Simple Harmonic Motion Damping

Definitions

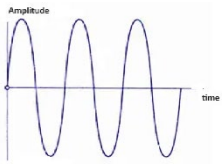
Damped oscillations: The amount of damping of a system affects the shape of the resonance curve.

Damped oscillations are oscillations where energy is taken from the system and so the amplitude decays. They may be of two types:

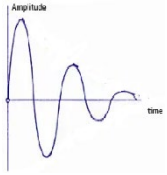
(i) Natural damping, examples of which are: internal forces in a spring, fluids exerting a viscous drag.

(ii) Artificial damping, examples of which are: shock absorbers in cars, interference damping - gun mountings on ships.

An undamped system:



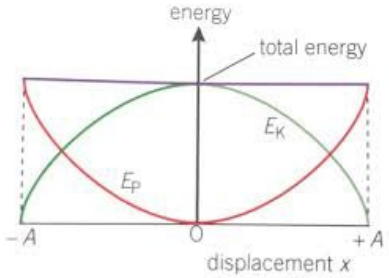
A damped system:



Equations

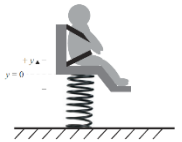
$E_p = \frac{1}{2}ky^2$	Energy	E_p	J
	constant	k	N m^{-1}
	Displacement from equilibrium	y	m
$E_{K(LIN)} = \frac{1}{2}mv^2$	Kinetic Energy	E_k	J
	mass	m	kg
	velocity	v	m s^{-1}

A graph of the variation of potential energy, kinetic energy and the total energy



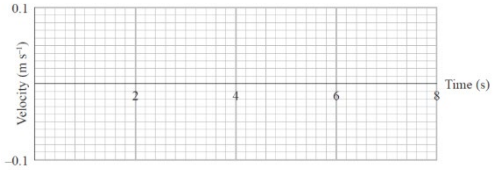
Questions

QUESTION THREE (2017;3)



Astronauts measure their mass by being strapped on to a lightweight seat that is attached to a spring as shown in the diagram. When Sylvia is displaced from equilibrium, she oscillates in simple harmonic motion with a period of 8.00 s. You may assume her motion is linear.

(b) On the axis below, draw a graph showing Sylvia's velocity vs time, starting when she is closest to the floor. Include the value of the maximum velocity.



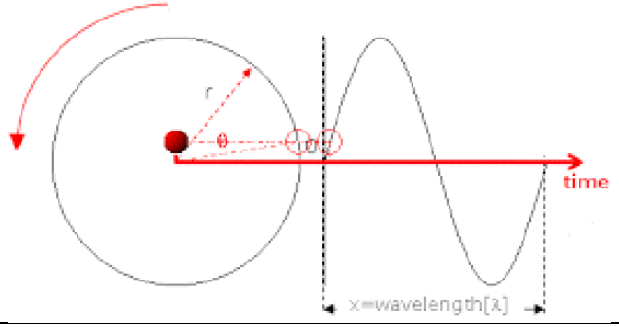
SIMPLE HARMONIC MOTION (2016;3)

(d) A toy bumble bee hangs on a spring. The bumble bee's oscillation has a period of 1.57 s. Tom pushes the bumble bee and makes it resonate. He stops pushing the bumble bee when its displacement is 20 cm. Using the axes given, draw a graph of displacement against time for three complete oscillations, starting from y = +20 cm. Include appropriate values on both axes.

Terms

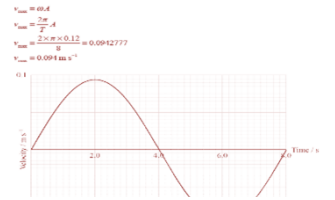
Tips

SHM can be represented by a reference circle.



Answers

(b)



(d)