A-LEVEL PHYSICS • HOLIDAY HOMEWORK 假期作业

17 SHM graphs and energy – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary 词汇

Write each word three times. 把每个单词抄写三遍。

English	中文	Write it 3 times (English)
amplitude	振幅	
period	周期	
frequency	频率	

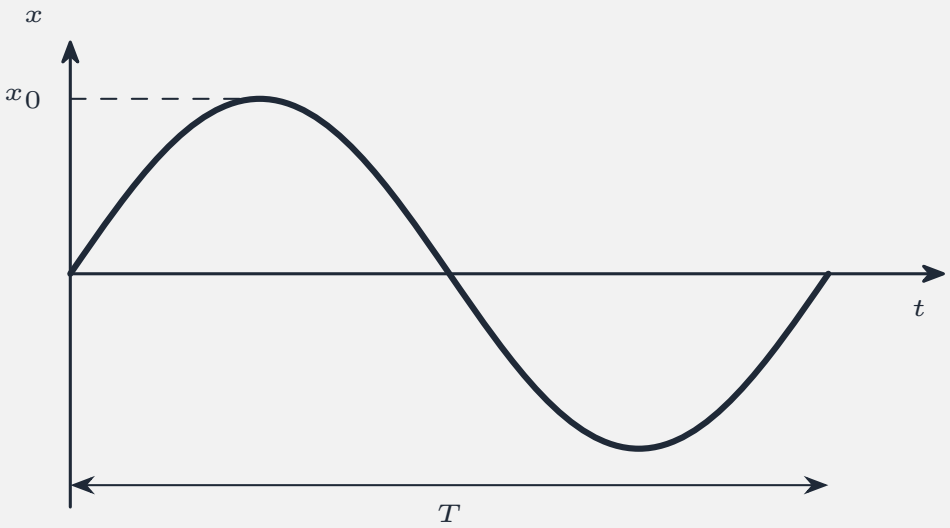
Recall

An object in SHM swings out to a largest displacement, the **amplitude** 振幅, and back, over and over.

New ideas

Read these first. Each idea has a short worked example. Then do the Practice.

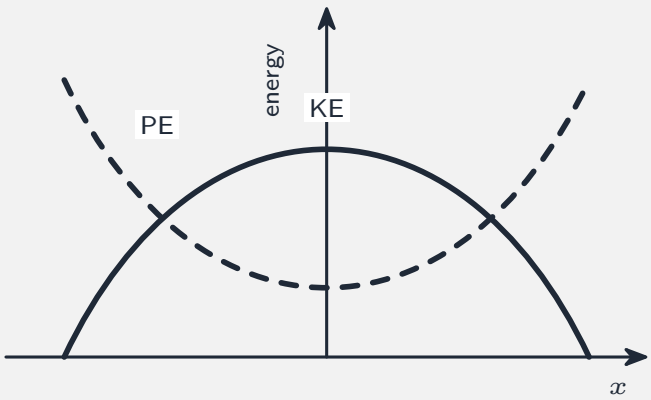
■ 1 Displacement against time



The displacement traces a sine curve. The amplitude x_0 is the largest displacement; the **period** 周期 T is the time for one full swing; the **frequency** 频率 $f = 1/T$.

Worked example. A pendulum takes 2.0 s for one full swing, so $T = 2.0$ s, $f = 1/T = 0.50$ Hz, and $\omega = 2\pi f = 2\pi(0.50) \approx 3.1$ rad s^{-1}.

2 Energy in SHM



Energy swaps between kinetic (greatest at the centre) and potential (greatest at the ends). The total energy stays constant.

Worked example. At the ends of the swing the mass is momentarily still, so all its energy is potential. As it passes the centre it moves fastest, so all of that energy is now kinetic.

Watch out: the *speed* (and kinetic energy) is largest at the *centre*, where the acceleration is zero —don't confuse "maximum acceleration" with "maximum speed".

Practice

Try these in order.

17.1 What is the *amplitude* of an oscillation? [1]

17.2 What is the *period*? [1]

17.3 Write the link between frequency and period. [1]

17.4 A pendulum has period 2.5 s. Find its frequency. [1]

17.5 Where in the swing is the kinetic energy greatest? [1]

17.6 At which points is the potential energy greatest, and what is the kinetic energy there? Explain. [2]

17.7 Challenge. A child on a swing is given one push and then left alone. In real life the swing slowly stops. Explain why, in terms of energy, even though SHM theory says the total energy is constant. [2]