

Lecture 2.

Lecture objectives.

- To understand the derivation of a complete solution to the SHM equation of motion.
- To derive expressions for velocity and acceleration from the displacement.
- To appreciate the phase difference between displacement, velocity and acceleration.
- To understand the kinetic energy and potential energy ideas associated with SHM.
- To derive the expression for total energy of SHM system, and to appreciate this is constant due to exchange between KE and PE.

Post-lecture tasks. (Young, Ch. 13; exercises, Q1, 3 and 4)

1. A vibrating object goes through four complete vibrations in 1.0 seconds. Find the angular frequency and the period of the rotation.
2. a) A force of 36.0N is required to displace the end of a spring by 0.12m. What is the force constant of the spring?
b) A spring has a force constant of 1500N/m. What force is required to displace the end of the spring 0.06m?
3. A spring with force constant $k=600\text{N/m}$ is mounted horizontally on a bench, and trolley of mass 0.4kg is undergoing SHM with amplitude 0.075m. There is no friction. Calculate;
 - a) the max. speed of the trolley,
 - b) the speed of the trolley when it is at $x = 0.03\text{m}$,
 - c) the magnitude of the max. acceleration of the trolley,
 - d) the acceleration of the trolley when it is at $x = 0.03\text{m}$,
 - e) the total energy of the trolley at any point in its motion.