2.4 - Simple Harmonic Motion

PJ Gibson - Peace Corps Tanzania

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- (1998) Define simple harmonic motion.
- (1998) Prove that, the velocity v of a particle moving in simple harmonic motion is given by: $v = w(A^2 - y^2)^{0.5}$, where A is the amplitude of oscillation, w the angular frequency and y the displacement from the mean position.
- (1998) A simple pendulum has a period of 2.8 seconds. When its length is shortened by 1.0 metre, the period becomes 2.0 seconds. From this information, determine the acceleration g , of gravity and the original length of the pendulum.
- (1998) A particle rests on a horizontal platform which is moving vertically in simple harmonic motion with an amplitude of 50 mm. Above a certain frequency the particle ceases to remain in contact with the platform throughout the motion. With a help of a diagram and illustrative equations, find;
  - the lowest frequency at which this situation occurs.
  - the position at which contact ceases.
- (1999) Give two similarities between simple harmonic motion and circular motion.
- (1999) On the same set of axes, sketch how energy exchange (kinetic to potential) takes place in an oscillator placed in a damping medium.
- (2000) Define simple harmonic motion.
- (2000) Two simple pendulums of length 0.4 m and 0.6 m respectively are set oscillating in step.
  - After what further time will the two pendulums be in step again?
  - Find the number of oscillations made by each pendulum during the time found above.
- (2000) Cite two examples of SHM which are of importance to everyday life experience.
- (2000) Explain, giving reasons, whether either transverse or longitudinal waves could exist, if the vibratory motion causing them were not simple harmonic motion.
- (2014) State where the magnitude of acceleration is greatest in simple harmonic motion.
- (2014) Sketch a graph of acceleration against displacement for a simple harmonic motion.

- (2014) The displacement of a particle from the equilibrium position moving with simple harmonic motion is given by $x = 0.05\sin(6t)$, where t is the time in seconds measured at an instant when $x = 0$. Calculate the:
  - Amplitude of oscillations.
  - Period of oscillations.
  - Maximum acceleration of the particle.
- (2015) Briefly explain why the motion of a simple pendulum is not strictly simple harmonic?
  - Why is the velocity and acceleration of a body executing simple harmonic motion (S.H.M.) out of phase?
- (2015) A body of mass 0.30 kg executes simple harmonic motion with a period of 2.5 s and amplitude of 4.0×10^{-2} m. Determine the:
  - Maximum velocity of the body.
  - Maximum acceleration of the body.
  - Energy associated with the motion.
- (2015) A particle of mass 0.25 kg vibrates with a period of 2.0 s. If its greatest displacement is 0.4 m what is its maximum kinetic energy?
- (2016) Show that the total energy of a body executing S.H.M. is independent of time.
- (2016) A mass of 05 kg connected to a light spring of force constant 20 N/m oscillates on a horizontal frictionless surface. If the amplitude of the motion 1 s 3.0 cm , calculate the;
  - Maximum speed of the mass.
  - Kinetic energy of the system when the displacement is 2.0 cm.
- (2017) The equation of simple harmonic motion is given as $x = 6\sin(10\pi t) + 8\sin(10\pi t)$, where x is in centimeters and t in seconds. Determine the:
  - Amplitude
  - Initial phase of motion.
- (2017) Show that the total energy of a body executing simple harmonic motion is independent of time.
- (2017) Find the periodic time of a cubical body of side 0.2 m and mass 0.004 kg floating in water then pressed and released such that it oscillates vertically.
- (2018) What is meant by the following terms as used in simple harmonic motion (S.H.M)?
  - Periodic motion.
  - Oscillatory motion.
- (2018) List four important properties of a particle executing simple harmonic motion (S.H.M).
- (2018) Sketch a labeled graph that represents the total energy of a particle executing simple harmonic motion (S.H.M).

- (2018) The periodic time of a body executing S.H.M is 4 seconds. How much time interval from time, $t = 0$ will its displacement be half its amplitude?
- (2018) Giving reasons, explain whether either transverse or longitudinal waves could exist, if the vibratory motion causing them were not simple harmonic motion.
- (2019) Provide two typical examples of simple harmonic motion (S.H.M).
- (2019) Why the velocity and acceleration of a body executing simple harmonic motion are out of phase?
- (2019) The period of a particle executing simple harmonic motion (S.H.M) is 3 seconds. If its amplitude is 25 cm, calculate the time taken by the particle to move a distance of 12.5 cm on either side from the mean position.
- (2019) A person weighing 50 kg stands on a platform which oscillates with a frequency of 2 Hz and of amplitude 0.05 m. Find his/her minimum weight as recorded by a machine of the platform.