

7.2 Frequency and Period of SHM

Name: _____ Class: _____ Date: _____

Total: 14 marks

KEY WORDS period 周期 • frequency 频率 • amplitude 振幅 • angular frequency 角频率
• simple pendulum 单摆

Objective

Build the skills to answer exam questions on **frequency and period of SHM**.

You must be able to:

- use the **period** 周期 T , **frequency** 频率 $f = 1/T$, and **angular frequency** 角频率 $\omega = 2\pi/T$
- use $T = 2\pi\sqrt{m/k}$ for a mass-spring system
- use $T = 2\pi\sqrt{L/g}$ for a simple pendulum
- state that the period is independent of amplitude

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Period, frequency, angular frequency

$$T = \frac{1}{f}, \quad \omega = 2\pi f = \frac{2\pi}{T}.$$

A period of 0.25 s gives $f = 4$ Hz.

■ Mass on a spring

$$T = 2\pi\sqrt{\frac{m}{k}}.$$

Heavier mass or a softer spring means a longer period.

■ A simple pendulum

$$T = 2\pi\sqrt{\frac{L}{g}}.$$

The mass of the bob does not appear – only the length matters.

2 Practice

Now apply the methods above.

2.1 An oscillator has a period of 0.5 s. Find its frequency. [2]

2.2 State how the period of a mass-spring system changes if the mass increases. [1]

2.3 A pendulum's length is quadrupled. By what factor does its period change? [2]

2.4 Does a larger swing amplitude change an ideal pendulum's period? Answer yes or no. [1]

3 Exam-style questions

3.1 The period of a simple pendulum depends on [1]

A	B
C	D

A the bob's mass

B the length and g

C the amplitude

D the colour

3.2 Quadrupling the mass on a spring changes the period by a factor of [1]

A	B
C	D

A 2

B 4

C 16

D 1/2

3.3 A 0.2 kg mass hangs on a spring with $k = 50 \text{ N m}^{-1}$.

(a) Find the period. [2]

(b) Find the frequency. [1]

3.4 A pendulum of length 1.0 m swings ($g = 9.8 \text{ m s}^{-2}$).

(a) Find its period. [2]

(b) State the effect on the period of doubling the bob's mass. [1]