HEALTH PHYSICS
Learning Outcomes

Section 1 – The Use of Thermometers

The human body, in common with other mammals, maintains its own set temperature. The human body should have a temperature of around 37 °C, and it is maintained by the burning of food, and by sweating and shivering. If our body temperature is not 37 °C, then it suggests that something isn't quite right with our health.

At General level you should be able to:

- ❑ 1. State that a thermometer needs to have some physical property that changes with temperature and is easily measurable.
- ❑ 2. Describe how a liquid in glass thermometer works.
- ❑ 3. Describe the main differences between a clinical and ordinary thermometer.
- ❑ 4. Describe how body temperature is measured using a clinical thermometer.
- ❑ 5. Explain how body temperature is used in the diagnosis of illness.

Section 2 - Using Sound

One of the earliest ways of getting information about the inside of the human body without opening it up was to listen to it. Initially, doctors would place their ears against patients' chests or backs, but the stethoscope put an end to that. Today, a stethoscope is a very expected piece of equipment for a doctor.

At General level you should be able to:

- ❑ 1. State what sound energy can and cannot travel through.
- ❑ 2. Explain how a stethoscope can be used as an aid to hearing.
- ❑ 3. Give one example of a use for ultrasound in medicine.
- ❑ 4. Give the name of high frequency sounds beyond the range of human hearing.
- ❑ 5. Give two examples of noise pollution.
- ❑ 6. Give examples of sound levels of some everyday sounds.
- ❑ 7. State that excessive noise can damage hearing.

At Credit level you should also be able to:

- ❍ 8. In addition to ***3*** above, explain a use for ultrasound in medicine.

Section 3 – Light and Sight

Most humans would agree that sight is their most important sense. Unfortunately, not everyone is born with perfect eyesight. However, physics can help people here too. In this section, you will study light, the human eye, some of its defects and how we can cure them.

At General level you should be able to:

- ❑ 1. Describe how the eye focuses light onto the retina.
- ❑ 2. State what is meant by refraction of light.
- ❑ 3. Draw diagrams to show the change in direction of light as it passes from (*a*) air to glass, and (*b*) glass to air.
- ❑ 4. Describe the shape of a convex and a concave lens.
- ❑ 5. Describe how these lenses affect parallel rays of light.
- ❑ 6. Describe how the orientation of the image on the retina compares to the object being looked at.
- ❑ 7. Use a ray diagram to show how an inverted image is formed on the retina.
- ❑ 8. Describe a simple experiment to find the focal length of a convex lens.
- ❑ 9. Give the meaning of long sight and short sight.
- ❑ 10. State that long and short sight can be corrected using lenses.
- ❑ 11. State that fibre optics can be used to transmit *cold light* into the body.

HEALTH PHYSICS
Learning Outcomes

At Credit level you should also be able to:

❍ 12. Use correctly in context the following terms: *angle of incidence*; *angle of refraction*; *normal*.

❍ 13. Use a ray diagram to show how the lens of the eye forms an image of a distant object.

❍ 14. Use a ray diagram to show how the lens of the eye forms an image of a near object.

❍ 15. Use the equation $P = {}^{1}/_{f}$ (where P is the power of a lens and f is its focal length).

❍ 16. In addition to ***10*** above, explain the use of lenses to correct long and short sight.

❍ 17. Explain how fibre optics is used in the endoscope.

Section 4 - Using the Spectrum

The electromagnetic spectrum is a large family of waves with similar properties – for instance, they all travel at the speed of light. Although similar in some senses, they are very different in others. A few of these waves have been put to good use in medicine.

At General level you should be able to:

❑ 1. Describe one use for the laser in medicine.

❑ 2. Describe one use for x-rays in medicine.

❑ 3. State that photographic film can be used to detect x-rays.

❑ 4. Describe the use of ultraviolet in medicine.

❑ 5. Describe the use of infrared in medicine.

❑ 6. State the dangers of too much exposure to ultraviolet radiation.

At Credit level you should also be able to:

❍ 7. Describe the advantages of computerised tomography.

Section 5 – Nuclear Radiation – Humans and Medicine

Radiation is a bit of a mixed blessing. In large quantities, it kills. In smaller quantities, it may be linked with certain forms of cancer. However, if it used properly, radiation is a very useful tool for physicists. In hospitals, radiation is used to sterilise equipment, to kill off cancerous cells, and even to give a picture of the inside of the body!

In this section, you will find out about both the benefits and the dangers of radiation, and how we detect it.

At General level you should be able to:

❑ 1. Say what radiation can do to living cells.

❑ 2. Describe one medical use for radiation based on the fact that it can destroy cells.

❑ 3. Describe one medical use for radiation based on the fact that it is easy to detect.

❑ 4. State the range of alpha (α), beta (β) and gamma (γ) radiations, and say how easily each can be absorbed.

❑ 5. Say what happens to radiation energy as it passes through a material.

❑ 6. Describe a model of the atom, using *protons*, *neutrons* and *electrons*.

❑ 7. Say which of the three ionising radiations produce the greatest ionisation density.

❑ 8. Give one example of a way in which radiation affects non-living things.

❑ 9. Give the units of the *activity* of a source.

❑ 10. State what happens to the activity of a source as time passes.

❑ 11. Describe the safety precautions necessary when dealing with radioactive substances.

❑ 12. Give the units of *equivalent dose*.

At Credit level you should also be able to:

❍ 13. Explain the meaning of the term *ionisation*.

❍ 14. In addition to ***8*** above, describe how one of the effects of radiation is used as a detector for radiation.

HEALTH PHYSICS
Learning Outcomes

- ❍ 15. State the meaning of the term *half-life*.
- ❍ 16. Describe a method of measuring the half-life of a source.
- ❍ 17. Use information from a graph or table to calculate the half-life of a source.
- ❍ 18. Carry out half-life calculations.
- ❍ 19. State that equivalent dose takes account of the type of radiation and the energy of the radiation.
- ❍ 20. State that the *biological effect* of radiation depends on the equivalent dose and the type of tissue absorbing the radiation.