ENG1004 Eng Physics 1 Tutorial

Oscillations 1

Question 1

Consider a horizontal spring-mass system. The object of mass, m, is displaced off its equilibrium position by x_o. It is then released and the mass executes simple harmonic motion.

(i) Sketch the displacement-time graph of the object and write down the corresponding equation.
(ii) Sketch a velocity-time graph of the object and write down the corresponding equation.
(iii) Sketch a restoring force-time graph of the object and write down the corresponding equation.
(iv) Sketch a velocity-displacement graph of the object and write down the corresponding equation.
(v) Sketch a graph to show how kinetic energy and potential energy varies with time and write down the corresponding equations.

Question 2

A mass hangs in equilibrium from a light helical spring. It is given an initial vertical displacement of 0.1 m and released at time $t = 0$ such that it oscillates with angular frequency of 0.2 rad s^{-1}. Determine the displacement, in m, at time t.

Question 3

In a harbour, the rise and fall of water is simple harmonic with the time between successive high tides being 12 hours. The depth of the water in the harbour varies from 1.0 m at low tide to 3.0 m at high tide.

A ship which is stranded in the harbour at low tide ($t = 0$) requires a minimum depth of 1.5 m before it can leave the harbour. How long must the ship wait (in hours) before it can leave?

Question 4

A mass m at the end of a spring oscillates with a frequency of 0.83 Hz. When an additional 780-g mass is added to m, the frequency is 0.60 Hz. What is the value of m?

Answers:

Question 2:

$x = 0.1\cos(0.2t)$

Question 3:

2 hours

Question 4

0.85 kg