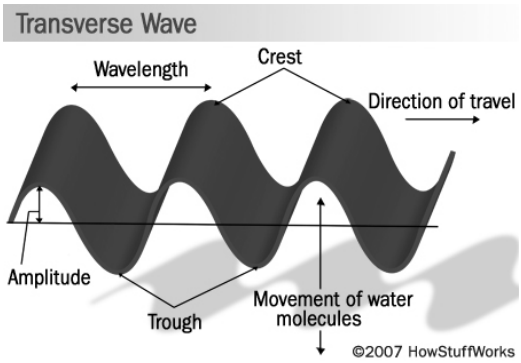
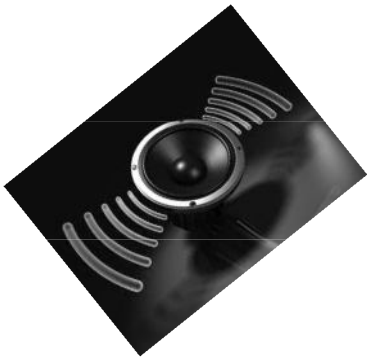
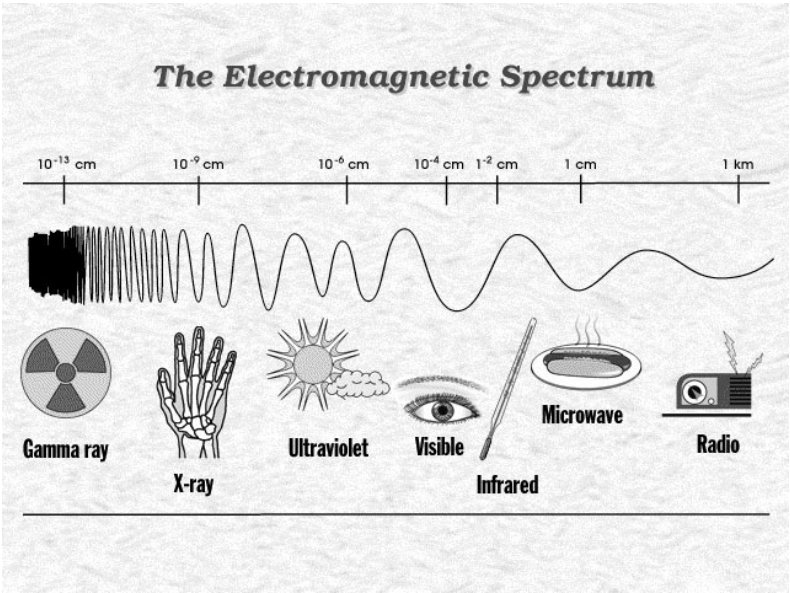




Nat 4 Waves & Radiation

Self Checks



Self check 1 : Waves

1. a) Explain, using a diagram, the difference between a transverse and longitudinal wave.
   b) What type of waves are the following:
   i) sound waves
   ii) water waves
   iii) light waves?

2. What is the number of waves in one second known as?

3. Frequency is measured in

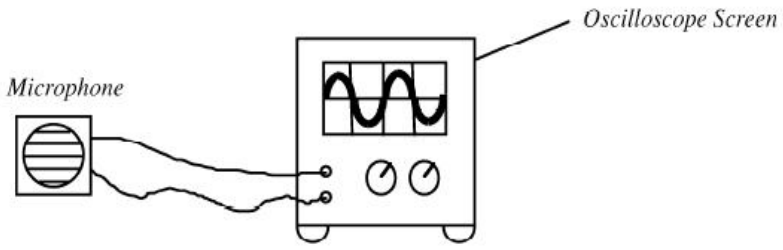
   A watts
   B decibels
   C hertz
   D volts

4. Match the terms in the table below to the correct definition, then copy :

WAVE TERMS	DEFINITIONS
frequency	height of the wave from the centre to the top
wavelength	distance travelled by the wave in one second
wavespeed	length from peak of one wave to the next
amplitude	number of waves which pass a point in one second

5. What is the frequency if : i) 10 waves pass a point in 2 seconds
   ii) 40 waves strike a beach in 4 seconds
   iii) 120 waves pass a point in 2 minutes?

6. A signal is displayed on the screen of the oscilloscope.

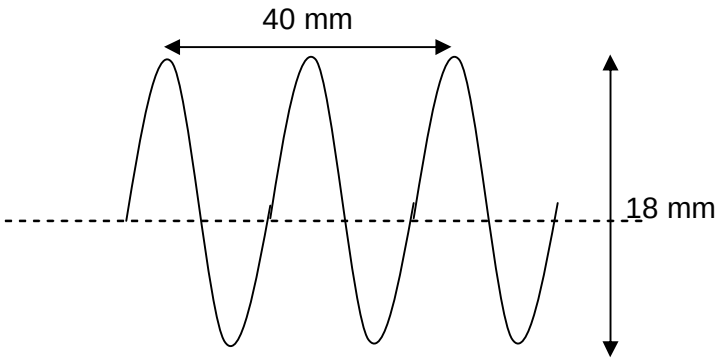


   a) How many waves are seen on the screen?

   b) The frequency of these waves is 50 Hz.
   How many waves are produced in one second?

Self check 1 continued

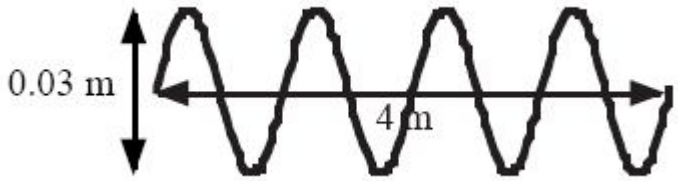
7. A wave is shown below:



a) What is the amplitude of the wave?

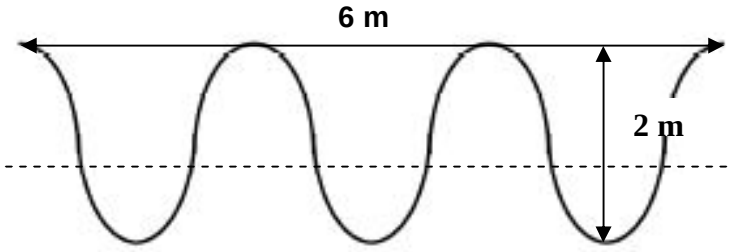
b) What is the wavelength of the wave?

8. The diagram below shows a wave .



Calculate the following quantities for this wave:
a) the wavelength
b) the amplitude.

9. Find the amplitude and wavelength of the wave below :



10. Copy the wave below and then draw a wave with greater amplitude and frequency.

Self check 2 : Wave Speed

1. A water wave travels a distance of 25 metres in a time of 5 seconds.
   What is the speed of the water wave?

2. Another wave covers a distance of 64 metres in a time of 16 seconds.
   At what speed does the wave travel?

3. A wave moves at 15 m/s for a time of 4 seconds. How far does the wave travel?

4. A tsunami travels across an ocean at a speed of 60 miles per hour.
   What distance does it cover in a time of 8 hours?

5. How long will it take a water wave which is travelling at 5m/s to move across an olympic pool which is 50 metres long?

6. A wave of frequency 6 hertz has a wavelength of 0.5 metres.
   What is the wave speed?

7. A water wave travels at 15 metres per second and has a wavelength of 5 metres.
   What is the frequency?

8. A wave of frequency 8 hertz has a wave speed of 0.2 metres per second.
   What is the wavelength?

9. A wave generator at swimming pool sends out 10 waves in 20 s. The waves cross the 25 m pool in 10 s. Calculate:

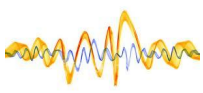
   a) The frequency of the waves.

   b) The speed of the waves.

10. A pupil sends 16 waves along a rope in 2 seconds. The waves have a wavelength of 0.5 m.

    (a) Find the frequency of the waves.

    (b) Calculate the speed of the waves.



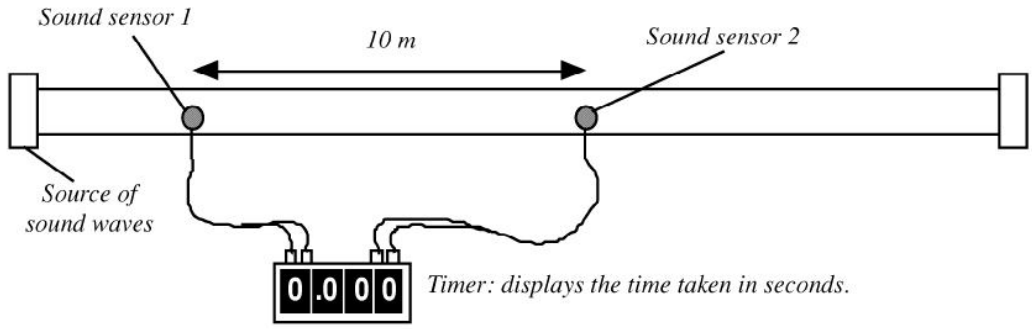
Self check 3 : Speed of Sound

1. a) What is the approximate value of the speed of sound in air?
   b) What is the speed of light in air?
   c) Give an example which shows that the speed of light is faster than the speed of sound.

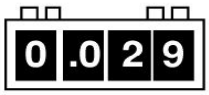
2. A block of flats have to be demolished. When the explosive is detonated, the observers, who are a safe distance away, hear nothing. They see the flat collapsing and sometime later hear the sound of the explosion.

   Explain why nothing is heard immediately.

3. Sound waves pass through a long pipe. When the sound reaches sound sensor 1 the timer is switched on. After the sound has travelled 10 metres the sound reaches sound sensor 2 and the timer is switched off.



   The final display on the timer, in seconds, is shown below



   Calculate the speed of sound.

4. On a day when the speed of sound in air is 330 m/s, how long would sound take to travel a distance of 1.6 km?

5. An explosion in Grangemouth could be heard in South Queensferry one minute later. Given they are 20 km apart, calculate the speed of sound in air.

6. Explain why, during a thunder storm, you see the lightning before you hear the thunder.

Self check 3 continued

7. During a thunder storm it is noticed that the time interval between the flash of lightning and the clap of thunder gets less. What does this tell you about the storm?

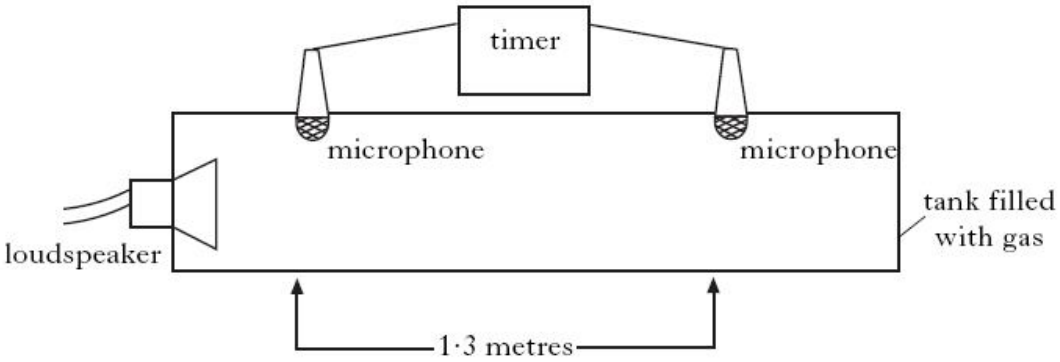
8. Thunder is heard 20 seconds after a lightning flash. If the speed of sound is 340 m/s, how far away is the storm?

9. Ten pupils are standing on Calton Hill, looking at Edinburgh Castle. They measure the time difference between seeing the smoke from the one o'clock gun and hearing the bang. The measured times are:-

3.8 s, 4.2 s, 4.0 s, 3.8 s, 4.4 s, 3.8 s, 4.0 s, 4.2 s, 3.6 s, 4.2 s.

a) Calculate the average time for the group.
b) Calculate the distance from the Castle to Calton Hill if the speed of sound is 330 m/s.

10. A pupil investigates the speed of sound in different gases. She designs an experiment as shown below. A short note is produced by the loudspeaker and the sound travels though the tank from one microphone to another.



The tank is filled with carbon dioxide. The sound takes 0.005 s to travel 2 metres.

a) Calculate the speed of sound in carbon dioxide.

b) The tank is now filled with a different gas. It takes the sound 0.5 s to travel 2 m. Explain if the speed of sound in the gas is less than, equal to or greater than the speed of sound in carbon dioxide.

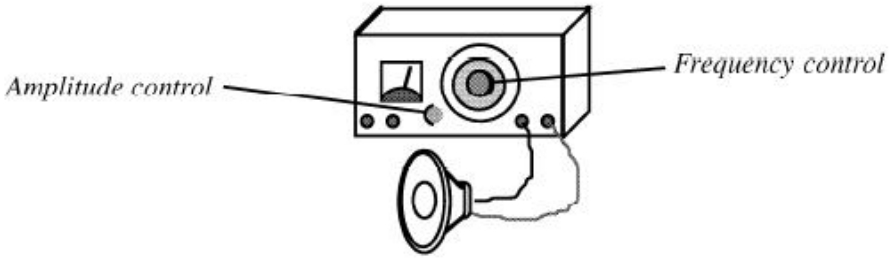
Self check 4 : Sound Waves

1. Copy and complete the following sentences using the appropriate words from the list :

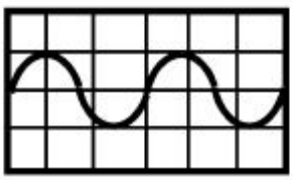
   vacuum particles energy gases

   For sound to be able to travel, there must be _____ . Sound can travel in solids, liquids and _____ since the sound can vibrate through the particles. Sound does not travel through a _____ as there are no particles to carry the _____ .

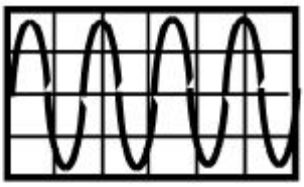
2. Jane uses a signal generator to change the sound produced by a speaker.



   Jane then connects the signal generator to an oscilloscope.



Oscilloscope trace before Jane adjusts the controls



Oscilloscope trace after Jane adjusts the controls

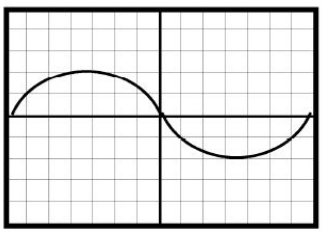
   a) Describe the two changes in the wave signal.

   b) What does that tell us about the volume and pitch of the sound?

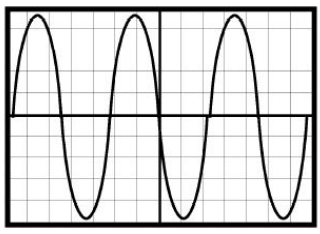
3. Which oscilloscope trace, A or B, shows

   A) the quietest sound

   B) the lowest pitch sound



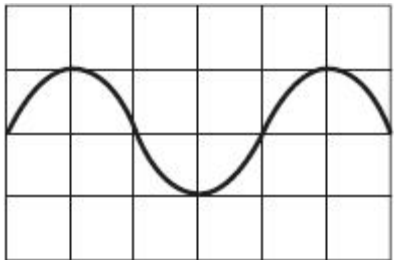
Trace A



Trace B

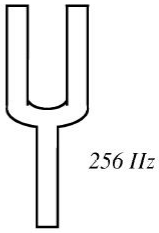
Self check 4 continued

4. A student investigates sound waves. She connects a microphone to an oscilloscope. The microphone detects a sound and the following trace is seen on the oscilloscope screen.



The student then uses a signal double the frequency. The oscilloscope setting remain constant. Draw accurately the trace that would now be seen on the Oscilloscope screen.

5. Jason generates sound by striking tuning forks.

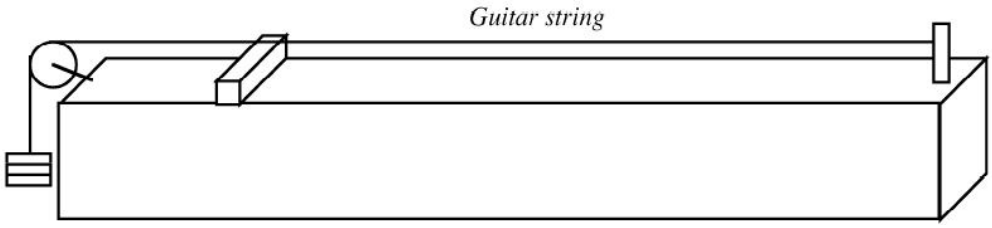


He then strikes the tuning fork and produces a note of frequency 256 Hz. The second tuning fork he strikes produces a note one octave higher than the first.

a) What is the frequency of the second tuning fork ?

b) What would be the frequency of a note one octave below the original note ?

6. Guitar strings are being tested using the setup shown below.



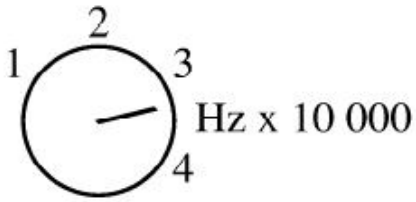
The string is plucked and a note of 300 Hz is produced.
State two ways that this setup could be changed to increase the frequency of the note produced.

Self check 5 : Ultrasound

1. Humans can detect sound with a range of frequencies from 20 to 20 000 Hz.
   What are frequencies beyond the range of human hearing known as?

2. In class, a signal generator attached to a loudspeaker is adjusted to the frequency shown.

   Robert tells the teacher that he can hear the note from the loudspeaker.

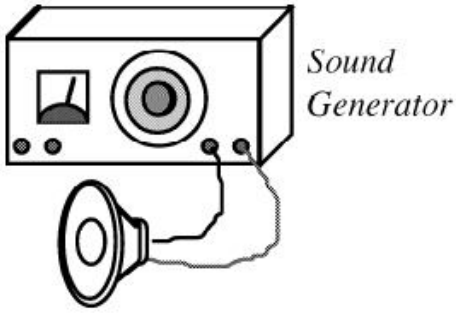


   a) Why does the teacher tell him that he is mistaken?

   b) State a frequency that would probably be heard by the whole class.

3. A special sound generator is being tested in a school laboratory.

   A detector with a meter is needed to pick up the sound since the frequency is beyond the range of human hearing.



   a) What is the name of this type of sound?

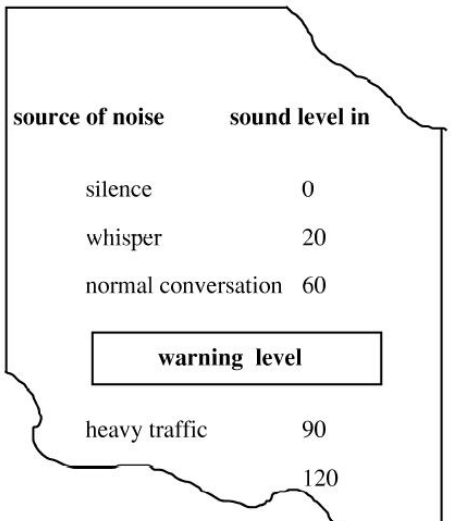
   b) Which mammal would be able to hear this sound?

   c) This type of sound has an important medical use. Describe what it is used for.

   d) It is not only medical staff who use this type of sounding equipment.
   In what industry might it be used and how is it put to use.

Self check 6 : Loud Sounds

1. This poster appears on the wall of a hospital waiting room but part of it has been torn and some words are missing.



   A) What is the missing word after "sound level in"?

   B) The source of the sound with a level of 120 is also torn out of the poster. This source is a source of noise pollution. Give some possible examples of noise pollution.

   C) Why does the lower section of the paper carry a warning?

2. A sound engineer sometimes wears ear defenders in a studio.

   What is the purpose of ear defenders?

3. A public address system is used at airports to give passengers information. It is made up of three components, as shown below.

   State clearly the function of each of these components.

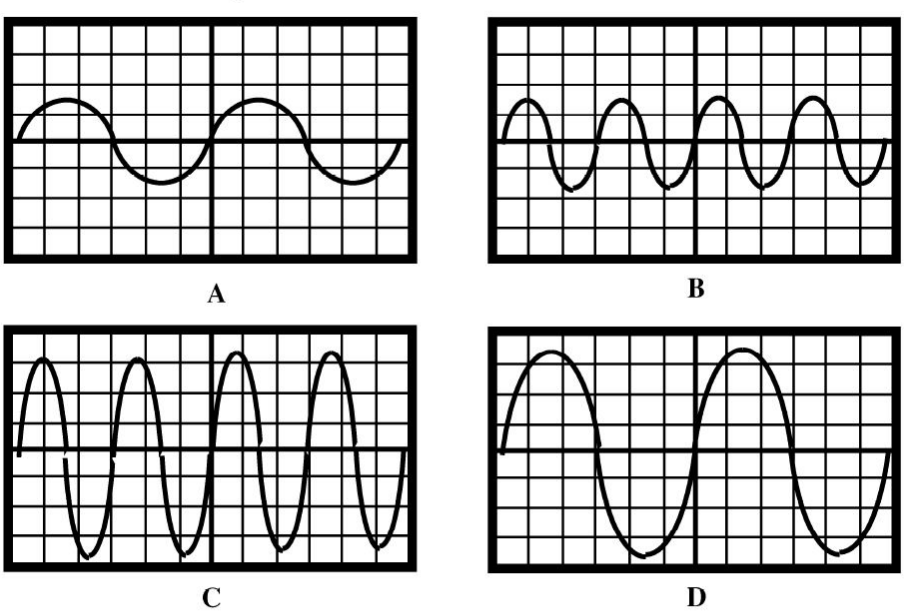
4. Give four examples of electronic devices that use amplifiers.

5. A boy decides to record his voice on his phone. He speaks into the phone and is surprised to find that his voice sounds different when played back.

   Why does his recorded voice sound different to him?

Self Check 6 continued

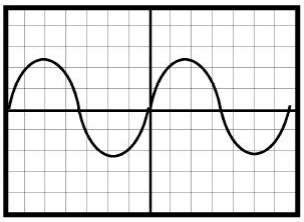
6. Four oscilloscope traces are shown. The oscilloscope controls are all at identical settings.



Trace A is the input signal to an amplifier.

a) Which trace shows the output signal of the amplifier?
b) The input signal has a frequency of 200 Hz. State the frequency of the output signal.

7. Laura whistles into a microphone connected to an oscilloscope.
The trace produced on the oscilloscope is shown below.



Laura again whistles into the microphone which is connected to the same oscilloscope through an amplifier. The oscilloscope settings have not been changed.

Copy the original trace and draw the new trace which would be obtained once the amplifier is used.

Self Check 7 : E-M Spectrum

1. The waves shown below are all members of the electromagnetic spectrum. Answer the following questions about the spectrum.

Gamma Rays	X-Rays	Ultraviolet	Visible Light	Infrared	Microwaves	Radio & TV Waves

a) State the speed of these waves.

b) Which of the waves has the
   (i) greatest wavelength?
   (ii) largest frequency?

c) Are the waves of the electromagnetic spectrum, transverse or longitudinal?

2. How far will radio waves travel in 2 seconds?

3. How long will it take for microwaves to travel a distance of 1 800 000 000 metres?

4. The sun emits both infrared and visible light.

a) State which of these two has the greatest wavelength.

b) How does the speed of red light compare with infrared?

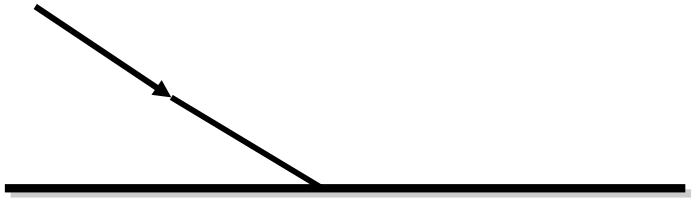
c) It takes visible light from the sun 8 minutes to reach the Earth. How long does it take infrared?

d) It takes visible light from the sun 8 minutes to reach the Earth. How far away is the sun in metres?

Self Check 8 : Reflection of Light

1. Stars and lamps can be seen because they give out light. How are other things, such as a pencil or your jotter seen ?

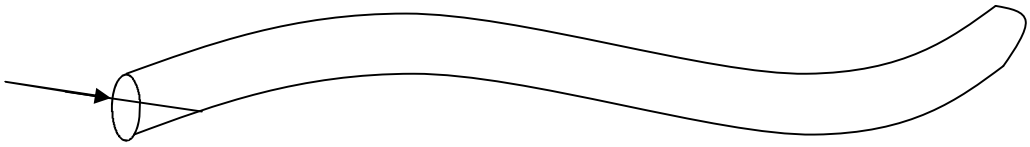
2. A beam of light strikes a mirror as shown :



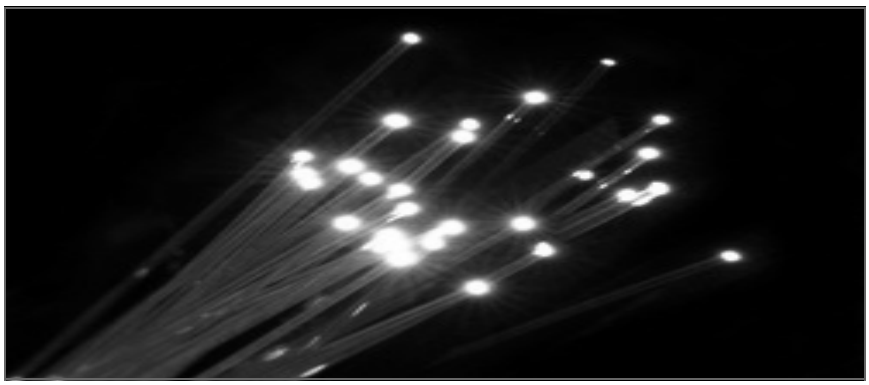
Neatly copy and complete the diagram showing the direction of the beam of light. Add the **normal** to the diagram and label the **angle of incidence** and the **angle of reflection**.

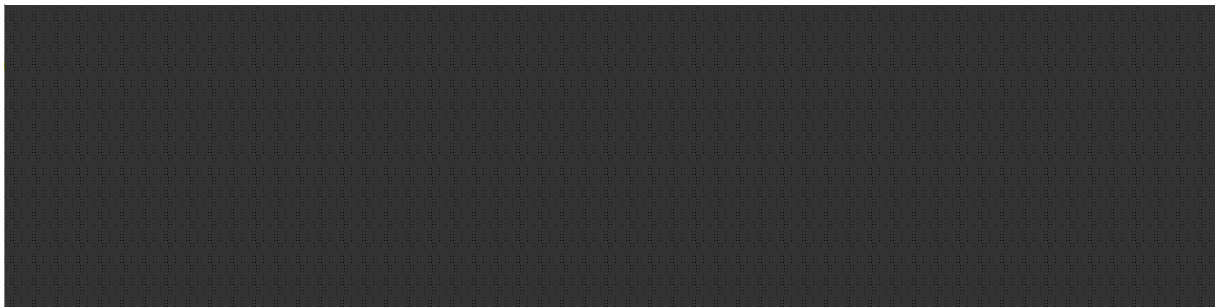
3. What is an optical fibre ?

4. Light is passed along an optical fibre without any of the light escaping. Copy and complete the following diagram of an optical fibre to show how this is achieved:



5. Describe one practical use of optical fibres.

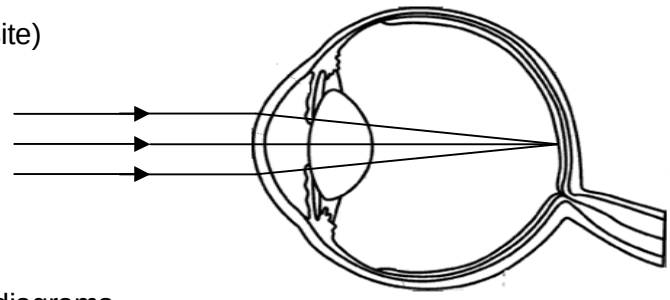




Self Check 9 : Refraction

1. The speed of light changes as it passes from one material to another. This may cause the light to bend. What name is given to this process?

2. Light bends as it enters the human eye as the speed of light changes. (See the diagram opposite)

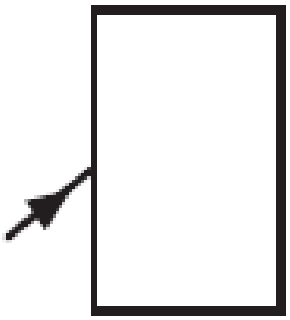


   a) In what parts of the eye does the bending take place?

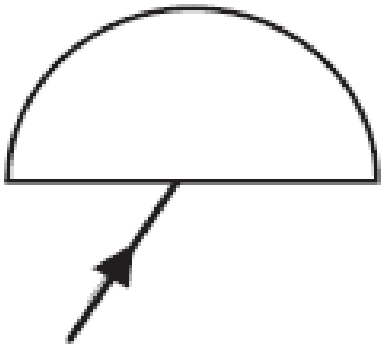
   b) The rays of light are focussed upon which part of the eye?

3. Copy and complete the following diagrams showing the path of the rays through the shapes

   a)

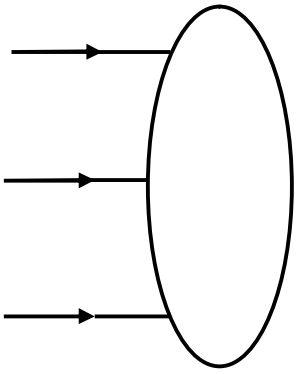


   b)

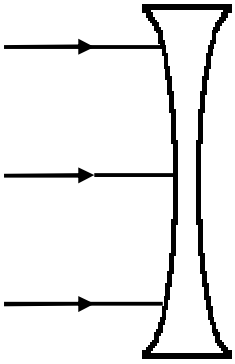


4. Neatly copy and complete the following diagrams to show the path of the light rays in and after passing through the glass lens :

   a)



   b)



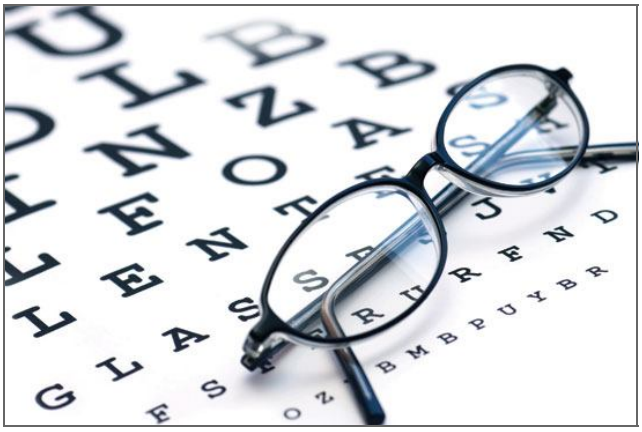
   c) Name each of the lenses correctly.

Self Check 9 continued

5. Joanne can see the cables clearly when she is wiring a plug but cannot see clearly the number plate on a far away car.

   a) Would Joanne be described as long sighted, normal sighted or short sighted?

   b) What type of lens would Joanne need in glasses to correct her eye defect?



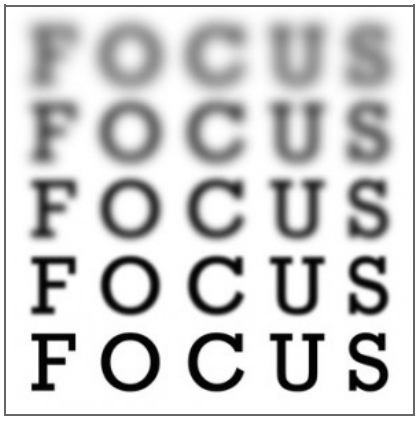
6. a) A man has to strain to read a newspaper. From which eye defect does he suffer?

   b) He decides he wants glasses to help him. What type of lens should be in his glasses?

7. Show using a diagram how rays would pass through an eye resulting in

   a) short sight

   b) long sight.



Self Check 10 : Infrared

1. All hot objects give off heat radiation. What is the name for this invisible heat energy?

2. Special cameras which detect infrared radiation can be used in medicine to take colour photographs known as thermograms. Why are there different colours on a thermogram?

3. During earthquakes people are often trapped under the rubble of collapsed buildings. Rescue teams use infrared sensing equipment to detect the radiation given off by the trapped people. Describe in a few sentences how this equipment is used to save lives.

4. People who suffer from sore backs or muscle strains visit a physiotherapist who may use a heat lamp to relieve the pain. How does the infrared radiation help?

5. The heating effect of infrared radiation is often used in the car industry. Why is infrared radiation used after car body painting?

6. Some surfaces absorb infrared radiation better than others. The table below shows the
Percentage of infrared absorbed by different surfaces.

Surface	Percentage of Infrared radiation absorbed (%)
Whitewashed wall	40
Red brick wall	70
Polished aluminium	25
Tar	90

a) Draw a bar chart showing the percentage of infrared radiation absorbed by the surface.

b) Which surface absorbed the most infrared radiation?

c) Which surface would you choose for the outer wall of a house in a very sunny country?

d) Explain your answer to C).

Self Check 11 : Ultraviolet

1. There is some ultra violet radiation present in the radiation from the Sun.

   a) What effect does a low level of exposure have on us?

   b) What is the possible effect of over exposure?

2. When some chemicals absorb ultraviolet radiation they glow or emit visible light.

   a) What name is given to this effect?

   b) Describe how this effect is used in security markings

      (i) on bank notes (ii) on passports (iii) on concert tickets.

3. How do sun tan creams work to help protect your skin?

4. Why is it not possible to get a tan indoors, even if sitting at the window?

5. Why do scientists fear more cases of skin cancer if any more of the ozone layer is destroyed?

Self Check 12 : X-rays

1. Give one way in which X-rays are different from light.

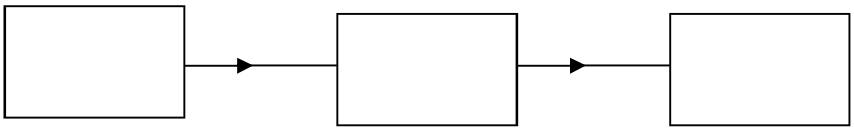
2. At large airports, passengers must pass through an X-ray machine for security reasons. Signs warn travellers not to have camera film when they pass through. What happens to the film ?

3. An X-ray photograph of an arm is shown below.

   a) Why does the bone appear as a lighter area and the tissue as a darker area in the photograph?

   b) What difference would be seen on the photograph if there was a break in the bone?

4. To take an X-ray photograph of an arm bone (B), an X-ray machine (X) and a photographic film (F) are needed. Copy the boxes below and place B, X and F in the correct order to show their positions so that the photograph may be taken.



5. Why do radiographers in hospitals, who take X-rays to detect broken bones, stand behind protective shields?

6. Describe one use of X-rays in industry.

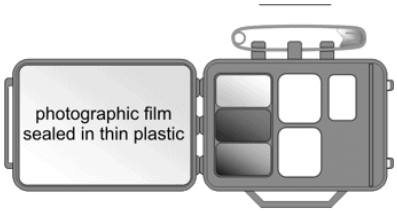
Self Check 13 : Gamma Rays

1. Gamma rays can be used in the treatment of cancer and in the sterilisation of medical instruments. In each case the same effect of gamma rays is being used. What is the effect?

2. Great care is required when handling gamma sources.

   a) Explain why sources must only be handled with long forceps.

   b) Workers who deal with gamma sources wear special film badges.



   What is the purpose these badges?

3. Only very thick concrete, steel or lead offer any protection as a shield against gamma radiation. Why do other materials not offer much protection?

4. In medicine chemicals which give out gamma rays are used to trace paths through the inside of the body.

   a) Why are gamma rays used for this purpose?

   b) Describe how doctors can map out the path taken by the chemical.

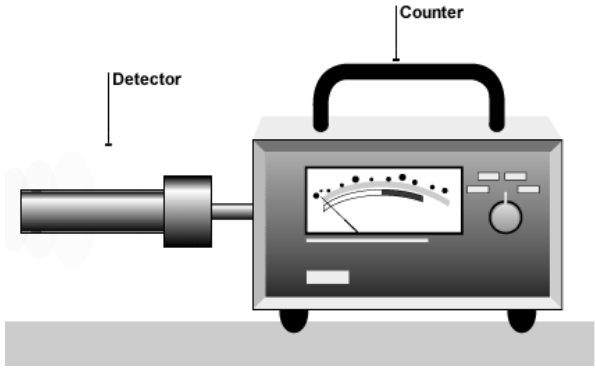
   c) The strength of a gamma source decreases with time. Why is this essential in this case?

5. State **two** safety precautions needed when dealing with a source of gamma radiation.

Self Check 14 : Nuclear Radiation

1. Using a diagram, describe the simple model of an atom.

2. A teacher places the apparatus below on a bench in a laboratory.

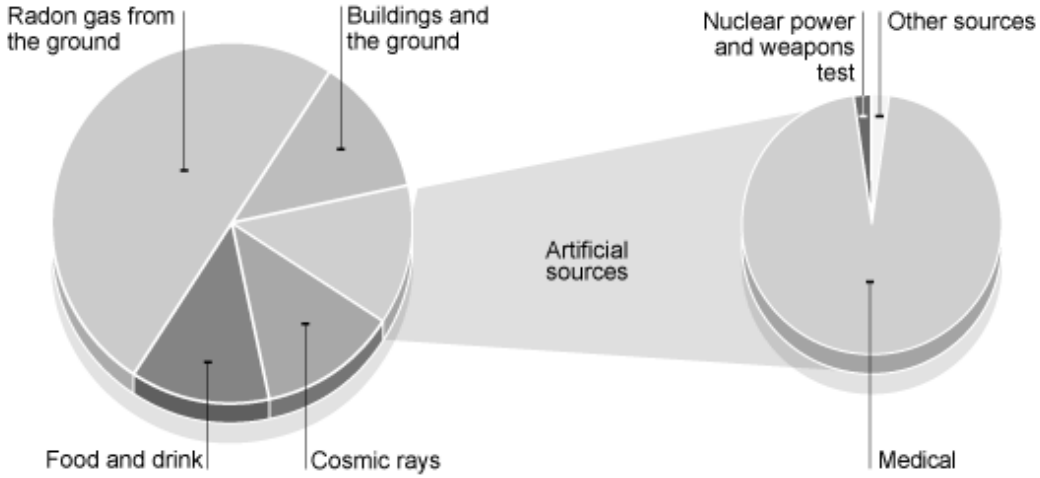


a) What is the name of the detector of radiation shown in the diagram?

b) As soon as the detector is switched on it starts to take readings although there Is no radioactive source nearby. What is being detected by the apparatus?

3. What is meant by the term " background radiation"?

4. Study the pie charts below which identify the sources of background radiation.



a) Which natural source results in the most background radiation?

b) Which artificial source results in the most background radiation?

Self Check 14 continued

5. The table below gives the dose of radiation received by a patient in different medical examinations.

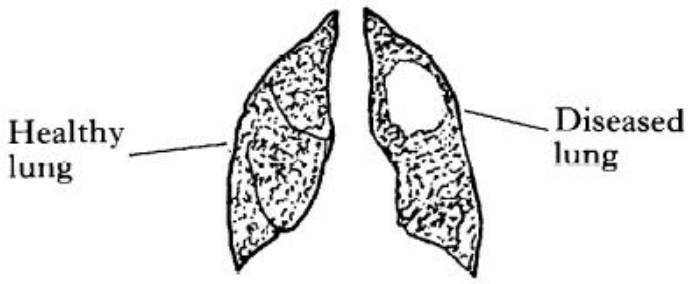
Source	Dose (units)
Chest X-ray	30
Pelvic X-ray	300
Barium meal	1000
Thyroid Scan	16400

a) In which examination does the patient receive the highest dose?

b) The maximum allowed dose in one year for a member of the public is 5000 units. How many barium meals is a patient allowed in a year?

C) One thyroid scan is much greater than the maximum dose allowed for a member of the public. Why are hospitals allowed to give such a large dose to one person?

6. A doctor injects a radioactive tracer into the blood stream to check the supply of blood reaching a patient's lungs. A radiation detector is used to build up a diagram of the position of the tracer in the lungs. The diagram shows the picture obtained for a patient who has a healthy and a diseased lung.



a) What information does the light area in the picture of the diseased lung give the doctor?

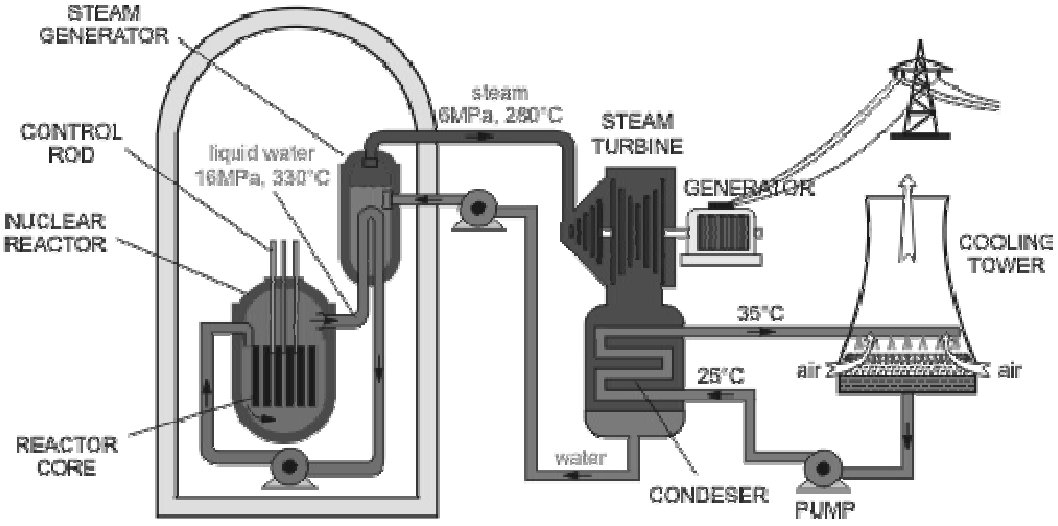
b) Most of the radiation from the tracer passes through the body to the detector. Name the type of radiation emitted by the tracer.

c) What will have happened to the activity of the tracer some time after the picture was taken?

Self Check 15 : Nuclear Industry

1. Using a diagram, describe the simple model of the atom.

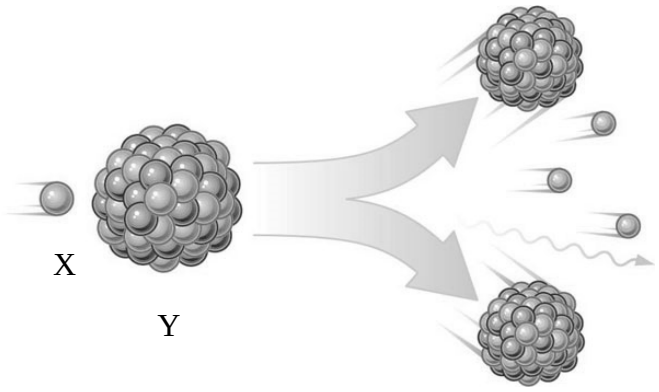
2. Many countries use nuclear reactors to produce electrical energy. A diagram of a nuclear power station including the reactor is shown below.



a) What type of nuclear reaction tales place within the reactor ?

b) State one advantage and one disadvantage of using nuclear power for the generation of electricity.

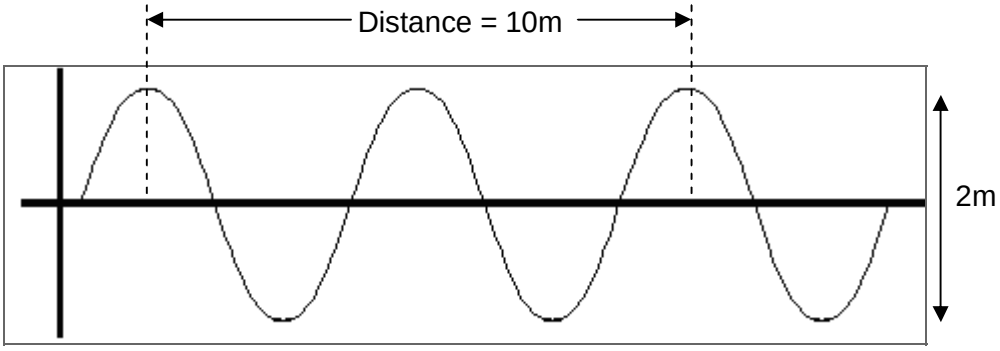
3. The diagram below shows the nuclear reaction which takes place within the nuclear reactor.



Identify X and Y.

Extra Work Self Check 1

1. During an experiment, the following note are taken:



(a) Using the information provided in the diagram, find the wavelength.

(b) Calculate the speed of the wave if the frequency is 5Hz.

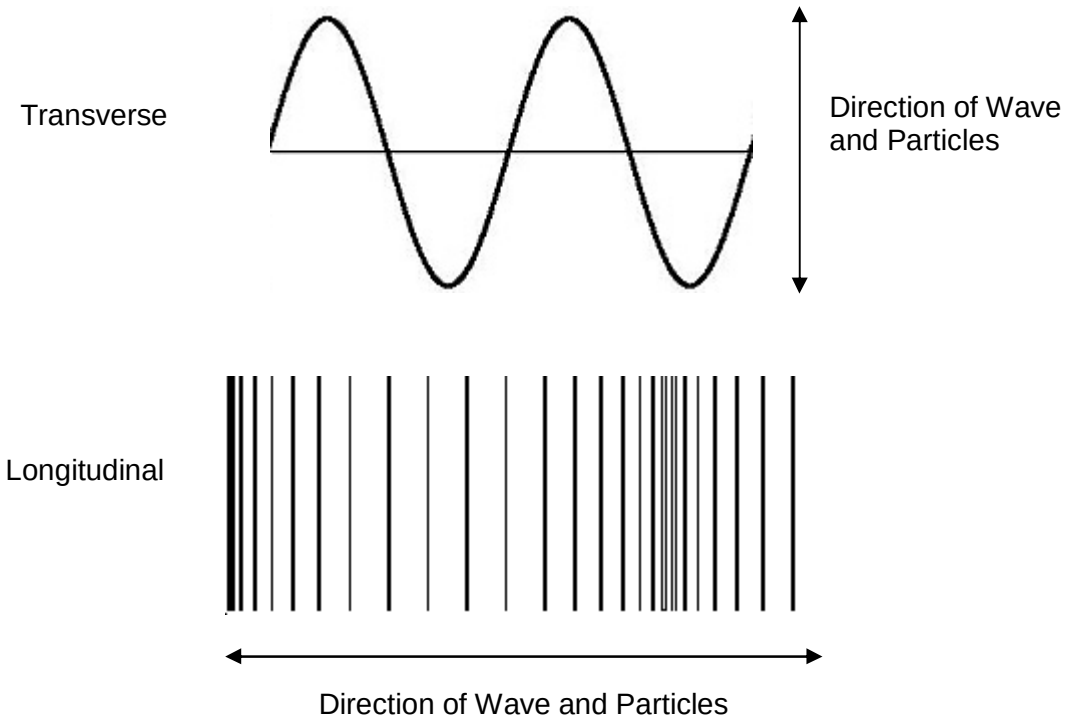
2. As a wave approaches the shore, the water becomes shallower.

(a) What will change for the wave as it approaches the shore?

(b) A wave takes 3 minutes to travel to the shore from a distance of 500 metres. What is the average speed of the wave?

Extra Work Self Check 1 continued

3. To explain the differences between transverse and longitudinal waves, a student draws two diagrams on the board as shown below:

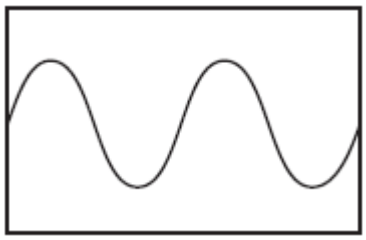


(a) A second student notices a mistake. What is the mistake shown?

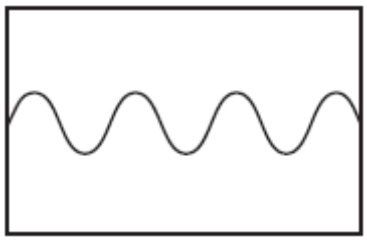
(b) The first student decides the transverse wave has a speed of 30m/s and a wavelength of 0.3m. What is the frequency of the wave?

Extra Work Self Check 2

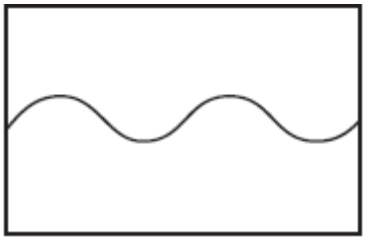
1. A student produces a sound wave using a tuning fork. The note is displayed on an oscilloscope as shown below:



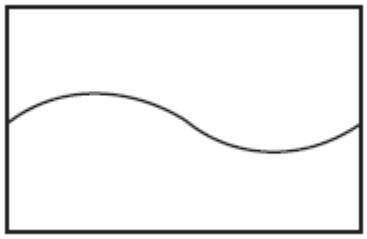
Leaving the oscilloscope controls as they are, the student now produces a quieter note. Which of the following 3 diagrams represents the new note.
Explain your answer.



A



B



C

2. A sound wave is produced in large sealed tube that contains air. The sound wave has a frequency of 600Hz.

   (a) Calculate the wavelength of the sound wave.

   (b) All of the air is now removed from the tube. Describe the change that occurs.

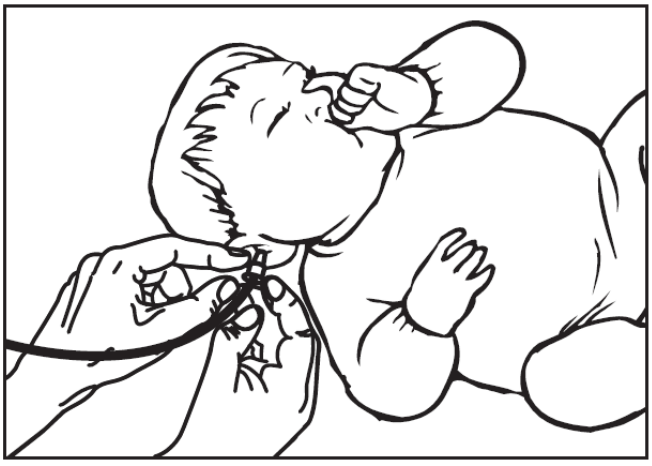
Extra Work Self Check 2 continued

3. Using a signal generator, a sound wave with a wavelength of 16mm is produced. The sound wave travels through the air to a student's ear.

(a) By calculating the frequency, describe the sound that the student will hear.

(b) A sound is produced that has a frequency of 1500Hz. How many octaves can this sound go up by before the student can no longer hear it?

4. A newborn baby is given a hearing test. A small device, containing a loudspeaker and a microphone, is placed in the baby's ear.



A pulse of audible sound lasting 0.5s is transmitted through the loudspeaker. The sound is played at levels up to 80dB.

(a) Give a reason why this pulse of sound does not cause damage to the baby's hearing.

(b) Suggest a frequency that could be used for the hearing test.

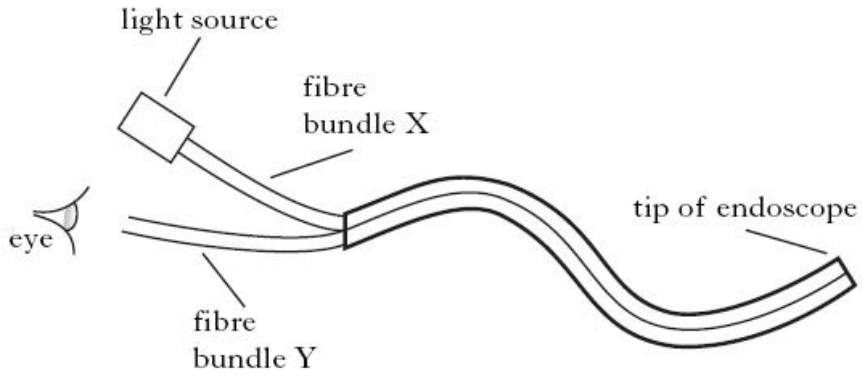
Extra Work Self Check 3

1. Long and short sight are the two most common visual defects in the UK. Converging and diverging lenses are used to fix these defects.

   (a) State which lenses are used to correct which eye defect.

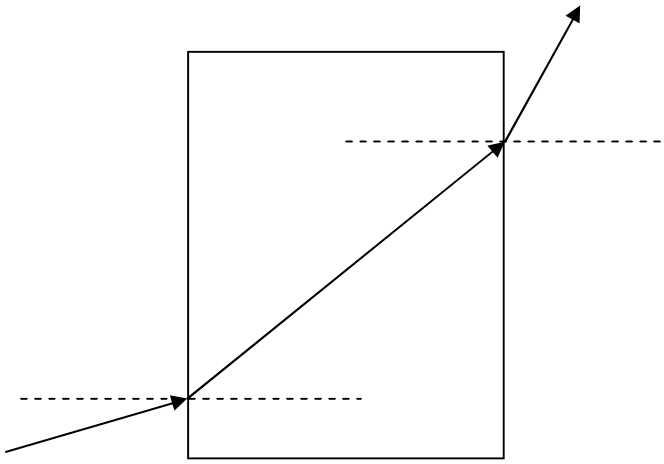
   (b) Using diagrams, describe how each lens corrects the defect involved.

2. Doctors can use an endoscope to examine internal organs of a patient. The endoscope has two separate bundles of optical fibres that are flexible.



   Explain the purpose of each bundle of optical fibres in the endoscope.

3. To explain refraction, a student draws the following diagram on the board:



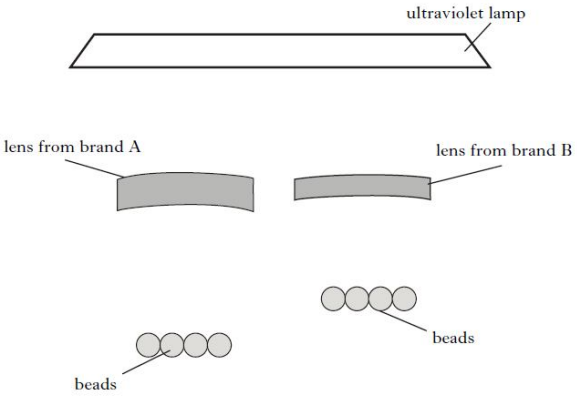
   (a) A second student says this diagram is wrong. Explain why the second student is correct.

   (b) Draw how the diagram should look.

Extra Work Self Check 4

1. A student sets up the following experiment to compare how two different brands of sunglasses protect from ultraviolet radiation. The student uses beads which change colour when exposed to ultraviolet radiation. The student covers one set of beads with a lens from brand A and another with a lens from brand B. The ultraviolet lamp is switched on for 30 minutes.

   The apparatus is set up as shown:



   (a) Give **one** reason why this test is not a fair one.

   (b) Why can exposure to ultraviolet radiation be harmful to humans?

2. The list below gives the different types of radiation that make up the electromagnetic spectrum:

   Radio **Infrared** **Ultraviolet** **Gamma**

   Microwaves **Visible Light** **X-Rays**

   Copy the table and fill in the types of radiation.

Type of Radiation	Application
	Helps to speed up muscles healing
	Used to identify security features
	Can be used as a medical tracer
	Used to look inside your luggage
	Used when communicate with others without wires

Extra Work Self Check 4 continued

3. The electromagnetic spectrum is shown below.

Radio Waves	X	Infrared	Y	Ultraviolet	Z	Gamma

.

Different types of waves in the spectrum are used in medicine.

(a) What property do all electromagnetic waves have in common?

(b) Copy and complete the diagram correctly identifying waves X, Y and Z.

(c) Gamma radiation is used in medicine as a tracer.

(i) Explain why gamma radiation is used rather than alpha or beta radiation.

(ii) The activity of the gamma radiation is measured using a Geiger-Muller tube. After a few days, the activity of the gamma radiation is measured again. How is the second reading different from the first? Explain your answer.

4. A student sets up an experiment to measure which travels faster - infrared, red light, violet light, or ultraviolet. All of the waves travel the same distance.
Describe the results the student will obtain.

Extra Work Self Check 5

Below are three images which are taken by thermal cameras. These images are taken using an invisible form of electromagnetic radiation.

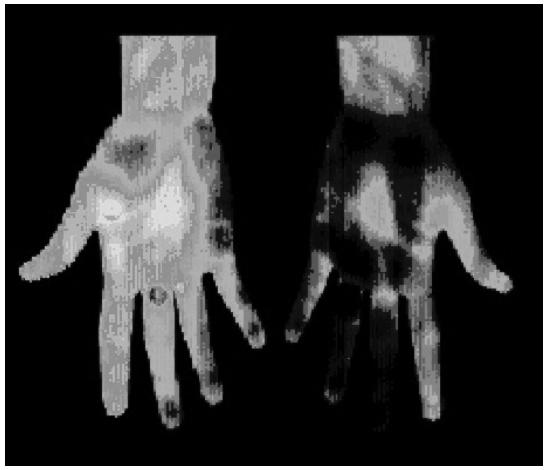
(a) State the radiation used to make these images.

(b) For each image state.

i) What is the source of the invisible radiation?
ii) Who might use these thermal images?
iii) Why is the thermal image useful in each case?

1

2



3

Extra Work Self Check 6

1. Many people use sunbeds to develop a sun tan. These beds have a number of large tubes which emit UV.

(a) Why are people advised to use sun beds sparingly?

(b) Why must they wear dark goggles when they use them?

(c) Some people use sun beds for medical benefits. Name two medical benefits of using sunbeds.

2. (a) Why might a South American hill top shepherd be particularly concerned about the ozone layer?

(b) What could he do to protect his eyes and skin?

Extra Work Self Check 7

1. The diagram below is an x-ray photograph of a human heart.

(a) Why do x-rays show up bones and heavy tissue like the heart?

(b) The x-ray clearly shows some blood vessels feeding the heart muscle.
Why would you not normally expect these vessels to show up on an x-ray?

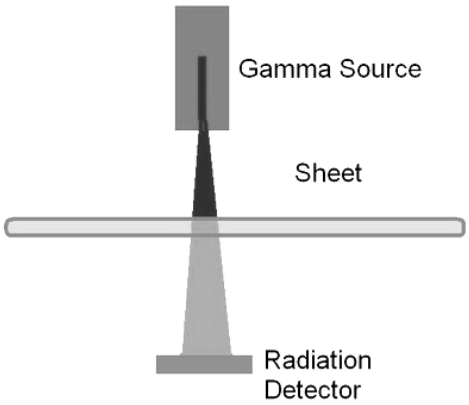
(c) The blood vessels can show up, as above, after a barium injection.
What does barium do to the x-rays?

(d) Why might a radiographer ask a patient to drink a “barium meal” before an x-ray?

(e) What is the purpose of the letter “R” in the x ray?

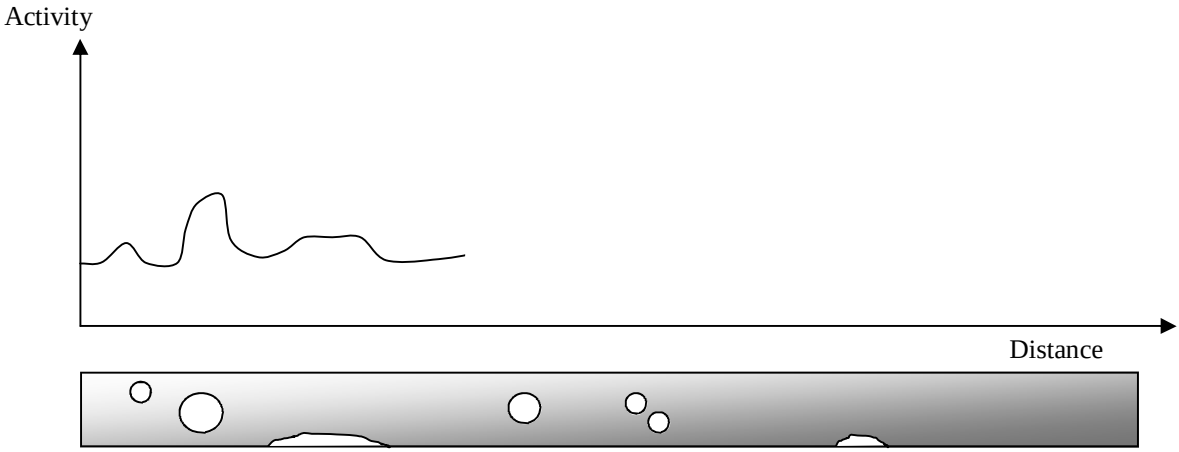
Extra Work Self Check 8

1. A gamma ray source is used to check a sheet of steel plate for defects. The plate is passed between the source and detector and the activity is recorded as the plate moves.



(a) How might a defect, such as crack or an air pocket, be detected with the device above?

(b) The sheet below is tested and failed, generating the graph shown. Copy and complete the trace.



(c) Whys is gamma radiation required, rather than beta or alpha?

(d) A similar arrangement can be used to check other materials, but a change of source is required. What source would you recommend is used to check

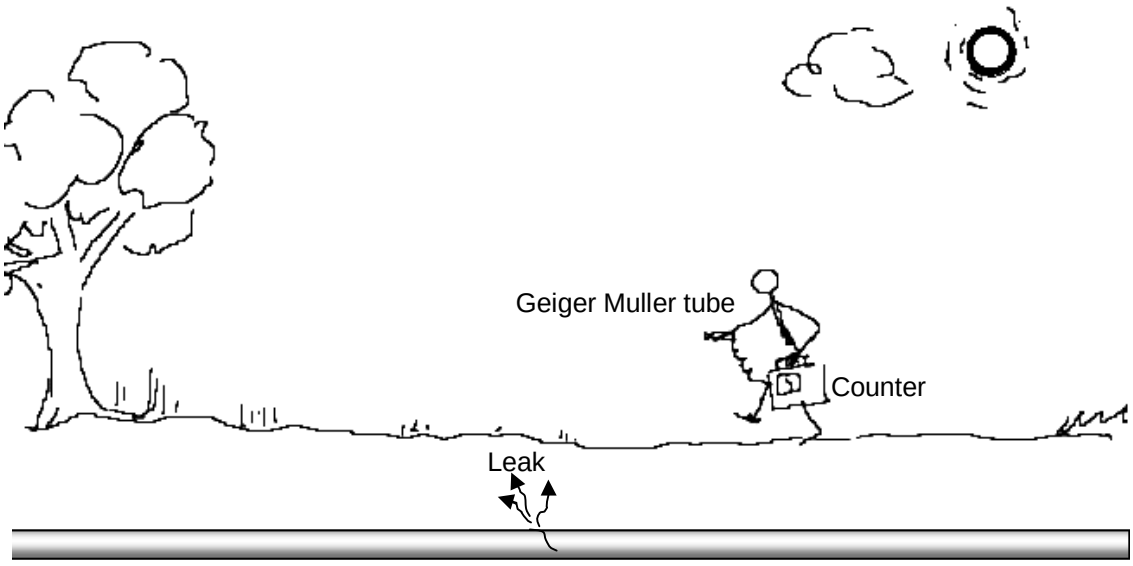
(i) The thickness of aluminium foil?

(ii) The thickness of thin paper?

Explain your answer.

Extra Work Self Check 8 contin-

2. An underground pipe has been found to be leaking. In order to find the leak a man adds a gamma ray source to the water in the pipe as a "tracer." He then walks along the path above the pipe, as shown in the diagram below.



(a) Why is he checking the air with a Geiger counter?

(b) What will happen to the count rate above the crack?

(c) Why must he use a gamma source?

(d) What will happen to the source activity with time?

(e) Why is the time this takes to happen important?

Extra Work Self Check 9

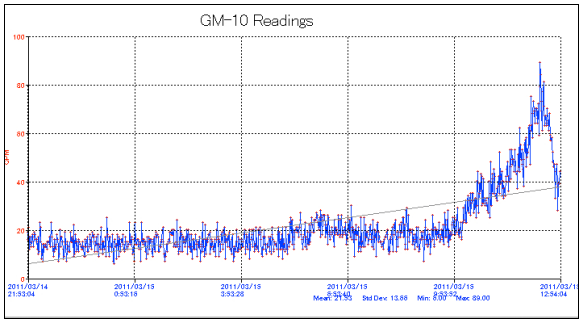
Fukishima Power Plant Meltdown, 2011.

In March, 2011 a nuclear power plant in Fukishima, Japan is said to have “narrowly averted” nuclear meltdown. The threat of melt down followed a chain of events triggered by an earthquake.

Scenes form Fukishima on the 12th March, 2011, one day after the earthquake.

1. The scene on the left shows the power plant after an explosion.
   (a) What concerns might there be about the smoke issuing from the reactor?
   (b) What effect might this have on background radiation?
   (c) Why did scientist monitor the wind direction closely in the days after the explosion?

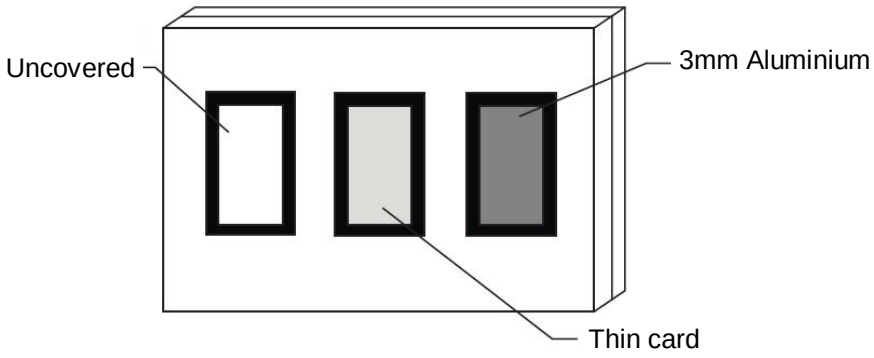
2. The scene on the right shows a child being checked by a government official.
   (a) What is the official checking the child for?
   (b) Why is he checking the child?
   (c) Suggest a suitable device that he may have use.



3. Four days later the background radiation in Tokyo rose to 4 times the normal background count.
   (a) Why did it not rise immediately?
   (b) The government advised the population of Tokyo that they should not be unduly concerned about this rise. Why do they think that a rise of four times in background count should not be alarming?

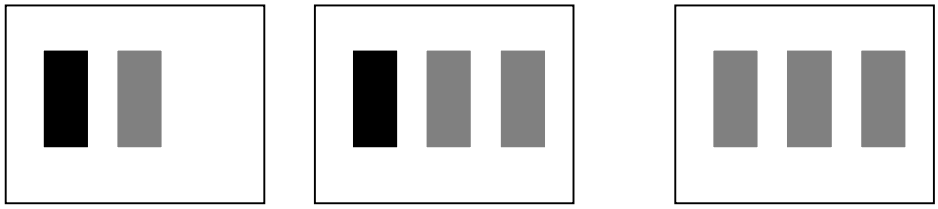
Extra Work Self Check 10

1. As a safety precaution a radiation worker wears a film badge when working with radioactive sources. The film badge contains photographic film.
Light cannot enter the badge. The film turns black when it is developed if it has been exposed to radiation.

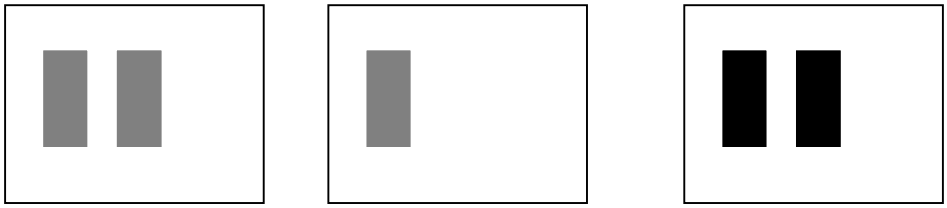


Describe how the film badge indicates the **type** and approximate **amount** of radiation received.

2. Six workers badges have been checked, suggest what type and amounts of radiation (high or low) the worker may have received.



(a) Richard (b) Murad (c) Elaine



(d) John (e) Paula (f) Aisha