P3. Waves

Lesson	Topic	Learning objective	Before	After
Embedded	3.1	Use the following units: degree (o), hertz (Hz), metre (m), metre/second (m/s) and second (s).		
1. What is a wave?	3.2	Explain the difference between longitudinal and transverse waves.		
	3.3	Know the definitions of amplitude, wavefront, frequency, wavelength and period of a wave.		
	3.4	Know that waves transfer energy and information without transferring matter.		
2. What is the wave speed equation?	3.5	Know and use the relationship between the speed, frequency and wavelength of a wave: wave speed = frequency x wavelength, $v = f\lambda$		
	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. What is the Doppler effect?	3.8	Explain why there is a change in the observed frequency and wavelength of a wave when its source is moving relative to an observer, and that this is known as the Doppler effect.		
	3.9	Explain that all waves can be reflected and refracted.		
4. What is the electromagnetic spectrum?	3.10	Know that light is part of a continuous electromagnetic spectrum that 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	Know the order of the electromagnetic specturm in terms of decreasing wavelength and increasing frequency, including the colors 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 optics fibers and photography, ultraviolet fluorescent lamps, x-rays observing the internal structure of objects and materials, including or medical applications, gamma rays sterilizing food and medical equipment.		
	3.13	Explain 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.		
	3.14	Know that light waves are transverse waves and that they can be reflected and refracted.		
5. What is reflection?	3.15	Use the law of reflection (the angle of incidence equals the angle of reflection).		
6. What is refraction?	3.16	Draw ray diagrams to illustrate reflection and refraction.		
	3.17	Practical: investigate the refraction of light, using rectangular blocks, semi-circular 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	Practical; investigate the refractive index of glass, using a glass block.		
7. What is the critical angle?	3.20	Describe the role of total internal reflection in transmitting information along optical fibers 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: $\sin c = 1/n$		
8. What is sound?	3.23	Know that sound waves are longitudinal waves which can be reflected and refracted.		