

Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Further Mechanics

Name of the Student: _____

Max. Marks : 22 Marks

Time : 22 Minutes

Q1.

- (a) A body is moving with simple harmonic motion. State **two** conditions that must be satisfied concerning the *acceleration* of the body.

condition 1 _____

condition 2 _____

(2)

- (b) A mass is suspended from a vertical spring and the system is allowed to come to rest. When the mass is now pulled down a distance of 76 mm and released, the time taken for 25 oscillations is 23 s.

Calculate

- (i) the frequency of the oscillations,

- (ii) the maximum acceleration of the mass,

- (iii) the displacement of the mass from its rest position 0.60 s after being released. State the direction of this displacement.

(6)

- (c)

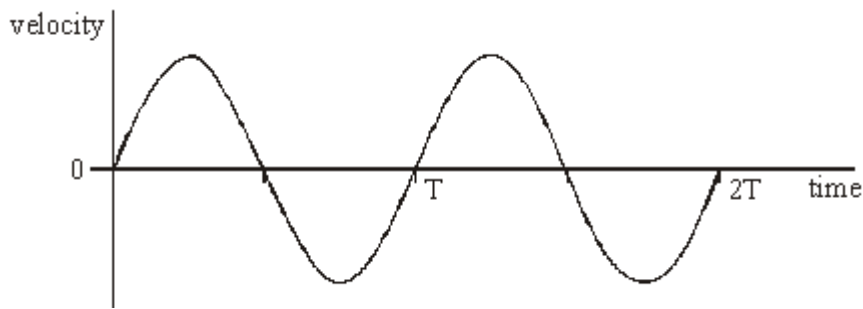


Figure 1

Figure 1 shows qualitatively how the velocity of the mass varies with time over the first two cycles after release.

- (i) Using the axes in **Figure 2**, sketch a graph to show qualitatively how the displacement of the mass varies with time during the same time interval.

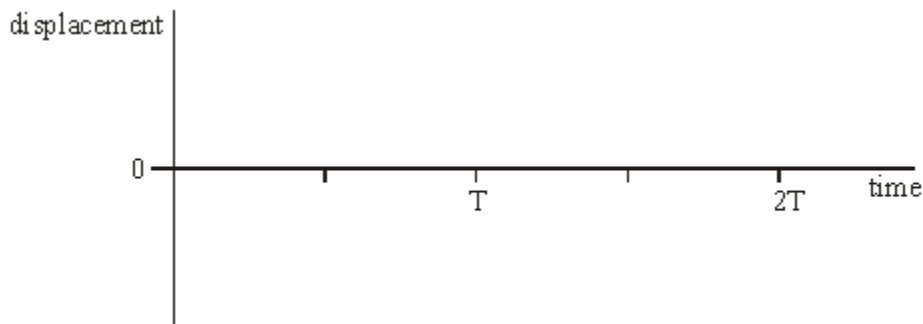


Figure 2

- (ii) Using the axes in **Figure 3**, sketch a graph to show qualitatively how the potential energy of the mass-spring system varies with time during the same time interval.

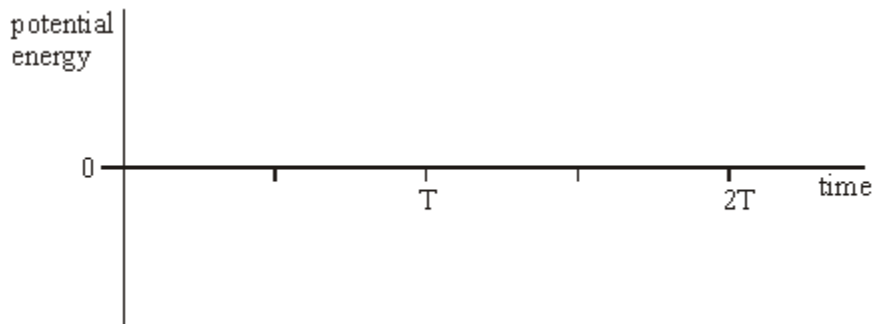


Figure 3

(4)

(Total 12 marks)

Q2.

Figure 1 shows an apparatus for investigating forced vibrations and resonance of a mass-spring system. **Figure 2** shows the displacement-time graph when the system is resonating.

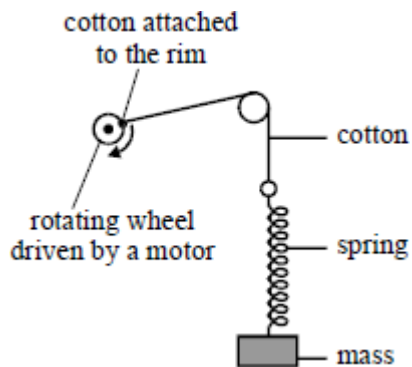


Figure 1

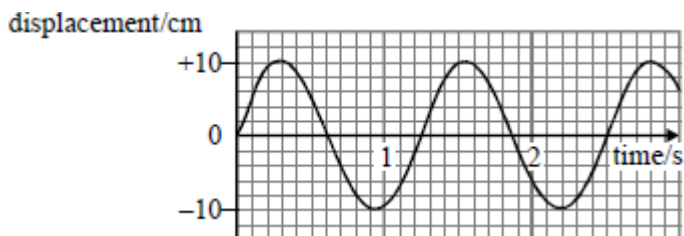


Figure 2

(a) (i) State what is meant by a forced vibration.

(1)

(ii) Under what condition will resonance occur in the system shown in **Figure 1**?

(1)

(b) The spring constant of the spring used in the experiment was 9.0 N m^{-1} . Using information from **Figure 2**, determine the value of the mass suspended from the spring.

(3)

(c) When the rotating wheel stops, **Figure 3** shows how the amplitude of the oscillations of the mass subsequently varies with time.

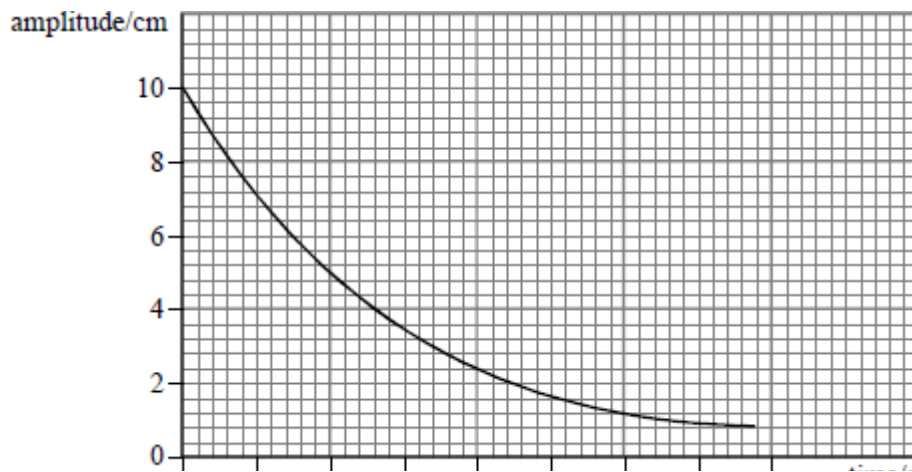


Figure 3

- (i) Explain whether the graph supports the suggestion that the amplitude of the damped oscillations varies exponentially with time. Show your reasoning clearly.

(3)

- (ii) Determine the ratio:

$$\frac{\text{energy of the oscillator after twenty oscillations}}{\text{energy of the oscillator at time } t = 0}$$

(2)

(Total 10 marks)