

# Physics

## A Level Preparation Work

### Task 1

Watch all the videos from the following play list about waves

<https://www.alevelphysicsonline.com/waves>

### Task 2

The following are the definitions from the waves topic. Please learn these for a test at the beginning of the first lesson.

Progressive wave	A pattern of disturbances travelling through a medium and carrying energy with it, involving the particles of the medium oscillating about their equilibrium positions.
Transverse wave	A transverse wave is one where the particle oscillations are at right angles to the direction of travel (or propagation) of the wave.
Longitudinal wave	A longitudinal wave is one where the particle oscillations are in line with (parallel to) the direction of travel (of propagation) of the wave.
Polarised wave	A polarised wave is a transverse wave in which particle oscillations occur in only one of the directions at right angles to the direction of wave propagation.
Wavelength of a progressive wave	The wavelength of a progressive wave is the minimum distance (measured along the direction of propagation) between two points on the wave oscillating in phase.
Frequency of a wave	The frequency of a wave is the number of cycles of a wave that pass a given point in one second,  [or equivalently the number of cycles of oscillation per second performed by any particle in the medium through which the wave is passing.]
Velocity of a wave	The velocity of a wave is the distance that the wave profile moves per unit time.
Diffraction	Diffraction is the spreading out of waves when they meet obstacles, such as the edges of a slit. Some of the wave's energy travels into the geometrical shadows of the obstacles.
The principle of superposition.	The principle of superposition states that if waves from two sources [or travelling by different routes from the same source] occupy the

	same region then the total displacement at any one point is the vector sum of their individual displacements at that point.
In phase	Waves arriving at a point are said to be <i>in phase</i> if they have the same frequency and are at the same point in their cycles at the same time. [Wave <i>sources</i> are in phase if the waves have the same frequency and are at the same point in their cycles at the same time, as they leave the sources.]
Phase difference	Phase difference is the difference in position of 2 points within a cycle of oscillation. It is measured as a fraction of the cycle or as an angle, where one whole cycle is 2 or 360°]
Coherence	Waves or wave sources, which have a constant phase difference between them (and therefore must have the same frequency) are said to be coherent.
Stationary (or standing) wave	A stationary wave is a pattern of disturbances in a medium, in which energy is not propagated. The amplitude of particle oscillations is zero at equally-spaced <i>nodes</i> , rising to maxima at <i>antinodes</i> , midway between the nodes.
Snell's law	At the boundary between any two given materials, the ratio of the <b>sine</b> of the angle of incidence to the <b>sine</b> of the angle of refraction is a constant.
Critical angle	The angle of incidence at which the angle of refraction is 90 degrees
Diffraction grating	A slide or other thin object that contains lots of equally spaced slits very close together, used to show diffraction patterns of waves.
First Harmonic	The lowest frequency at which a stationary wave is formed where the wavelength is double the length of the vibrating medium

### Task 3

Find out what it means if a wave is polarised and where polarisation of waves is useful – write one paragraph

## Task 4

Complete the following questions

### **Frequency and Time Period**

Consider one point on a wave.

If it has a time period of 0.2 seconds, i.e. it takes 0.2 seconds to complete one full oscillation, then in one second it will complete 5 full oscillations.

It has a frequency of 5 hertz.

The number of oscillations of one point on a wave every second is called the frequency of the wave. It has the symbol  $f$  and is measured in hertz (symbol, Hz).

- 1) If you know the time period  $T$  you can work out the frequency using the equation  $f = 1/T$ .
- 2) If you know the frequency  $f$  you can work out the time period using the equation  $T = 1/f$ .

Examples:

- 1) One coil of a spring oscillates with a time period of 0.008 seconds. What is the frequency of the wave passing along that spring?

$$f = 1/T = 1 / 0.008 \text{ s} = 125 \text{ Hz}$$

- 2) A wave has a frequency of 350 Hz. What is the period of oscillation of one point on that wave?

$$T = 1/f = 1 / 350 \text{ Hz} = 0.0029 \text{ s}$$

Now you try these questions:

- 1) Ripples on the surface of a pond have a frequency of 12 Hz. What is the time period of oscillation of particles in the water?
- 2) One turn of a slinky spring takes 0.45 seconds to complete one full oscillation. What is the frequency of the wave on the spring?
- 3) A radio signal has a frequency of  $8 \times 10^5$  Hz (800 kHz). What is the time period of oscillations of the electromagnetic field?
- 4) Oscillations in a sound wave have a time period of 0.002 seconds. What is the frequency of the sound?

## Task 5

Symbol	Name	What it means		How to convert	
P	peta	$10^{15}$	10000000000000000		↓ x1000
T	tera	$10^{12}$	1000000000000	↑ ÷ 1000	↓ x1000
G	giga	$10^9$	1000000000	↑ ÷ 1000	↓ x1000
M	mega	$10^6$	1000000	↑ ÷ 1000	↓ x1000
K	kilo	$10^3$	1000	↑ ÷ 1000	↓ x1000
			1	↑ ÷ 1000	↓ x1000
m	milli	$10^{-3}$	0.001	↑ ÷ 1000	↓ x1000
μ	micro	$10^{-6}$	0.000001	↑ ÷ 1000	↓ x1000
n	nano	$10^{-9}$	0.000000001	↑ ÷ 1000	↓ x1000
p	pico	$10^{-12}$	0.000000000001	↑ ÷ 1000	↓ x1000
f	femto	$10^{-15}$	0.000000000000001	↑ ÷ 1000	

Learn the symbols and what they mean

## Task 6

Learn all the units below

Quantity	Name of unit	Symbol
Time period	seconds	s
Power of a lens	diopetre	D
Focal length	Metre	m
Momentum	Kilogram metres per second	kgm/s
Extension	metres	m
Spring constant	newtons per metre	N/m
Wavelength	metre	m
Frequency	hertz	Hz
Unit for electrical energy (when working out the cost of the energy)	kilowatt hours	kWh
Temperature	Degrees celcius or Kelvin	°C or K
Specific heat capacity	Joules per kg degress celcius	J/kg°C
Efficiency	1. if given as a percentage %, if given as a decimal no units	

Current	Ampere	A
distance	Metres	m
area	Metres Squared	m <sup>2</sup>
volume	Metres Cubed	m <sup>3</sup>
Force / <b>weight</b>	Newtons	N
Pascals	pressure	Pa
frequency	Hertz	Hz
resistance	Ohms	Ω
speed	Metres per Second	m/s
velocity	Metres per Second	(m/s) (with direction)
acceleration	Metres per Second Squared	<b>m/s<sup>2</sup></b>
Power	Watts	W
Please note also IW= IJ/s		
moment	Newton Metres	Nm
Kilograms per Metre Cubed	density	kg/m <sup>3</sup>
time	Seconds	s
mass	Kilograms	Kg
energy/ gravitational potential energy/ kinetic energy/ electrical energy/ workdone	Joules	J
charge	Coulombs	C
Voltage/ potential difference	volts	V
radioactivity	Bequerels	bq