**STANDING WAVES**

A travelling wave moving along a stretched string will be reflected at the ends. The reflected wave has the same speed, frequency and amplitude as the original wave. The resultant wave can be found by superposition of the two waves. A stationary wave is only obtained for certain distances between the ends of the string.

A stationary wave is the resultant wave formed by the superposition of two progressive waves of the same frequency and amplitude travelling in opposite directions.

1. Points where the displacement is always zero are called nodes N1, N2 and N3.
2. Points where the amplitude is a maximum are called antinodes A1 and A2.
3. All points between adjacent nodes vibrate in phase. They all reach max displacement together. For a travelling wave, points close to each other are out of phase.
4. Points move different amplitudes from their neighbours. For a travelling wave, the amplitude is the same for all points.
5. The wavelength (λ) is twice the distance between adjacent nodes or adjacent antinodes. The distance between adjacent antinodes is therefore λ/2.
6. All points in the stationary wave vibrate with the same frequency except that the points at the nodes are at rest.

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| **STANDING WAVE** | **TRAVELLING WAVE** |
| Nodes | No nodes |
| Antinodes | No antinodes |
| In phase between nodes | In phase if separated by n λ |
| Different amplitude | Same amplitude |
| λ = 2 x distance between adjacent nodes | λ = distance between adjacent points that are in phase |
| Same f  (no frequency at node) | Same f |
| Standing wave appears stationary | Wave form travels along |
| Energy held within oscillating system and transferred in both directions | Energy transferred in one direction only |