

Oscillations

Question Paper 2

Level	A Level
Subject	Physics
Exam Board	OCR
Topic	Newtonian world and astrophysics
Sub-Topic	Oscillations
Booklet	Question Paper 2

Time Allowed: 58 minutes

Score: / 48

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

- 1 (a) Fig. 2.1 shows a mass attached to the end of a spring. The mass is pulled down and then released. The mass performs vertical simple harmonic motion.

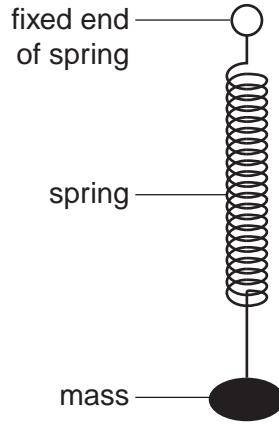


Fig. 2.1

- (i) Define *simple harmonic motion*.

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..... [2]

- (ii) Mark the following statements about the oscillating mass-spring system as *true* or *false*. [2]

statement	true/false
The period of oscillation is constant.	
The net force on the mass is equal to its weight.	
The acceleration of the mass is a maximum at the mid-point of the oscillations.	
The velocity of the mass is proportional to the displacement.	

2 (a) State two conditions concerning the **acceleration** of an oscillating object that must apply for simple harmonic motion.

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2.
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..... [2]

(b) Fig. 3.1 shows how the potential energy, in mJ, of a simple harmonic oscillator varies with displacement.

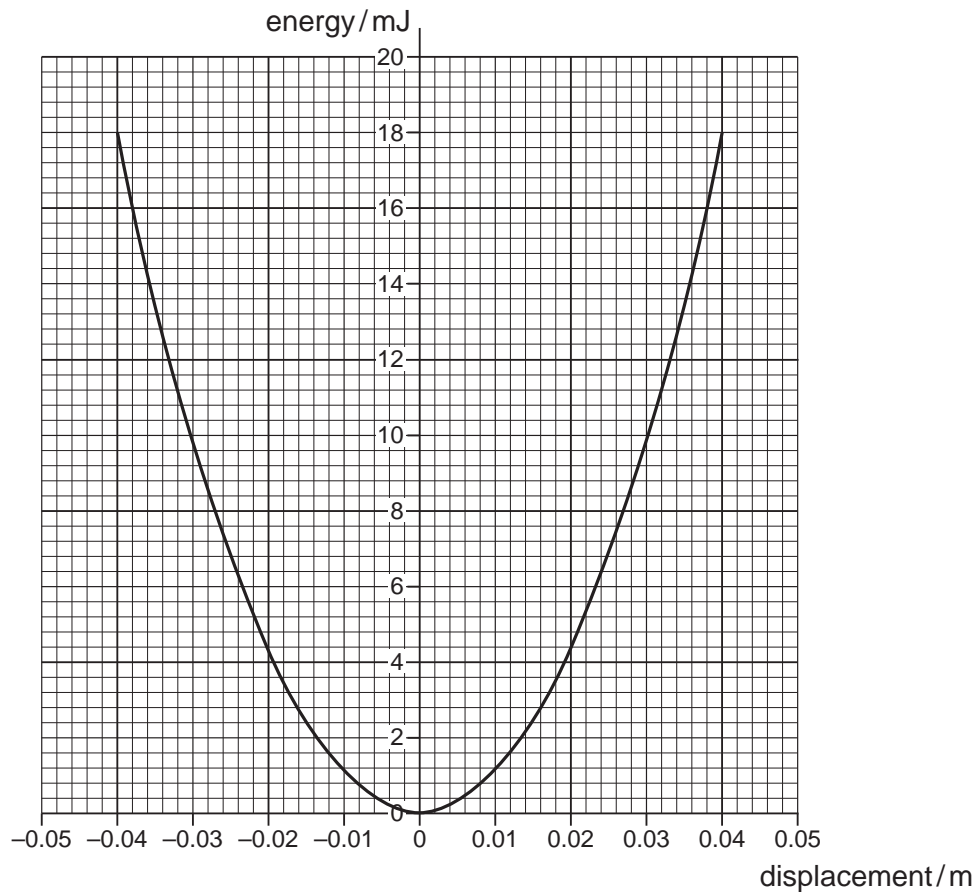


Fig. 3.1

On Fig. 3.1 sketch graphs to show the variation of

- (i) kinetic energy of the oscillator with displacement – label this graph **K** [2]
- (ii) the total energy of the oscillator with displacement – label this graph **T**. [1]

(c) Use Fig. 3.1 to determine

(i) the amplitude of the oscillations

amplitude = m [1]

(ii) the maximum speed of the oscillator of mass 0.12 kg

maximum speed = ms^{-1} [2]

(iii) the frequency of the oscillations.

frequency = Hz [2]

(d) Resonance can either be useful or a problem. Describe one example where resonance has a useful application and one example where resonance is a problem or nuisance. For each example identify what is oscillating and what causes these oscillations.

(i) useful application

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..... [2]

(ii) problem

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..... [4]

(b) When the masses hanging on the spring are 400g in total, they oscillate with an amplitude of 36 mm and a period of 1.2s. Calculate

(i) the maximum kinetic energy of the masses

maximum kinetic energy = J [3]

(ii) the maximum acceleration of the masses.

maximum acceleration = ms^{-2} [2]

- (c)** List the different types of energy involved in the oscillations of this mass-spring system. Describe the energy changes when the masses move from the lowest point of the oscillation to the highest point.



In your answer you should use appropriate technical terms spelled correctly.

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[Total: 13]

4 Fig. 2.1 shows a displacement against time graph for an oscillating mass.

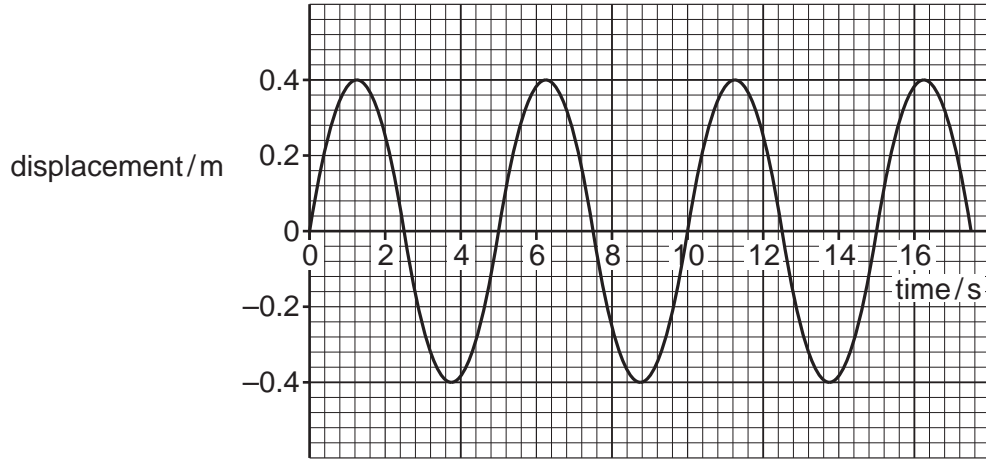


Fig. 2.1

(a) Use Fig. 2.1 to determine, for the oscillations of the mass,

(i) the amplitude and period

amplitude = m

period = s [1]

(ii) the angular frequency, ω .

$\omega = \dots\dots\dots \text{rad s}^{-1}$ [2]

(b) Mark with a cross (X) on Fig. 2.1, using a different position in each case,

(i) a point where the velocity of the mass is a maximum; label it **V** [1]

(ii) a point where the acceleration of the mass is zero; label it **A** [1]

(iii) a point where the potential energy of the mass is a minimum; label it **P**. [1]

(c) The cone of a loudspeaker oscillates with simple harmonic motion. It vibrates with a frequency of 2.4 kHz and has an amplitude of 1.8 mm.

(i) Calculate the maximum acceleration of the cone.

acceleration = ms^{-2} **[3]**

(ii) The cone experiences a mean damping force of 0.25 N. Calculate the average power needed to be supplied to the cone to keep it oscillating with a constant amplitude.

power = W **[3]**

[Total: 12]