

Section 3: Waves

KS3 Connections:

Exploring Science 7, 8 & 9

a) Units

b) Properties of waves

Students will be assessed on their ability to:

3.1 use the following units: degree ($^{\circ}$), hertz (Hz), metre (m), metre/second (m/s), second (s).

3.2 understand the difference between longitudinal and transverse waves and describe experiments to show longitudinal and transverse waves in, for example, ropes, springs and water

3.3 define amplitude, frequency, wavelength and period of a wave

3.4 understand that waves transfer energy and information without transferring matter

3.5 know and use the relationship between the speed, frequency and wavelength of a wave: wave speed = frequency \times wavelength

$$v = f \times \lambda$$

3.6 use the relationship between frequency and time period: frequency = 1/time period

$$f = 1/T$$

3.7 use the above relationships in different contexts including sound waves and electromagnetic waves

3.8 understand that waves can be diffracted when they pass an edge

3.9 understand that waves can be diffracted through gaps, and that the extent of diffraction depends on the wavelength and the physical dimension of the gap

c) The electromagnetic spectrum

3.10 understand that light is part of a continuous electromagnetic spectrum which includes radio, microwave, infrared, visible, ultraviolet, X-ray and gamma ray radiations and that all these waves travel at the same speed in free space

3.11 identify the order of the electromagnetic spectrum in terms of decreasing wavelength and increasing frequency, including the colours of the visible spectrum

3.12 explain some of the uses of electromagnetic radiations, including:

- radio waves: broadcasting and communications
- microwaves: cooking and satellite transmissions
- infrared: heaters and night vision equipment
- visible light: optical fibres and photography
- ultraviolet: fluorescent lamps
- X-rays: observing the internal structure of objects and materials and medical applications
- gamma rays: sterilising food and medical equipment

3.13 understand the detrimental effects of excessive exposure of the human body to electromagnetic waves, including:

- microwaves: internal heating of body tissue
- infrared: skin burns
- ultraviolet: damage to surface cells and blindness
- gamma rays: cancer, mutation

and describe simple protective measures against the risks.

d) Light and sound

3.14 understand that light waves are transverse waves which can be reflected, refracted **and diffracted**

- 3.15** use the law of reflection (the angle of incidence equals the angle of reflection)
- 3.16** construct ray diagrams to illustrate the formation of a virtual image in a plane mirror
- 3.17** describe experiments to investigate the refraction of light, using rectangular blocks, semicircular blocks and triangular prisms
- 3.18** know and use the relationship between refractive index, angle of incidence and angle of refraction:
 $n = \sin i / \sin r$
- 3.19** describe an experiment to determine the refractive index of glass, using a glass block
- 3.20** describe the role of total internal reflection in transmitting information along optical fibres and in prisms
- 3.21** explain the meaning of critical angle c
- 3.22** know and use the relationship between critical angle and refractive index:
 $\sin c = 1 / n$
- 3.23 understand the difference between analogue and digital signals**
- 3.24 describe the advantages of using digital signals rather than analogue signals**
- 3.25 describe how digital signals can carry more information**
- 3.26** understand that sound waves are longitudinal waves and how they can be reflected, refracted **and diffracted**
- 3.27** understand that the frequency range for human hearing is 20 Hz – 20 000 Hz
- 3.28** describe an experiment to measure the speed of sound in air
- 3.29 understand how an oscilloscope and microphone can be used to display a sound wave**
- 3.30 describe an experiment using an oscilloscope to determine the frequency of a sound wave**
- 3.31 relate the pitch of a sound to the frequency of vibration of the source**
- 3.32 relate the loudness of a sound to the amplitude of vibration.**