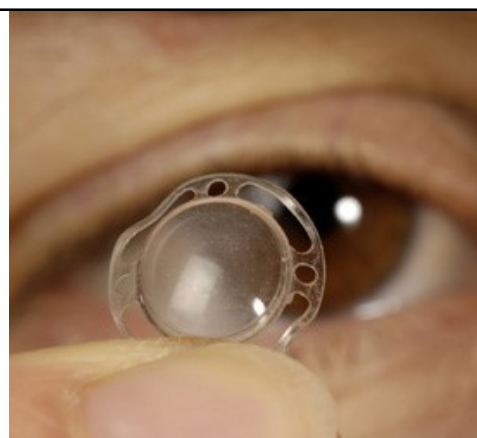


# **S2 Medical Physics**

## **Self Checks**



# **Self Check 1**

## **Thermometry**

1. Describe two important features of a liquid in glass thermometer, which allow you to take a body temperature.



2. Explain why the measurement of body temperature gives important information to a doctor.
3. Describe two differences between a clinical and ordinary thermometer.
4. During a mountain climb Arthur's body temperature is measured as  $34^{\circ}\text{C}$ . Explain whether this value should give cause for concern .



# **Self Check 2**

## **Using Sound**

1. There are three key parts of a stethoscope. Name each part and state what it does.
2. What sounds might a doctor be listening to with a stethoscope?
3. (a) What is meant by ultrasound?  
(b) Give an example of its use in medicine.
4. During a study class the noise of a pneumatic drill is heard through an open window.  
  
(a) Suggest a value for the noise level experienced a few metres from the drill.  
  
(b) If this noise persists for a short time what might be the physical effect on the person's hearing?

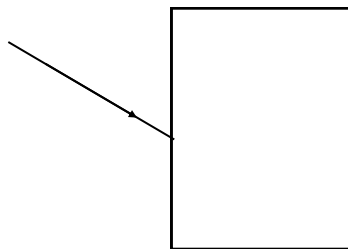


# **Self Check 3**

## **Light and Vision**



1. What is the job of the retina in the eye?
2. Describe how the image of a tree as seen on the retina compares to the original tree?
3. A ray of light enters a glass block as shown. Copy and complete the diagram showing the passage of the ray through the glass and out the other side.



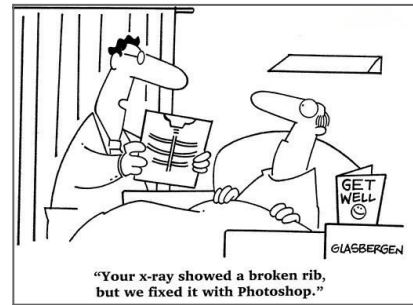
4. Teri can see distant objects clearly but near objects are blurred.
  - (a) What eyesight defect is she suffering from ?
  - (b) What kind of lens is needed to correct this problem?



# **Self Check 4**

## **Lasers**

1. Describe one use of lasers in medicine.



## **Using the Spectrum**

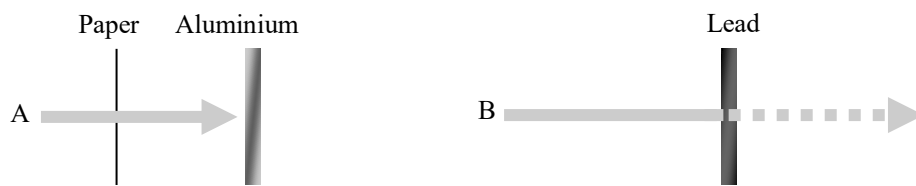
2. During a building collapse some people are suspected of being trapped. They can be detected by the heat given out by their bodies.  
What kind of radiation is being detected?
3. We are constantly exposed to ultra violet radiation from the sun.
  - (a) Why is it necessary to receive some of this type of radiation?
  - (b) Excess exposure to this radiation can cause problems.
    - (i) What are the short term dangers of excessive UV light?
    - (ii) What are the long term dangers of continual or repeated exposure to UV light?
4. When you have suspected broken limb, you may be given an X- ray.
  - (a) What is used to detect these rays?
  - (b) Explain why a break is shown as a white or a black line.



## **Self Check 5**

### **Radiations**

1. A radioactive source gives out two different types of radiation;  
Radiation A passes through paper but is absorbed by aluminium.  
Radiation B passes easily through the air and is reduced by a piece of lead.



What are the two radiations ?

2. Gamma radiation is dangerous but it is used to detect problems using a gamma camera.  
  
Why is a gamma source used rather than alpha or beta sources?
3. State two precautions that should be taken when handling radioactive sources
4. What is meant by background radiation?



# Extra Work Self Check 1

## Types of thermometers.

The following are some possible liquids that are used in thermometers.

Liquid	Lower limit ( $^{\circ}\text{C}$ )	Upper limit ( $^{\circ}\text{C}$ )	Wetting
Mercury	-38.5	800	No
Gallium Alloy	0	1200	No
Ethanol	-110	100	Yes
Pentanol	-115	135	Yes
Technical Pentane	-200	35	Yes

Mercury and gallium alloy are both liquids that don't "wet" the surface that they sit on. If mercury is held in a beaker and the beaker is tipped over, spilling the mercury, the beaker would be dry. No mercury would be left inside the beaker. In comparison, if a beaker of water is tipped over, spilling the water, the beaker would be "wet." Some of the water would 'stick' to the glass and not empty in the spill.

### Questions

1. Which liquids would be suitable for use in a science lab general thermometer?
2. Is it better that the liquids used for a thermometer wet, or do not wet the glass?  
Explain your answer.
3. Mercury has a freezing point of  $-38.84^{\circ}\text{C}$ . Why does this affect the lower limit of the thermometer?
4. Which liquids could be used in a clinical thermometer?
5. Which liquids could be used to measure the temperature of a standard home oven (up to  $250^{\circ}\text{C}$ )?
6. What type of thermometer might contain technical pentane?
7. Why is mercury is an excellent liquid for most thermometers?

You might know/Try to find out

8. There is a problem with mercury so it is not used in our school lab thermometers.  
What is the problem?
9. Why is this problem often overlooked elsewhere?

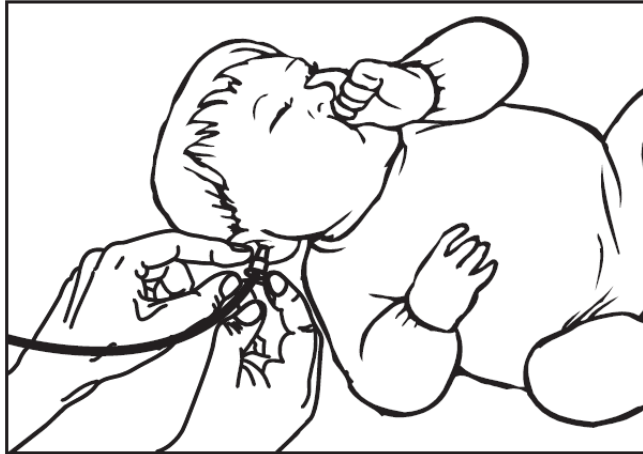
*Spilled mercury does not "wet" the surface.*



## S2 Medical Physics

## **Extra Work Self Check 2**

1. 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) A pulse of audible sound lasting 0.5s is transmitted through the loudspeaker.  
The sound is played at levels up to 80dB.
  - i) Give a reason why this pulse of sound does not cause damage to the baby's hearing.
  - ii) Suggest a frequency that could be used for the hearing test.
- b) An ultrasound scan can be used to produce an image of an unborn baby.  
Explain how the image of an unborn baby is formed by ultrasound.





## Extra Work Self Check 3

1. A short-sighted person has difficulty seeing the picture on a cinema screen. Figure 1 shows rays of light from the screen entering an eye of the person until the rays reach the retina.

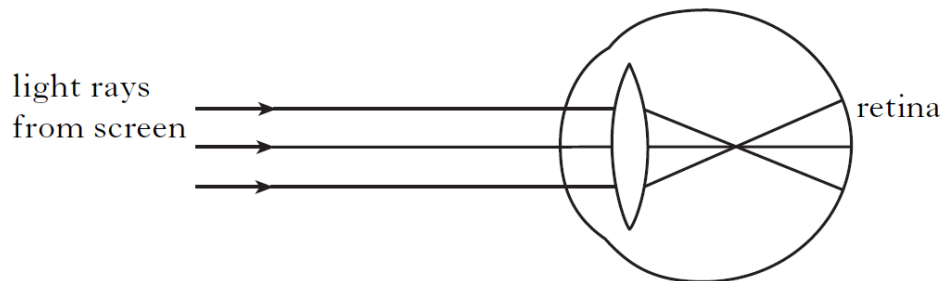
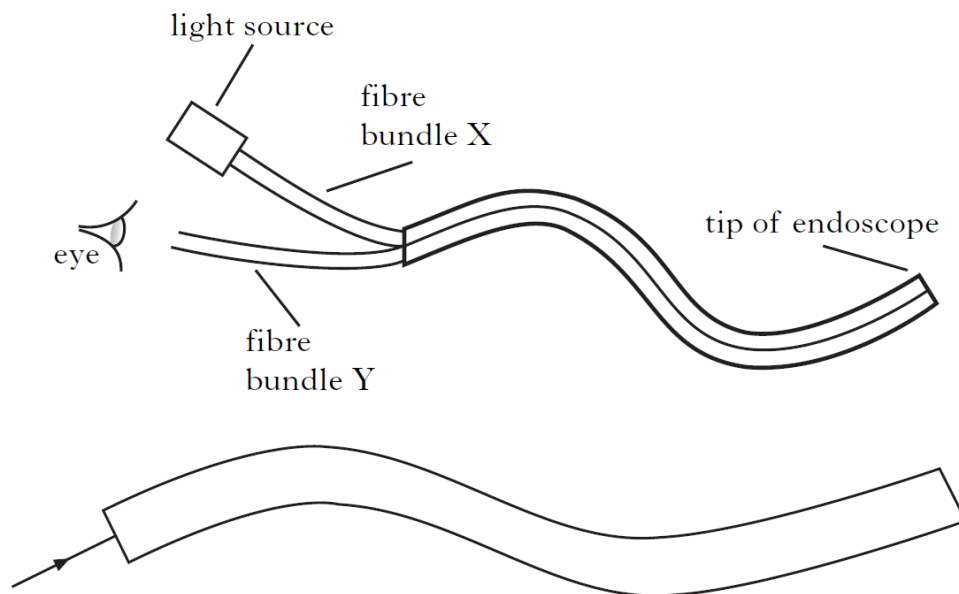


Figure 1

Draw the shape of lens that would correct this eye defect.

2. Doctors can use an endoscope to examine internal organs of a patient.



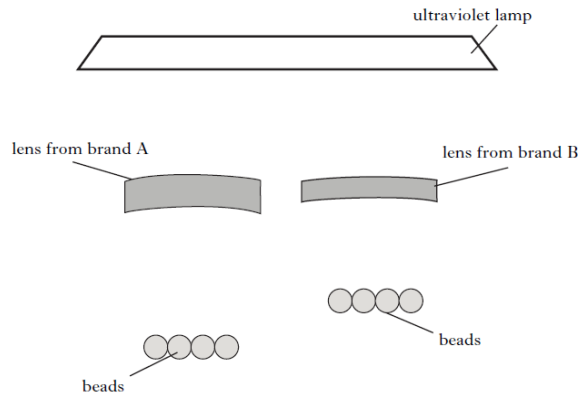
The endoscope has two separate bundles of optical fibres that are flexible. A section of optical fibre used in the endoscope is shown below.

- a) Copy and complete the diagram to show how light is transmitted along the optical fibre.
- b) Explain the purpose of each bundle of optical fibres in the endoscope.
- c) The tip of the endoscope that is inside the patient is designed to be very flexible. Suggest **one** reason for this.



## Extra Work Self Check 4

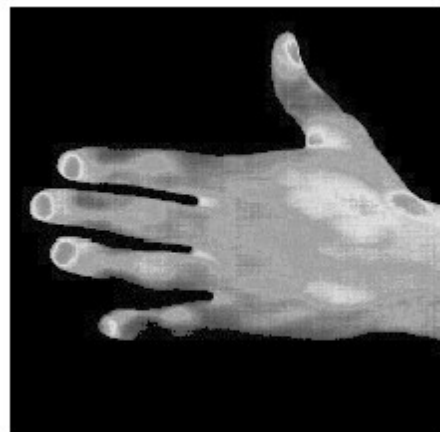
1. A student sets up the following experiment to compare how two different brands of sunglasses protect from ultraviolet radiation. The student uses beads which change colour when exposed to ultraviolet radiation. The student covers one set of beads with a lens from brand A and another with a lens from 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. Colour photographs called thermograms are used to find the temperature variation in a patient's body.

Name the radiation used to make thermograms.



## Extra Work Self Check 5

1. A teacher is demonstrating absorption of alpha, beta and gamma radiations.
- a) The teacher explains that when these radiations are absorbed they may cause ionisation in the absorbing material.

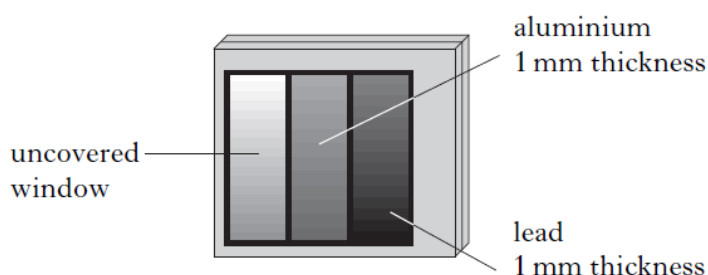
Which type of radiation: alpha, beta or gamma causes most ionisation?

- b) The radioactive sources are stored in lead-lined boxes. This is a safety precaution to minimise exposure of students and teacher to radiation from the sources.

State **one** further safety precaution that should be taken by the teacher when handling the radioactive sources.



2. Radioactive materials are used in hospitals.
- a) Describe **one** medical use of radiation where the radiation is used to destroy cells.
- b) A hospital physicist is working with some radioactive materials.
- The physicist wears a badge containing photographic film.



Light cannot reach the film. When developed, it is found that the film behind both the uncovered window and the window covered with 1 mm thick aluminium have turned black.

**State and explain** which **single** type of radiation could cause the film in **only** these areas to turn black.

