



NATIONAL 5 PHYSICS

WAVES

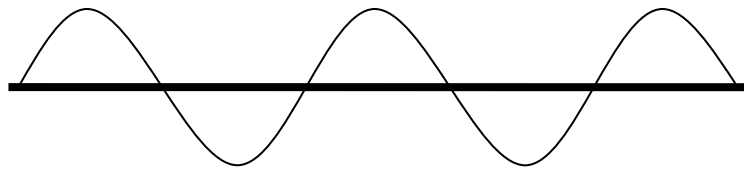
PROBLEM BOOKLET

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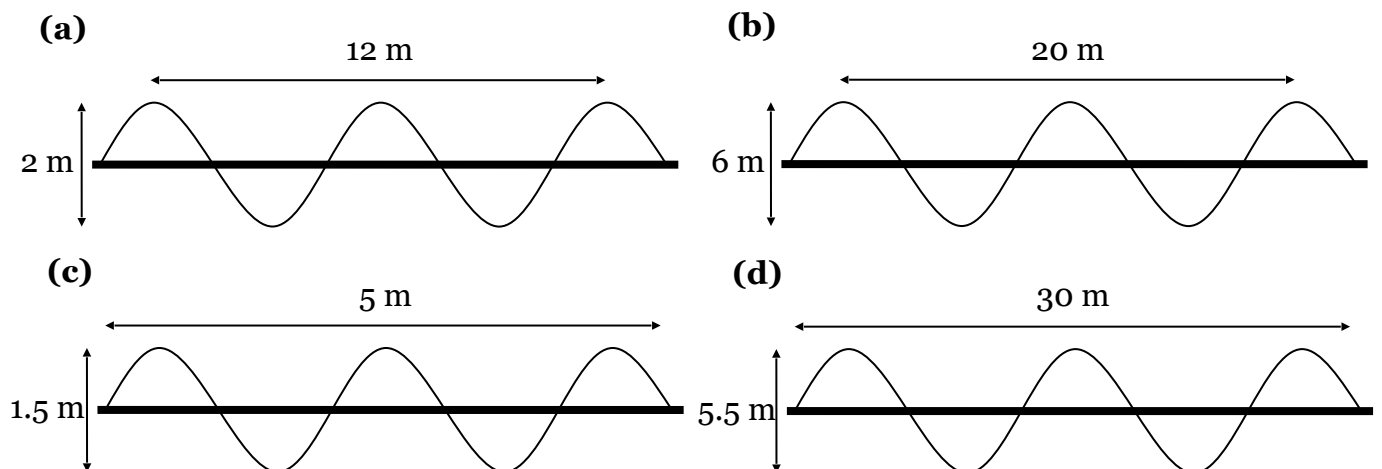
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Wave Properties

1. What can be transferred from one place to another as waves?
2. What is the meaning of the term 'transverse' when describing waves?
3. What is the meaning of the term 'longitudinal' when describing waves?
4. On this diagram of a wave and label the following: Wavelength, Amplitude, Crest, Trough, Axis



5. Describe the following properties of waves: Wavelength, Frequency, Amplitude, Wave speed
6. Water waves are represented in these diagrams. Calculate the wavelength and amplitude of each wave.



Wave Speed

1. A water wave travels along the length of a 25 metre swimming pool in 6.25 seconds. What is the speed of the water wave?
2. A wave moves along a slinky with a speed of 0.75 m s^{-1} . The wave travels the full length of the slinky in 3.2 seconds. How long is the slinky?
3. A seismic wave travels through the ground at 2.5 km s^{-1} after an earthquake. How long does it take the wave to travel 45 km?
4. Complete this table.

Speed / m s^{-1}	Distance / m	Time / s
	50	20
	280	1120
12		0.8
340		3.5
6.8	272	
95	475	

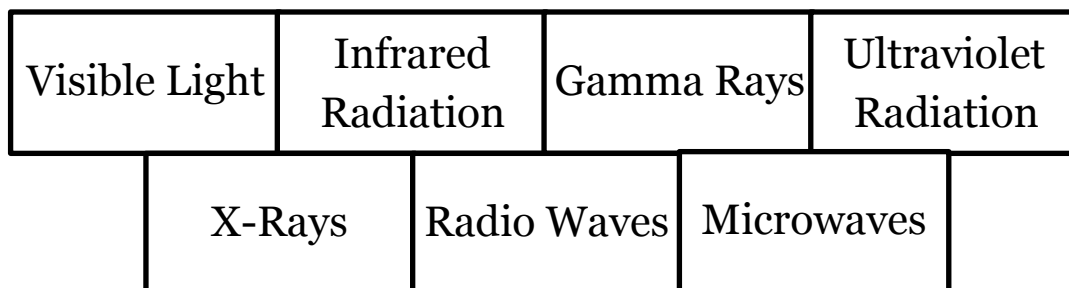
Wave Equation

1. What is the speed of a water wave that has a frequency of 0.5 Hz and a wavelength of 3.6 metres?
2. A wave moving through water has a speed of 2.8 m s^{-1} and a wavelength of 7.0 cm. What is the frequency of the wave?
3. A sound wave of frequency 8.5 kHz has a speed of 340 m s^{-1} in air. What is the wavelength of the wave?
4. Complete the table below:

Speed / ms^{-1}	Frequency / Hz	Wavelength / m
	800	4
	40 000	0.0085
5		0.25
690		2.3
45	15	
180	750	

Electromagnetic Spectrum

1. The parts of the electromagnetic spectrum are shown below.



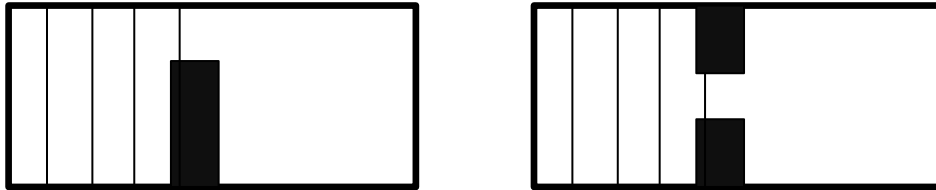
Rearrange these electromagnetic waves so that they are in order of increasing frequency.

2. What is the speed of an electromagnetic wave in a vacuum?
3. What happens to the wavelength of electromagnetic waves as frequency increases?
4. What happens to the energy of an electromagnetic wave as frequency increases?
5. Describe an application of each of these types of electromagnetic radiation in medicine: X-Rays, Gamma Rays, Infrared Radiation, Ultraviolet Radiation.
6. Describe an application of each of these types of electromagnetic radiation in telecommunication: Radio waves, Microwaves.
7. Describe an application of each of these types of electromagnetic radiation in the home: Infrared Radiation, Microwaves.
8. Why are gamma rays unsuitable for using in mobile phone communication? Give two reasons for your answer.
9. How long will it take visible light to travel through 250 km of water?
10. A radio carrier wave is sent out from BBC Radio 1 in London with a frequency of 97.5 MHz. A student in Edinburgh (which is 670 km away) is listening to the broadcast.
 - a) What is the wavelength of this radio wave?
 - b) How long will it take the wave to travel from London to Edinburgh?

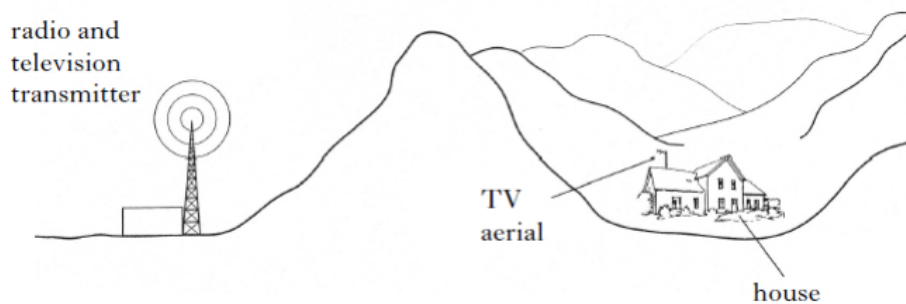
11. Ultraviolet radiation is one of many types of radiation given off by the Sun. The ultraviolet radiation from the Sun takes 8 minutes to reach the Earth. How far away is the Earth from the Sun?
12. What type of electromagnetic radiation is given off by a laser?
13. What is the frequency of a 650 nm laser?
14. What is the wavelength of a radio wave with a frequency of 94 MHz?

Diffraction

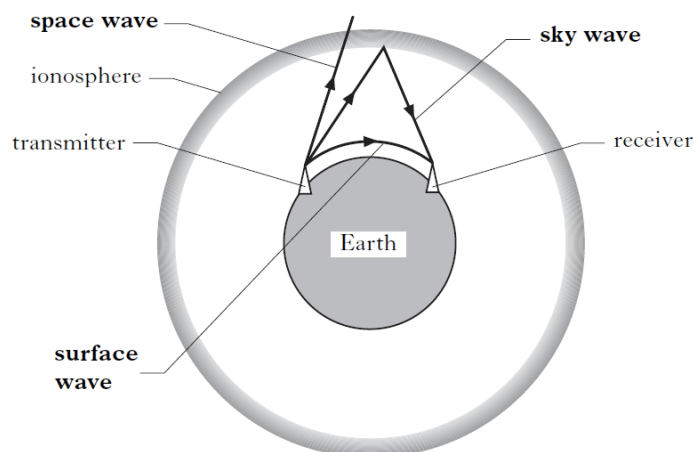
1. What is meant by the term 'diffraction'?
2. Copy and complete these diagrams to show water waves bending around an obstacle:



3. A hill lies between a radio and television transmitter and a house. The house is within the range of both the radio and television signals from the transmitter. The house has good radio reception but poor television reception. Suggest an explanation for this.



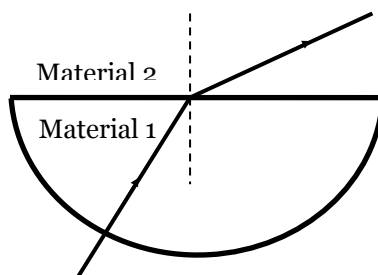
4. A mobile phone transmitter is attached to the existing transmitter. Predict whether the mobile phone reception will be good or poor in the house. Give a reason for your answer.
5. This diagram shows three types of signal in which radio waves can be sent between a transmitter and receiver. Which of the signals has the longest wavelength? Give a reason for your answer.



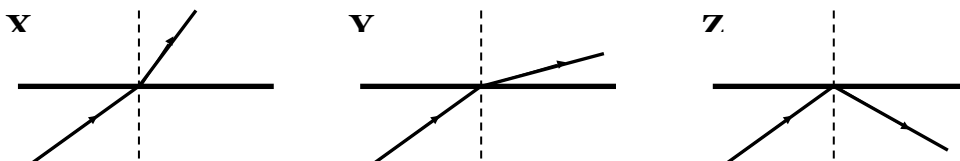
Not to scale

Refraction

1. What is meant by the term 'refraction'?
2. What is the difference between diffraction and refraction?
3. Copy this diagram and label it with the following: Incident ray, Refracted ray, Angle of incidence, Angle of refraction, Normal.

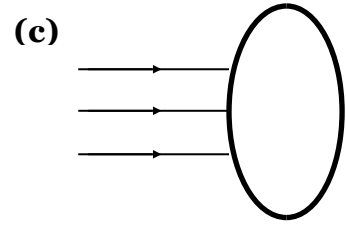
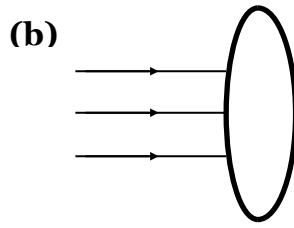
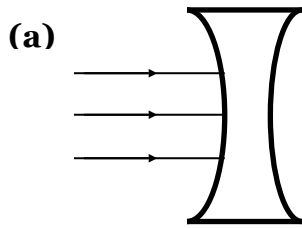


4. What is meant by the following statement: "The critical angle of a glass block in air is 41° ."?
5. Which of these diagrams shows what happens when a ray of light:



- a) travels from air in to glass at an angle above the critical angle of glass?
 - b) travels from glass in to air at an angle above the critical angle of glass?
 - c) travels from air in to water at an angle less than the critical angle of water?
 - d) travels from water in to air at an angle less than the critical angle of water?
6. A student is given a Perspex block, a pencil, a protractor, a ruler, a piece of blank A4 paper, a ray box and a power supply. Describe how the student could use this equipment to find the critical angle of Perspex.

7. Copy and complete these diagrams to show the effect the lenses have on parallel incident rays of light.



8. A student makes the following statement: "The focal length of a convex lens is 15 cm." What is the meaning of this statement?
9. A lifeguard is looking at a swimmer in a pool. Explain, with the aid of a diagram, why the lifeguard sees the swimmer at a shallower depth than the swimmer is actually at.