SPACE PHYSICS
Learning Outcomes

Section 1 - Signals from Space

From Earth we can see the sun, the moon, some of the planets and hundreds of thousands of stars with our eyes. With the aid of telescopes, very faint objects can be seen, like the rest of the planets and millions more stars. However, there are other forms of radiation that arrive at our planet that may also contain a lot of information about the universe. In this section you will study these radiations and learn how they can be detected.

At General level you should be able to:

- ❑ 1. Use these terms correctly: *star*, *sun*, *moon*, *planet*, *solar system*, *galaxy*, *the universe*.
- ❑ 2. Give rough values for the distance (in light years) from the earth to the following: *the sun, the next closest star* and *the edge of our galaxy*.
- ❑ 3. Draw a diagram of a refracting telescope, and label it to show the objective lens, the eyepiece lens and the light-tight tube.
- ❑ 4. State that the objective lens produces an image which is then magnified by the eyepiece lens.
- ❑ 5. State that different colours of light have different wavelengths.
- ❑ 6. List the colours red, blue and green in order of wavelength (longest wavelength first).
- ❑ 7. State how white light can be split to produce a spectrum of colours.
- ❑ 8. State that the line spectrum produced by a light source can give us information about the atoms in that source.
- ❑ 9. Give a definition of the electromagnetic spectrum.
- ❑ 10. State how radio waves from space can be picked up.

At Credit level you should also be able to:

- ❍ 11. Use the term *light year* correctly as a unit of distance.
- ❍ 12. Draw a ray diagram to show how an image is formed by a magnifying glass.
- ❍ 13. Explain why the brightness of an image produced by a telescope depends on the diameter of the objective lens.
- ❍ 14. Recognise the members of the electromagnetic spectrum.
- ❍ 15. List the members of the electromagnetic spectrum in order of frequency or in order of wavelength.
- ❍ 16. Give an example of a detector for each of the members of the electromagnetic spectrum.
- ❍ 17. Explain why different types of telescopes are used to detect signals from space.

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Section 2 - Space Travel

Humankind has been able to travel in space for less than 50 years. Currently, the limit of our travel is the moon that orbits our planet, but we have sent unmanned craft deep into space to explore planets, asteroids, comets and even the Sun itself (this was a one-way trip!) Who knows where we may be able to travel to within your lifetime? In this section you will study how things move in space.

At General level you should be able to:

- ❑ 1. State that a rocket is pushed forward because the exhaust gases are pushed backwards.
- ❑ 2. Explain simple situations involving the rule that *if A pushes B, B pushes A back*.
- ❑ 3. Carry out calculations involving thrust (F), mass (m) and acceleration (a).
- ❑ 4. Explain why a rocket's motors don't have to be on during interplanetary flight.
- ❑ 5. State that the force of gravity near the earth's surface gives all objects the same acceleration if we ignore air resistance.
- ❑ 6. State what happens to the weight of an object on the moon or on other planets compared to its weight on earth.
- ❑ 7. State that objects in free fall appear to be weightless.
- ❑ 8. Explain the curved path of a projectile in terms of gravitational pull.
- ❑ 9. State that kinetic energy is transferred to heat due to friction.

At Credit level you should also be able to:

- ❍ 10. State *Newton's Third Law*.
- ❍ 11. Identify pairs of action-reaction forces in situations involving several forces.
- ❍ 12. Explain why gravitational field strength and gravitational acceleration have the same numerical value.
- ❍ 13. Carry out calculations involving weight (W), mass (m) gravitational acceleration (a) and/or gravitational field strength (g). This may include situations where g is not equal to 10 Nkg^{-1}.
- ❍ 14. Use the following terms correctly: *mass*, *weight*, *inertia*, *gravitational field strength*, *gravitational acceleration*.
- ❍ 15. State that the weight of a body decreases as its distance from the earth increases.
- ❍ 16. Explain that projectile motion can be treated as two separate motions.
- ❍ 17. Use this idea to solve projectile motion problems.
- ❍ 18. Explain satellite motion using the theory from projectile motion.
- ❍ 19. Carry out calculations involving the relationships:
  $E_h = cm\Delta T$
  $W = Fd$
  $E_k = \frac{1}{2}mv^2$