World Communicates – Overview Preliminary Topic 2

Module: World Communicates

Year: Preliminary

Context: Information Transfer

PFA: Nature & Practice (P2), Applications & Uses (P3), Current Issues & Research (P5)

Knowledge: Energy (P7), Waves (P8), Fields (P9), Matter (P10)

Skills:

Values: P16

World Communicates – Assumed Knowledge Preliminary Topic 2

- 5.6.1a
  identify waves as carriers of energy
- 5.6.1b
  qualitatively describe features of waves includes frequency, wavelength and speed.
- 5.6.1c
  give examples of different types of radiation that make up the electromagnetic spectrum and identify some of their uses.
- 5.6.4a
  distinguish between the absorption, reflection, refraction and scattering of light and identify everyday situations where each occurs.

- 5.9.1b

  identify that some types of electromagnetic radiation are used to provide information about the universe.

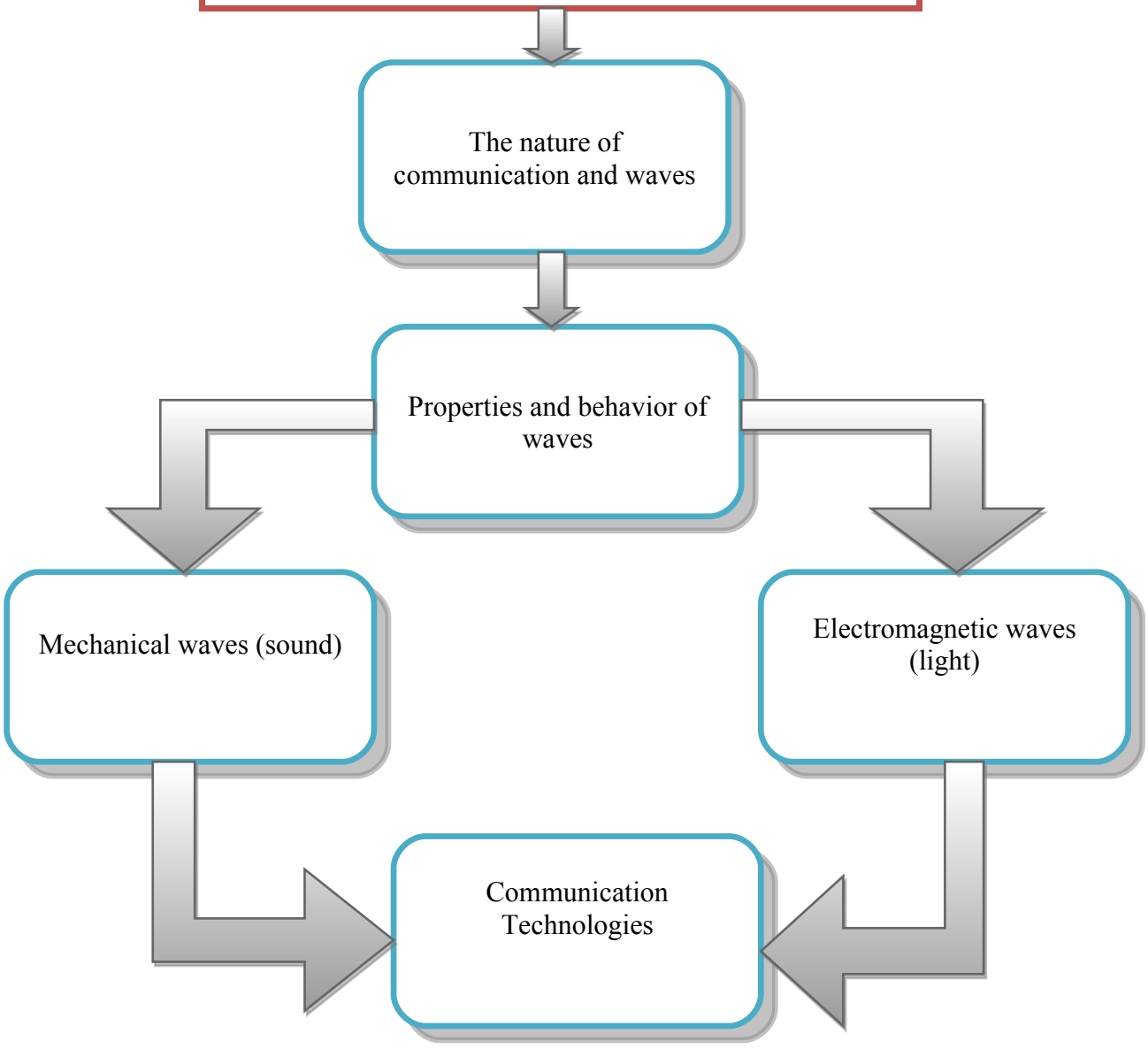
- 5.12c

  describe some everyday uses and effects of electromagnetic radiation, including applications in communication technology.

World Communicates – Concept Map Preliminary Topic 2

Prior Knowledge

- Basic features of waves
- Waves as carriers of energy
- Some types, everyday uses, effects and communication applications of electromagnetic radiation



World Communicates – Outcomes Preliminary Topic 2

Focus Point 1	**The wave model can be used to explain how current technologies transfer information**	

Theory 1.1	• Describe the energy transformations required in one of the following:
	  o Mobile telephone
	  o Fax/modem
	  o Radio and television	

Prac 1	• Perform a first-hand investigation to observe and gather information about the transmission of waves in:
	  o Slinky springs
	  o Water surfaces
	  o Ropes
	• or use appropriate computer simulations	

Theory 1.2	• Describe waves as a transfer of energy disturbance that may occur in one, two or three dimensions, depending on the nature of the wave and the medium	
Theory 1.3	• Identify that mechanical waves require a medium for propagation while electromagnetic waves do not	
Theory 1.4	• Define and apply the following terms to the wave model: • medium, displacement, amplitude, period, compression, rarefaction, crest, trough, transverse waves, longitudinal waves, frequency, wavelength, velocity	
Prac 2	• Present diagrammatic information about transverse and longitudinal waves, direction of particle movement and the direction of propagation	
Prac 3	• Perform a first-hand investigation to gather information about the frequency and amplitude of	

	waves using an oscilloscope or electronic data-logging equipment	
Prac 4	• Present and analyse information from displacement-time graphs for transverse wave motion	
Theory 1.5	• Describe the relationship between particle motion and the direction of energy propagation in transverse and longitudinal waves	
Prac 5	• Plan, choose equipment for and perform a first-hand investigation to gather information to identify the relationship between the frequency and wavelength of a sound wave travelling at a constant velocity	
Theory 1.6	• Quantify the relationship between velocity, frequency and wavelength for a wave: $v = f\lambda$	
Prac 6	• Solve problems and analyse information by applying the mathematical model of $v = f\lambda$ • to a range of situations	

Focus Point 2	**Features of a wave model can be used to account for the properties of sound**	
Theory 2.1	• Identify that sound waves are vibrations or oscillations of particles in a medium	
Prac 7	• Perform a first-hand investigation and gather information to analyse sound waves from a variety of sources using the Cathode Ray Oscilloscope (CRO) or an alternate computer technology	
Theory 2.2	• Relate compressions and rarefactions of sound waves to the crests and troughs of transverse waves used to represent them	
Theory 2.3	• Explain qualitatively that pitch is related to frequency and volume to amplitude of sound waves	
Theory 2.4	• Explain an echo as a reflection of a sound wave	

Theory 2.5	• Describe the principle of superposition and compare the resulting waves to the original waves in sound	
Prac 8	• Perform a first-hand investigation, gather, process and present information using a CRO or computer to demonstrate the principle of superposition for two waves travelling in the same medium	
Prac 9	• Present graphical information, solve problems and analyse information involving superposition of sound waves	

Focus Point 3	**Recent technological developments have allowed greater use of the electromagnetic spectrum**	
Theory 3.1	• Describe electromagnetic waves in terms of their speed in space and their lack of requirement of a medium for propagation	
Theory 3.2	• Identify the electromagnetic wavebands filtered out by the atmosphere, especially UV, X-rays and gamma rays	
Prac 10	• Analyse information to identify the waves involved in the transfer of energy that occurs during the use of one of the following: o Mobile phone o Television o Radar	
Theory 3.3	• Identify methods for the detection of various wavebands in the electromagnetic spectrum	
Theory 3.4	• Explain that the relationship between the intensity of electromagnetic radiation and distance from a source is an example of the inverse square law: $I \propto \frac{1}{d^2}$	
Prac 11	• Outline how the modulation of amplitude or frequency of visible light, microwaves and/or radio waves can be used to transmit information investigation and gather information to model the inverse square law for light intensity and distance	

	from the source	
Theory 3.5	• Outline how the modulation of amplitude or frequency of visible light, microwaves and/or radio waves can be used to transmit information	
Theory 3.6	• Discuss problems produced by the limited range of the electromagnetic spectrum available for communication purposes	
Prac 12	• Analyse information to identify the electromagnetic spectrum range utilised in modern communication technologies	

Focus Point 4	**Many communication technologies use applications of reflection and refraction of electromagnetic waves**	
Theory 4.1	• Describe and apply the law of reflection and explain the effect of reflection from a plane surface on waves	
Theory 4.2	• Describe ways in which applications of reflection of light, radio waves and microwaves have assisted in information transfer	
Prac 13	• Perform first-hand investigations and gather information to observe the path of light rays and construct diagrams indicating both the direction of travel of the light rays and a wave front	
Theory 4.3	• Describe ways in which applications of reflection of light, radio waves and microwaves have assisted in information transfer	
Theory 4.4	• Describe one application of reflection for each of the following: o Plane surfaces o Concave surfaces o Convex surfaces o Radio waves being reflected by the ionosphere	
Prac 14	• Present information using ray diagrams to show the	

	path of waves reflected from: o Plane surfaces o Concave surfaces o Convex surface o The ionosphere	
Theory 4.5	• Explain that refraction is related to the velocities of a wave in different media and outline how this may result in the bending of a wavefront	
Theory 4.6	• Define refractive index in terms of changes in the velocity of a wave in passing from one medium to another	
Prac 15	• Perform an investigation and gather information to graph the angle of incidence and refraction for light encountering a medium change showing the relationship between these angles	
Theory 4.7	• Define Snell's Law: $\frac{v_1}{v_2} = \frac{\sin i}{\sin r}$	
Prac 16	• Perform a first-hand investigation and gather information to calculate the refractive index of glass or perspex	
Theory 4.8	• Identify the conditions necessary for total internal reflection with reference to the critical angle	
Prac 17	• Solve problems and analyse information using Snell's Law	
Theory 4.9	• Outline how total internal reflection is used in optical fibres	

Focus Point 5	**Electromagnetic waves have potential for future communication technologies and data storage technologies**	
Theory 5.1	• Identify types of communication data that are stored or transmitted in digital form	

Prac 18	• Identify data sources, gather, process and present information from secondary sources to identify areas of current research and use the available evidence to discuss some of the underlying physical principles used in one application of physics related to waves, such as: o Global Positioning System o CD technology o The internet (digital process) o DVD technology	

World Communicates – Notes Preliminary Topic 2