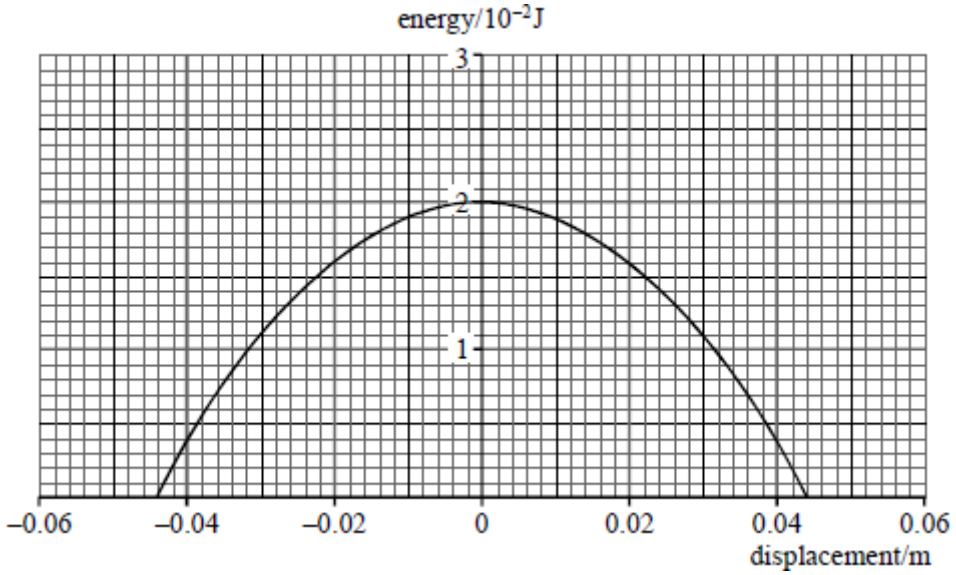
Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Q1.

The diagram below shows how the kinetic energy of a simple pendulum varies with displacement.



(a) Sketch on the diagram above a graph to show how the potential energy of the pendulum varies with displacement.

(2)

(b) (i) State the amplitude of the oscillation.

_____

(1)

(ii) The frequency of vibration of the pendulum is 3.5 Hz. Write down the equation that models the variation of position with time for the simple harmonic motion of **this** pendulum.

_____

(1)

(iii) Calculate the maximum acceleration of the simple pendulum.

(2)

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(Total 6 marks)

Q2.

Figure 1 shows three stages during the oscillations of a loaded spring. The positions shown are when the mass attached to the spring is at the top, equilibrium (middle) position and bottom of its motion.

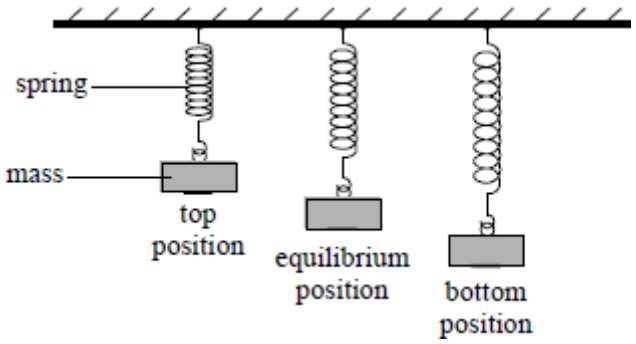


Figure 1

(a) (i) Describe what is meant by the *period* of this oscillation.

_____

_____

(1)

(ii) Mark and label the *amplitude* of the oscillation on **Figure 1**.

(1)

(b) Explain how you would determine an accurate value for the period of the oscillation.

_____

_____

_____

_____

_____

_____

(2)

(c) The mass is displaced from its equilibrium position in the air and then released. The graph in **Figure 2** shows the displacement-time graph from the moment of release. The mass-spring system is then submerged in water and set oscillating with the same initial displacement.

Sketch **on the same set of axes** the displacement-time graph for the motion in the water.

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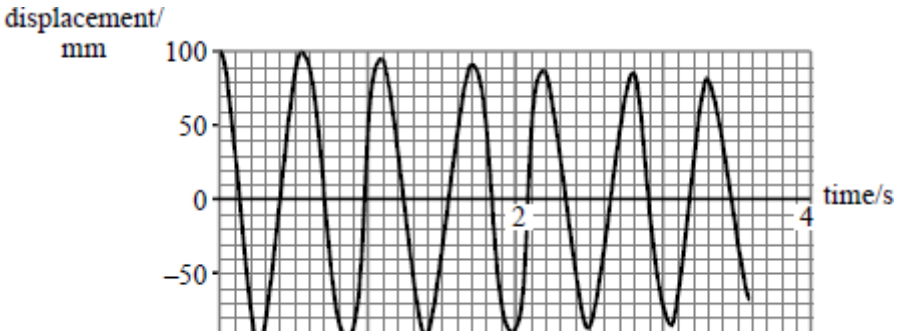


Figure 2

(2)

(Total 6 marks)

Q3.

Figure 1 shows a mass suspended on a spring.

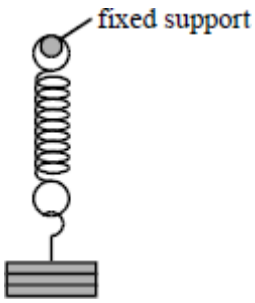


Figure 1

The mass is pulled down by a distance A below the equilibrium position and then released at time t = 0. It undergoes simple harmonic motion.

(a) Taking upward displacements as being positive, draw graphs on **Figure 2** to show the variation of displacement, velocity and the acceleration with time. Use the same time scale for each of the three graphs.

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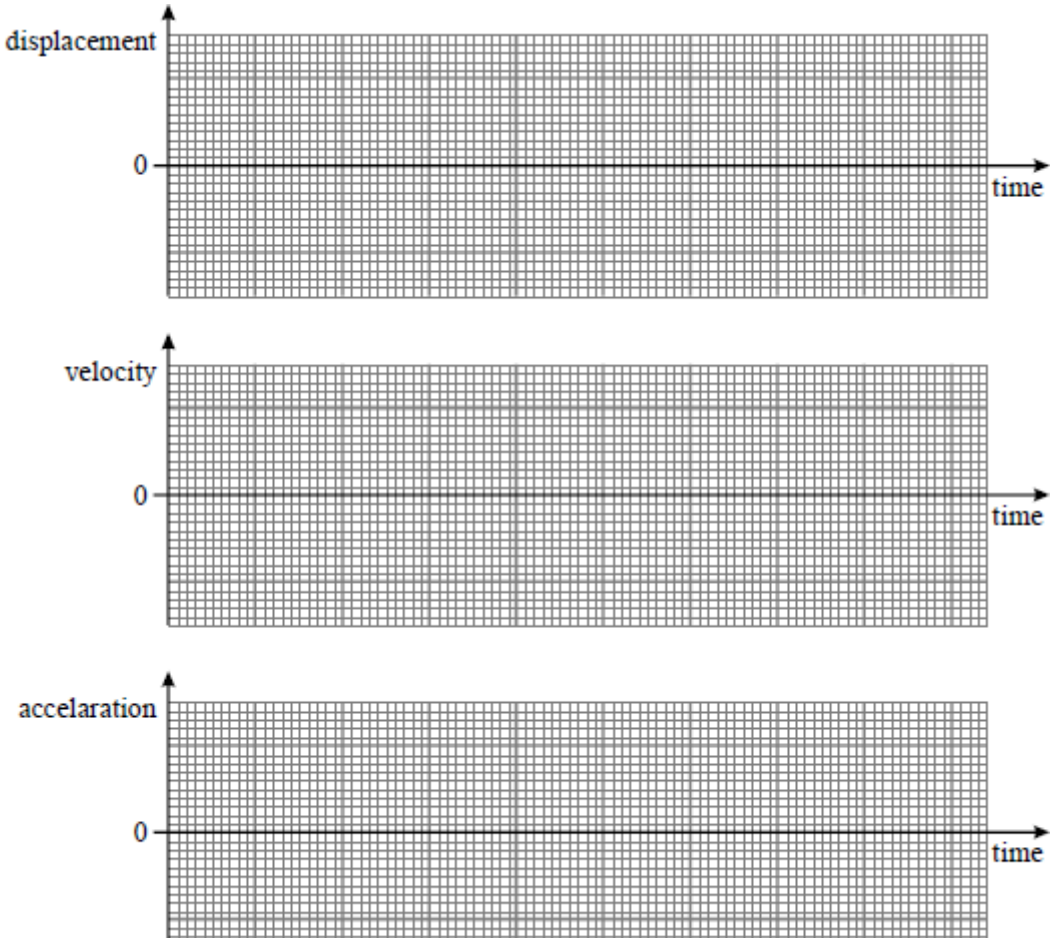


Figure 2

(4)

(b) The spring stiffness, k, is 32 N m^{-1}. The spring is loaded with a mass of 0.45 kg. Calculate the frequency of the oscillation.

(3)

(Total 7 marks)

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