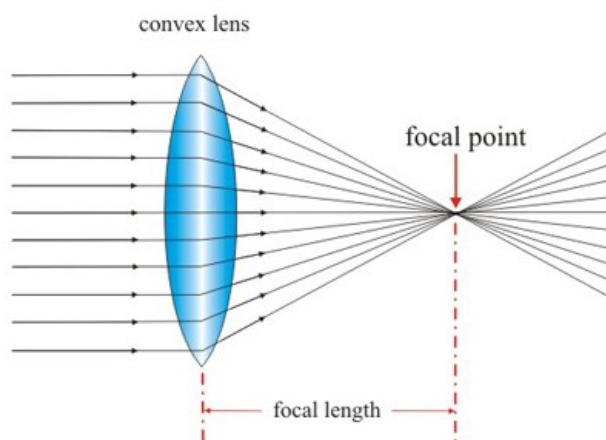




S2 Medical Physics

Homework



Homework 1

Thermometers

1. A thermometer uses liquid mercury in a glass tube to measure temperature changes. What property of the mercury makes it suitable for measuring temperature changes?
2. The diagram below shows a clinical thermometer.



Describe the two main differences between an ordinary thermometer and a clinical thermometer.

3. Copy the table below and match the type of thermometer to the measurable physical quantity which changes in each case.

Type of Thermometer	Measurable Physical Quantity
Mercury Thermometer	resistance to electrical current
Crystal Strip Thermometer	different amounts of expansion
Rotary Thermometer	liquid expansion on heating
Digital Thermometer	colour change with temperature

4. After being rescued from a mountain trip, an explorer's temperature is measured and is found to be 34°C .
 - (a) State normal body temperature.
 - (b) Explain why the explorer's temperature is a concern to the rescuers.
 - (c) What is the name of the condition the climber is experiencing?



Homework 2

Sound

1. A stethoscope can be used to listen to a patient's lungs. Describe how a stethoscope is able to be used for this task.
2. A pupil creates the following table in her jotter:

Sound is produced by	frequency
The number of waves per second is the	ultrasound
Sound levels are measured in	vibrations
Frequencies above 20 000Hz are	decibels

The pupil has entered the information incorrectly into her table. Redraw the table with the information entered correctly.

3. The photo shows an ultrasound picture of an unborn baby.

- (a) Explain how ultrasound waves can be used to produce the picture.
- (b) Why are ultrasound waves used instead of X rays?



4.
 - (a) Explain what is meant by “noise pollution”
 - (b) Give one example of noise pollution.

5. An ultrasound pulse is transmitted through fat tissue. The speed of sound in fat is 1450m/s. If the wavelength used is 0.005 m, calculate the frequency of the ultrasound pulse.

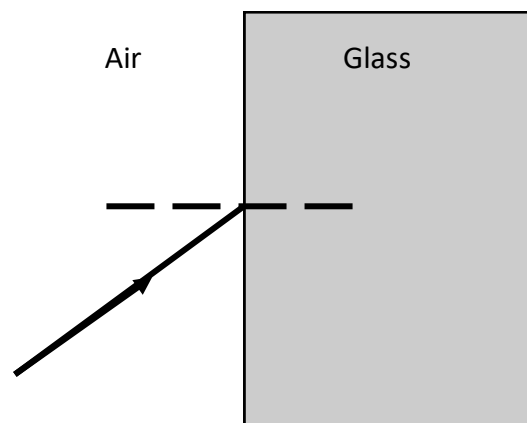


Homework 3

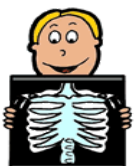
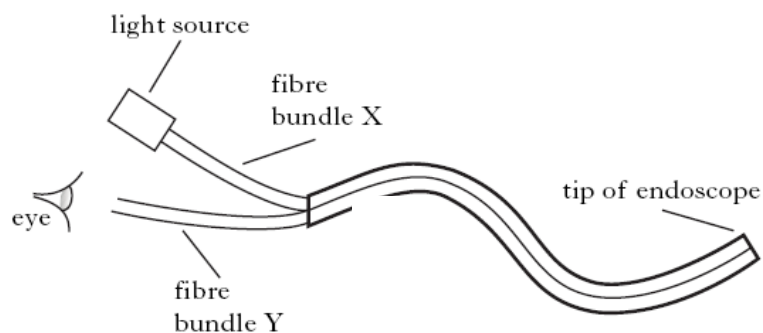
Optics

1. Copy and complete the diagram below to show what happens to the ray of light as it passes from air into glass and from glass into air.

Label your diagram to show the angle of incidence in the air, and the angle of refraction in the glass.



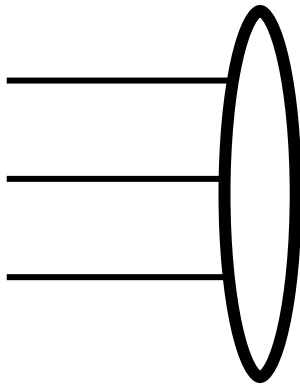
2. Keyhole surgery is used in several operations. This involves the use of an endoscope, which has fibre optics as part of its construction.
 - (a) What is a fibre optic?
 - (b) What is the advantage of using an endoscope as a source of light, when examining tissue inside the body?



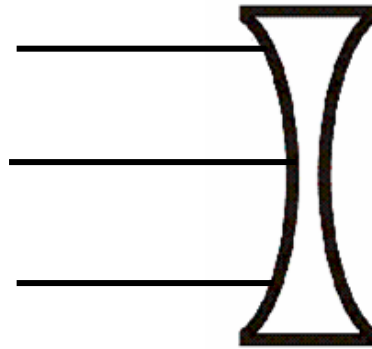
Homework 3 Continued

Optics

3. A diagram of two different types of lens are shown below:

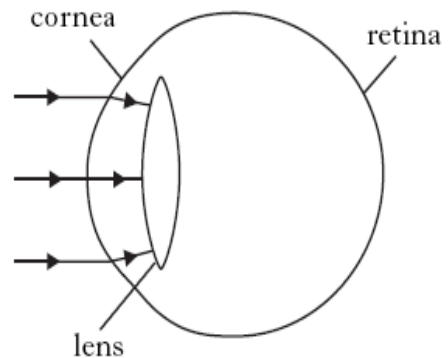


Lens 1



Lens 2

- (a) What is the name given to lens 1?
- (b) What is the name given to lens 2?
- (c) Copy and complete the diagrams for both lenses showing what happens to the rays after they pass through each lens.
4. In the eye, refraction of light occurs at both the cornea and the lens.
- (a) Copy the diagram and complete it for someone who is said to be “short sighted”
- (b) Which lens should be used to correct short sightedness?
- (c) Apart from wearing glasses or contact lenses, state one other treatment which could be used to correct this sight defect.



Homework 4

The Electromagnetic Spectrum

1. X rays are part of the electromagnetic spectrum. They have a short wavelength and carry a lot of energy. X rays are invisible to the human eye.

(a) What are X rays used for in medicine?

(b) What is used to detect X rays?



2. CT Scans are used to detect brain tumours.

What is the advantage of using this type of scan instead of using a series of X rays?

3. MRI Scans are now used in hospitals. They use magnetic fields to build up an image of the patient.

(a) What advantage does MRI have over X Rays?

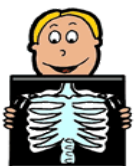
(b) Why might a patient who has a metal pin in their leg not be suitable for this type of scan?

4. In some parts of the world, including the UK, there is a maximum time people should sunbathe each day.

(a) What radiation are you exposed to during sunbathing?

(b) What are the dangers of excessive exposure to this radiation?

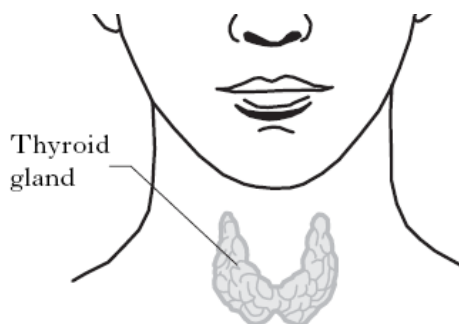
5. Some people suffer from arthritis and this causes a rise in temperature in the joints. Which radiation will be emitted from the joint indicating the change in temperature?



Homework 5

Radiation

1. Radiotherapy is a treatment used to treat cancers. A machine which produces Gamma Rays rotates around the body.
 - (a) What does the Gamma Radiation do to the cells of the tumour?
 - (b) Explain why rotating the machine provides a safer way of ensuring that the cancerous tissue receives the maximum dose.
2. The thyroid gland, located in the neck, is essential for maintaining good health.

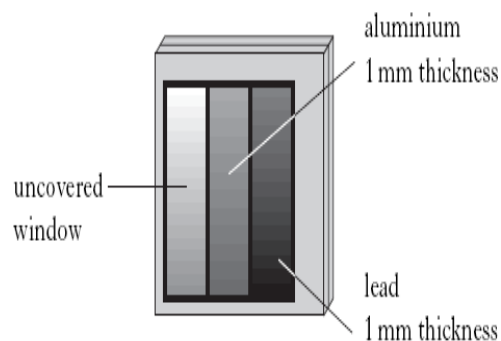


A radioactive source, which is a gamma radiation emitter, is used as a radioactive tracer for the diagnosis of thyroid gland disorders.

- (a) Describe how the doctor would use the source as a tracer.
- (b) Why wouldn't an alpha emitter be suitable for this function?

3. A hospital physicist is working with some radioactive materials. The physicist wears a badge containing photographic film. Light cannot reach the film

When developed the film behind the uncovered window has turned black but the film behind the other two windows are unchanged.



Which two types of radiation could the worker have been exposed to?

