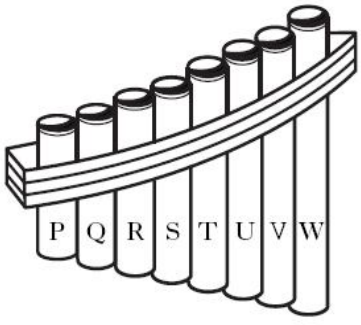
Guitar B

Which guitar will produce the highest pitched sound. Explain your answer.

4. To play the panpipes you must blow into the pipes.
Each pipe produces a different note.

(a) What must the air in each pipe do to produce a note?

(b) Pipe W produces a note of frequency 256Hz.
If pipe Q produces a note which is an octave lower than pipe W.
What frequency of note is produced by pipe Q ?



Homework 5: Ultrasound

1. Humans can hear sounds that range between two frequencies.

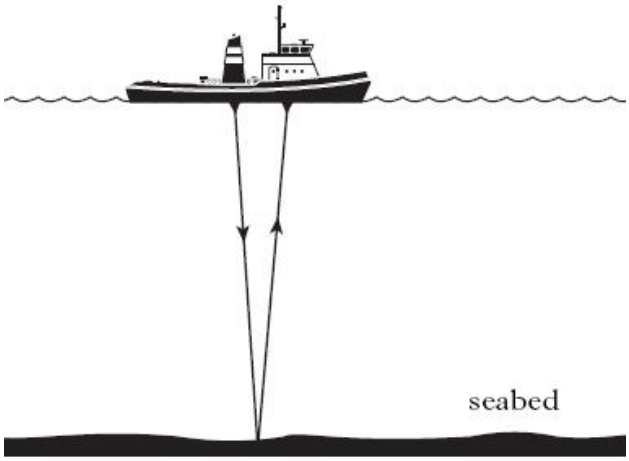
   (a) What is the range of human hearing?
   (b) What name is given to frequencies above this range?
   (c) Give an example of an animal that can hear above this upper frequency.

2. A signal generator produces a sound wave that has a wavelength of 0.01m. Can the pupils hear the sound being made? Explain your answer.

3. An ultrasound scan can be used to create an image of an unborn baby.

   (a) Why is an ultrasound scan used instead of an x-ray?
   (b) Name one other use for ultrasound waves in medicine.

4. Some boats use sound waves to find the depth of the sea.



   If the speed of sound in water is 1500 metres per second and the time for the sound to return to the boat is 5 seconds, calculate the depth of the sea beneath the boat.

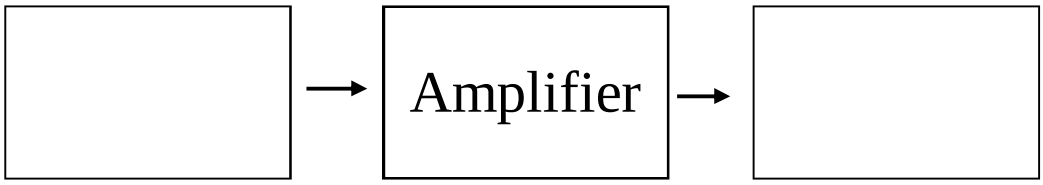
Homework 6: Loud Sounds

1. (a) What is the name of the unit that measures how loud sounds are?
   (b) What is the meaning of noise pollution?
   (c) Give two examples of noise pollution.

2. (a) When listening to loud sounds for a long period of time, it can start to cause damage to your hearing. A what sound level can hearing loss occur?

   (b) During a hearing test, a girl hears a loud sound for 0.2s. Explain why this will not cause any damage to her hearing.

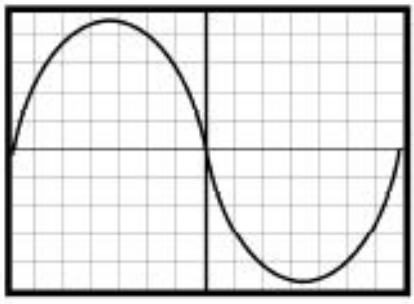
3. In a public announcement system, there are three stages:



Input Process Output

   Name a suitable input and output device for this announcement system.

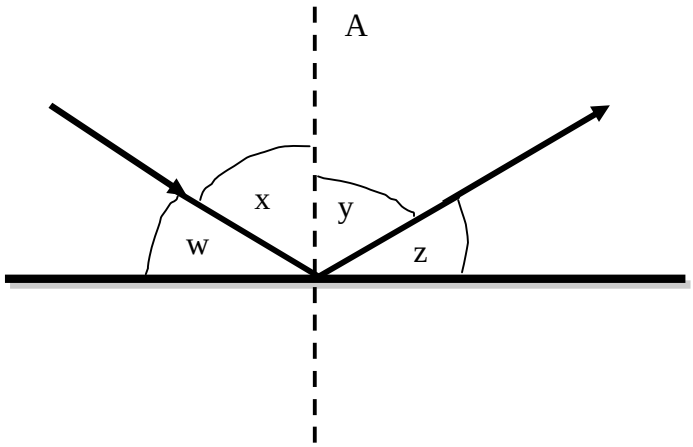
4. The diagram to the right shows the wave produced by the output section of the system above. Copy the wave and then draw how the wave will look before passing through the amplifier.



Homework 7: Reflection of Light

1. Explain how we can see objects in terms of light.

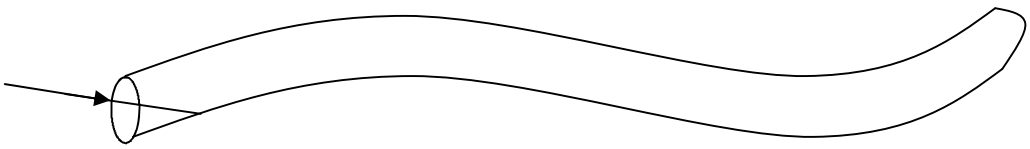
2. The diagram below shows how light reflects off a mirror:



(a) What is the name given to the line labelled A?
(b) Which angle is the angle of incidence?
(c) Which angle is the angle of reflection?

3. Optical fibres are objects that can easily transmit light from one location to another.

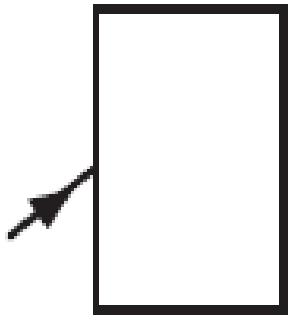
(a) Describe what an optical fibre is.
(b) Give one medical and one non-medical use for optical fibres.
(c) Copy and complete the diagram showing how light passes through an optical fibre.



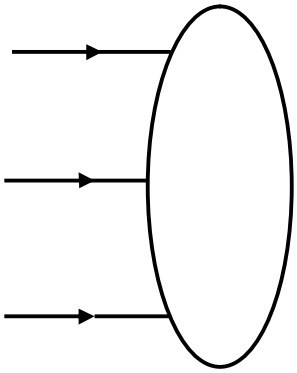
Homework 8: Refraction of Light

1. What is meant by the refraction of light?

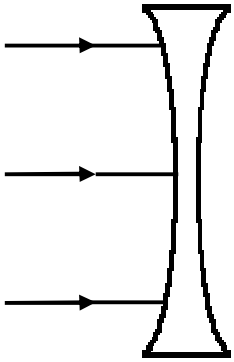
2. Copy and complete the diagram showing what happens to a ray of light as it enters and exits a glass block. You **must** clearly label your normal, angle of incidence and angle of refraction.



3. The diagrams below show two lenses:



Lens A



Lens B

(a) Name lenses A and B
(b) Copy and complete the diagrams showing how light is refracted through the lenses.

4. Two common eye defects in the UK are long and short sight.

(a) A pupil looks at two books—one right in front of her and the other a couple of metres away. Describe what these two books will look like if the girl is long sighted.

(b) With the aid of a diagram, show what happens to light when it enters the eye of someone who is short sighted.

Homework 9: E-M Spectrum 1

1. There are 7 members of the Electromagnetic Spectrum

Radio and TV	X	Infrared	Y	Ultravi-olet	Z	Gamma Rays

(a) Identify waves X, Y and Z.
(b) At what speed to all members of the Electromagnetic Spectrum travel ?

2. A thermographic unit senses radiation from the surface of a patient's body and is used to detect small changes in temperature.

(a) Name the type of radiation used by the thermographic unit.
(b) What other word is used to describe this radiation.
(c) Name one medical use for this radiation.

3. How would you be able to tell the difference between a genuine ticket for the Scottish Cup final and a fake ticket ?

4. Exposure to ultraviolet light can have both benefits and risks to our health.

(a) Give **one** example of how UV light can be a benefit.
(b) Give **two** examples of what could happen if you are exposed to too much UV light.
(c) Give **two** examples of how you can protect yourself from over-exposure.

Homework 10: E-M Spectrum 2

1. Like infrared and ultraviolet, X-rays are a member of the Electromagnetic Spectrum. They are also invisible to the naked eye. What can be used to detect X-rays?

2. In medicine, X-rays are used to look at broken bones.
Give one example of how X-rays are used in industry.

3. Radiographers that work with X-rays in hospitals have to take precautions when they are working. Give two examples of safety measures that are in place for radiographers.

4. There are many ways in which gamma rays are similar to X-rays. State two ways in which these waves are similar.

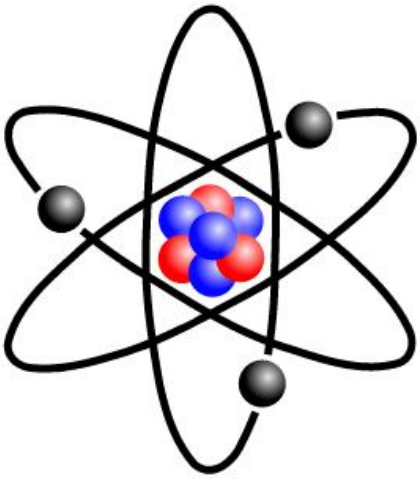
5. A technician injects a source of gamma radiation into a patient, as a tracer, to diagnose a medical condition inside the patient. The tracer emits gamma radiation. A gamma camera scans and detects the gamma radiation.

Why is gamma radiation used as a tracer?

6. Describe one use of gamma radiation in industry.

Homework 11: Radiation

1. In 1909, the physicist Ernest Rutherford described how he thought an atom looks. This is known as the Rutherford model.



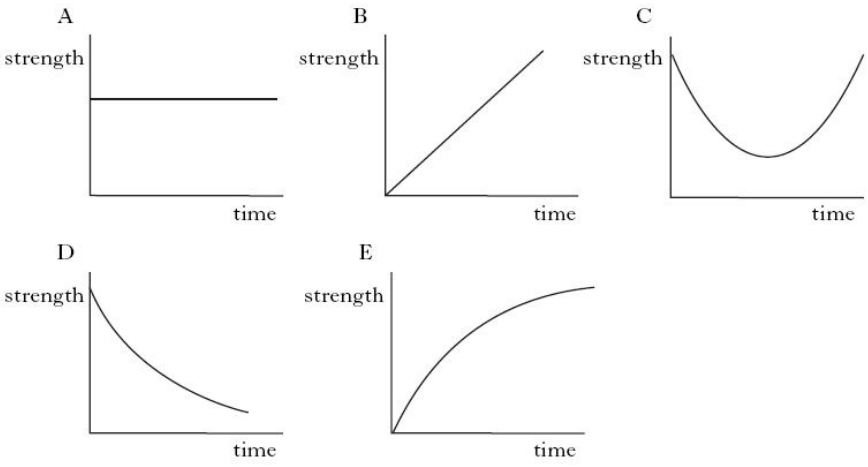
(a) Copy the above diagram and label each of the particles that make up an atom.
(b) Describe the charge of each of these particles.

2. In our everyday lives, we are continually exposed to background radiation.

(a) Give two examples of natural forms of background radiation.
(b) Give two examples of artificial forms of background radiation.

3. Exposure to radiation at low levels can be perfectly safe. Describe what can happen if you are exposed to high levels of radiation.

4. Which of the following graphs shows how the strength of a radioactive source changes with time?



Homework 12: Nuclear Reactors

1. Radiation can be very dangerous if handled incorrectly. Give three examples of safety precautions that should be taken when handling radiation.

2. What can be used to detect radiation?

3. In power stations, electricity can be made through nuclear reactions.

   (a) In what part of the power station do the reactions take place?
   (b) What is made as a result of these reactions?
   (c) In which part of the power station is electricity created?

4. State one advantage **and** one disadvantage of using nuclear power for the generation of electrcity.

5. Name three nuclear disasters, and state whether they were man-made or accidental.

6. A student makes the following statements about a carbon atom.

   I The atom is made up only of protons and neutrons.

   II The nucleus of the atom contains protons, neutrons and electrons.

   III The nucleus of the atom contains only protons and neutrons.

   Which of the statements is/are correct?

   A I only

   B II only

   C III only

   D I and II only

   E I and III only

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National 4 Waves and Radiation

National 4 Waves and Radiation

6. The diagram below shows the eye of someone who has short site. Using a diagram, show how a lens can be used to correct this defect.