Homework 1: Wave parameters and behaviours.

1. A student makes the following statements about waves.

   I Waves are created by vibration.
   II Waves transfer energy.
   III The amplitude of a wave depends on its wavelength.

   Which of these statements is/are correct?

   A I only
   B II only
   C III only
   D I and II only
   E I and III only.

2. Which of the following waves is a longitudinal wave?

   A Microwaves
   B Radio waves
   C Sound waves
   D Light waves
   E Water waves.

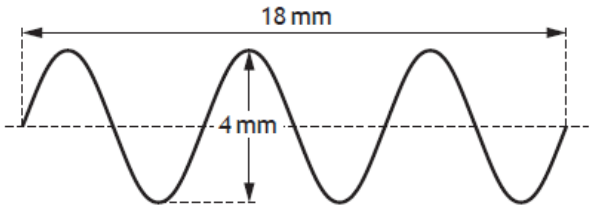
3. When a sound wave travels through air the particles of air

   A move continuously away from the source
   B move continuously towards the source
   C vibrate at random
   D vibrate at 90 ° to the wave
   E vibrate along the wave direction.

4. The period of vibration of a guitar string is 8 ms.
   The frequency of the sound produced by the guitar string is

   A 0·125 Hz
   B 12·5 Hz
   C 125 Hz
   D 800 Hz
   E 8000 Hz.

5. The diagram represents a water wave.



   The amplitude of the water wave is

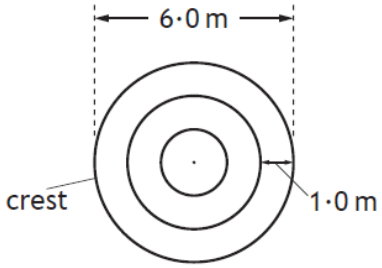
   A 2 mm
   B 3 mm
   C 4 mm
   D 6 mm
   E 18 mm.

6. A ray of light strikes a plane mirror at an angle of 40 ° to the mirror surface.

Which row shows the correct values of angle of incidence and angle of reflection for this ray?

	Angle of incidence (°)	Angle of reflection (°)
A	40	40
B	40	50
C	40	140
D	50	40
E	50	50

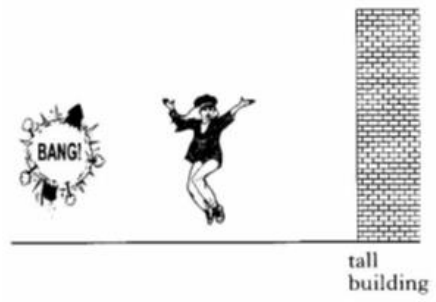
7. The diagram represents the position of the crests of waves 3 seconds after a stone is thrown into a pool of still water.



Which row in the table shows the speed and the frequency of the waves?

	Speed (ms^{-1})	Frequency (Hz)
A	0·33	3
B	0·33	1
C	1·0	1
D	1·0	3
E	1·0	4

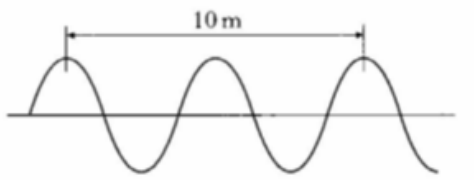
8. The diagram shows a girl standing at a fireworks display. There is a tall building nearby.



When a firework explodes, the girl hears two bangs 0·5 s apart. The speed of sound is 340 ms^{-1}. How far is the girl from the building?

A 42·5 m
B 85·0 m
C 170 m
D 340 m
E 680 m

9. A water wave is shown below.



The speed of the wave is 2·0 ms^{-1}.
The frequency of the wave is

A 0·2 Hz
B 0·4 Hz
C 2·5 Hz
D 10 Hz
E 20 Hz.

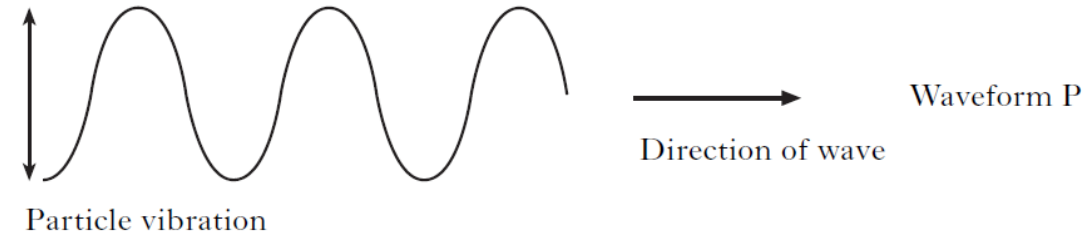
10. A student makes the following statements about waves.

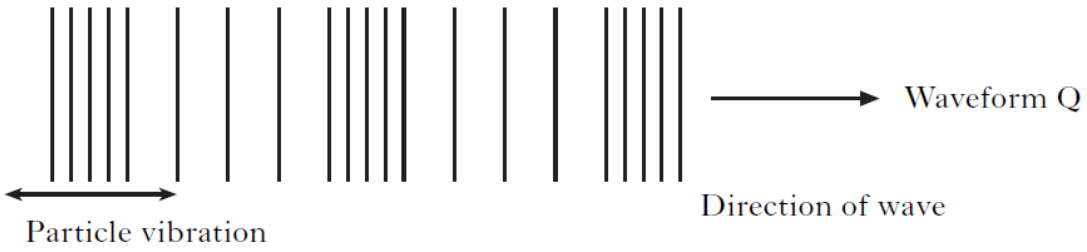
I Diffraction is when waves bend around obstacles.
II During diffraction the wavelength changes.
III A wave with a short wavelength diffracts more than a wave with a long wavelength.

Which of these statements is/are correct?

A I only
B II only
C III only
D I and II only
E I and III only.

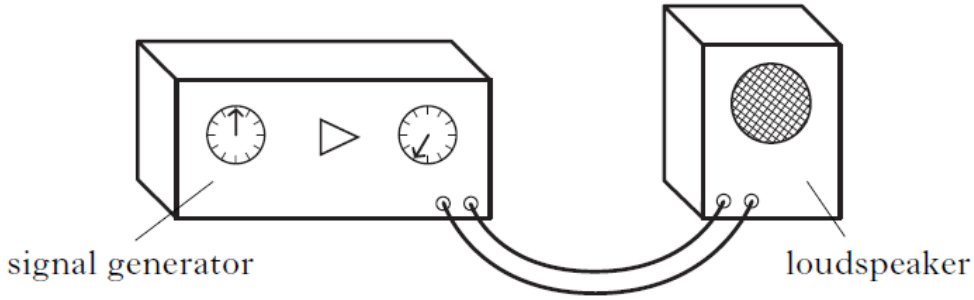
11. Two types of waveform are shown.





(a) (i) State which waveform represents a longitudinal wave.
(ii) State which waveform represents a sound wave.

(b) A signal generator is connected to a loudspeaker which produces a sound wave of frequency 2 kHz.

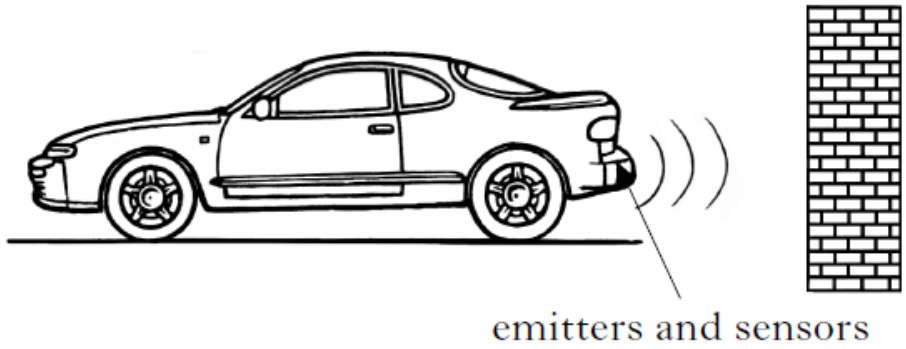


(i) Calculate the wavelength of the sound wave in air.
(ii) The loudspeaker is placed a distance of 10.2m from a wall. Calculate the time taken for the sound to return to the loudspeaker.

(c) The loudspeaker is now placed in a tank of carbon dioxide gas. The frequency remains at 2 kHz.

State the effect this change has on the wavelength of the sound?
Justify your answer.

12. Parking sensors are fitted to the rear bumper of some cars. A buzzer emits audible beeps, which become more frequent as the car moves closer to an object.



Ultrasonic pulses are emitted from the rear of the car. Objects behind the car reflect the pulses, which are detected by sensors. Ultrasonic pulses travel at the speed of sound.

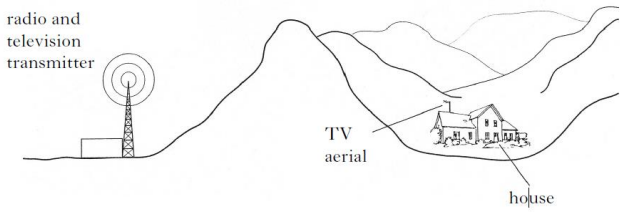
(a) The ultrasound waves have a frequency of 40 kHz.
Calculate the wavelength of these waves.

(b) The car stops 1.7m from an object.
Calculate the time for a transmitted wave to return to the car.

(c) The car is moved closer to the object.
State what happens to the time for a transmitted wave to return to the car.

(d) At a certain distance, the buzzer beeps every 0·125 s.
Calculate the frequency of the beeps.

13. 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.



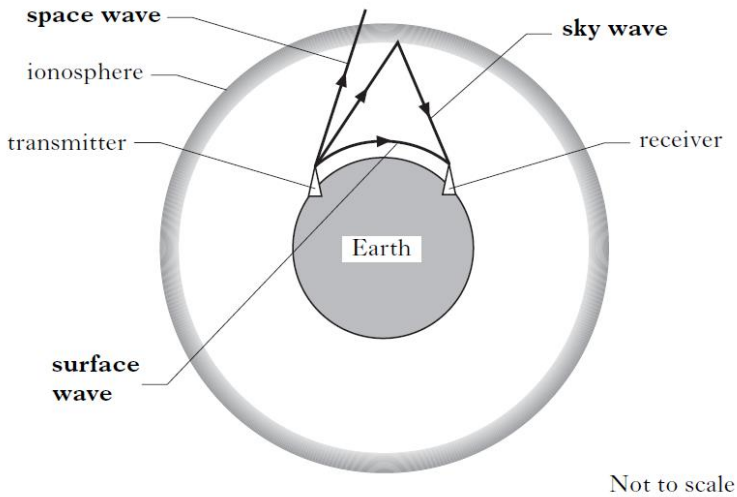
(a) In the house, a radio has good reception but a TV has poor reception from this transmitter.
Suggest an explanation for this.

Radio waves have a wide range of frequencies.
The table gives information about different wavebands.

Waveband	*Frequency Range*	*Example*
Low frequency (LF)	30 kHz – 300 kHz	Radio 4
Medium frequency (MF)	300 kHz – 3 MHz	Radio Scotland
High frequency (HF)	3 MHz – 30 MHz	Amateur radio
Very high frequency (VHF)	30 MHz – 300 MHz	Radio 1 FM
Ultra high frequency (UHF)	300 MHz – 3 GHz	BBC 1 and ITV
Super high frequency (SHF)	3 GHz – 30 GHz	Satellite TV

(b) Coastguards use signals of frequency 500 kHz.
Identify which waveband these signals belong to.

(c) The diagram shows how radio signals of different wavelengths are sent between a transmitter and a receiver.



Not to scale

(i) Identify which of the waves in the diagram shows diffraction.
(ii) State what this indicates about the wavelength of the diffracted wave compared to the other two waves.
(iii) The Earth's ionosphere is shown on the diagram. The ionosphere is a layer of charged particles in the upper atmosphere. High frequency waves are transmitted as sky waves.

Explain how the transmitted waves reach the receiver.