PSC Q2T3 Test Topics – Waves

Waves transfer energy from place to place without any **net** movement of matter.
A wave is a ***periodic disturbance*** that varies in magnitude *from place to place at a given time* and *from time to time at a given place.*

There are two or more broad classifications of waves:

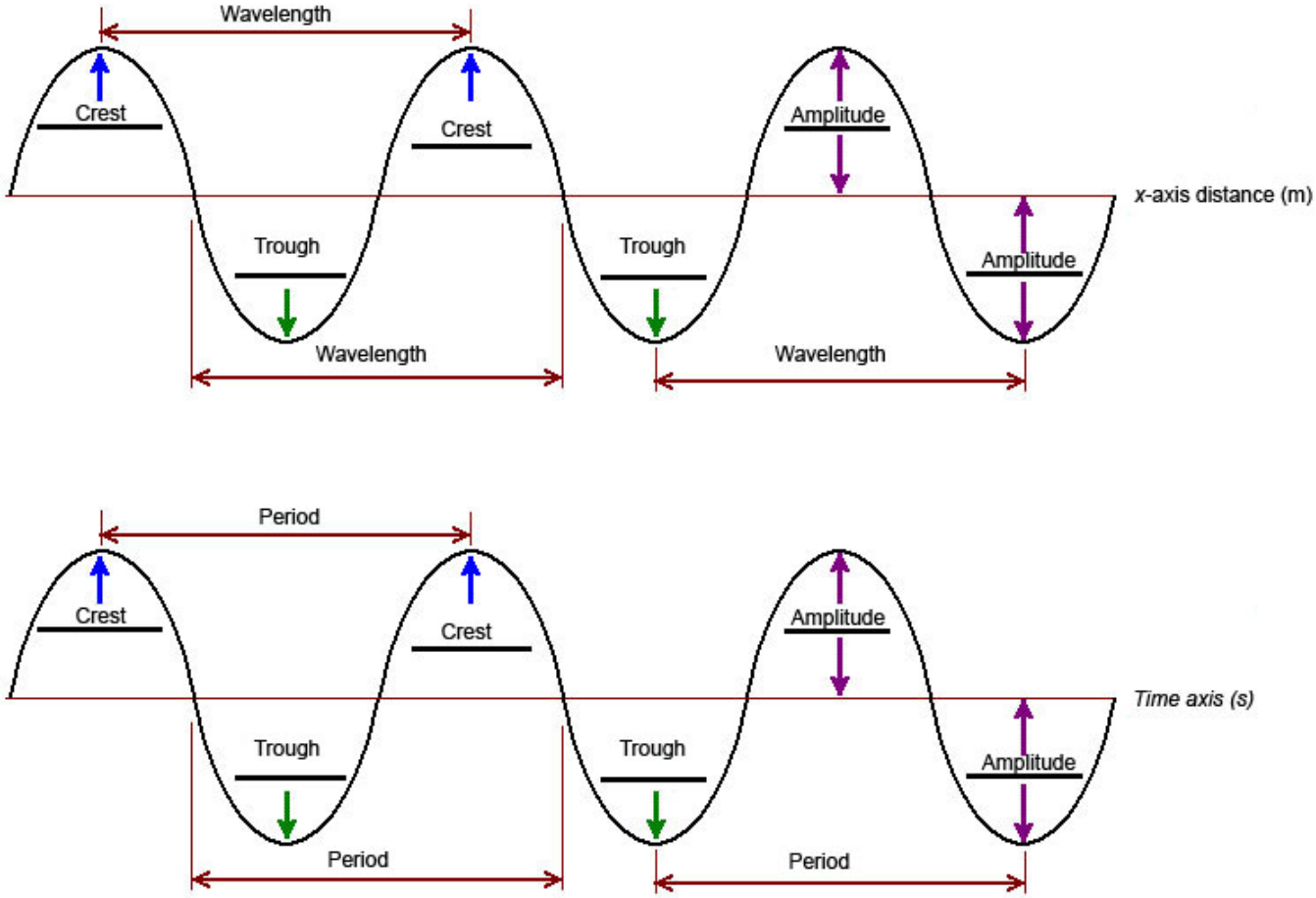
- Mechanical waves which require an "elastic" medium through which they travel
- Electromagnetic waves which include visible light as well as all the other waves found on the electromagnetic spectrum. These waves can travel through empty space and do not require a medium. They can, however travel through matter to varying degrees specific to the particular wave and the kind of matter.
- It is possible that gravity waves are an entirely different kind of wave that travel through empty space at the speed of light. Theory indicates that they would consist of "ripples" in space–time. They have not yet been detected.
- If gravity waves exist, we may yet find still more kinds of waves.

There are two classifications of waves based on the relationship between the disturbance and the motion of the wave itself.

- Transverse waves are waves in which the motion of the particles of the medium are perpendicular to the motion of the wave.
    - Places where the medium is displaced in one direction the most are called crests.
    - Places where the medium is displaced in the opposite direction the most are called troughs.
- Longitudinal waves are waves in which the motion of the particles of the medium are parallel to the movement of the wave.
    - Longitudinal waves are also called "compression" waves because the disturbance consists of alternating areas of high and low pressure areas within the medium.
    - Areas where the pressure is slightly higher than normal are called areas of compression.
    - Areas where the pressure is slightly lower than normal are called areas of rarefaction.
    - These are comparable to the crests and troughs of transverse waves.
    - Sound waves are longitudinal.

Some other important characteristics of waves are:

- Electromagnetic waves are transverse because the variations of the electrical and magnetic fields are perpendicular to the motion of the wave.
- The speed (v) of a mechanical wave is determined by the nature of the medium and the nature of the wave.
- The wave length of a transverse wave is the distance between one crest and the next crest or between one trough and the next trough.
- The wave length (λ) of a longitudinal wave is the distance between one point of maximum compression and the next point of maximum compression or the distance between consecution points of maximum rarefaction.
- The frequency (f) of a wave is the number crests (or troughs) that pass a point in a second.
- The unit for frequency is the Hz (hertz) which is also 1/s.
- The period (T) of a wave is the time between crests (or troughs) passing a point.
- The unit for period is the second (s).
- Period and frequency are reciprocals of each other. $\boxed{T = \frac{1}{f}}$
- The relation among speed, frequency and wavelength is $\boxed{v = f\lambda}$
- The amplitude of a mechanical wave is the maximum displacement of the particles of the medium from their equilibrium positions.
- Resonance occurs when two objects naturally vibrate at the same frequency and, as a result, wave energy is easily transferred from one to the other. An example of this is the sound of resonance between a tuning fork and a column of air.


Wavelength
Crest
Crest
Amplitude
x-axis distance (m)
Trough
Trough
Amplitude
Wavelength
Wavelength
Period
Crest
Crest
Amplitude
Time axis (s)
Trough
Trough
Amplitude
Period
Period