

14.2 Periodic Waves

Name: _____ Class: _____ Date: _____

Total: 10 marks**KEY WORDS** frequency 频率 • period 周期 • wavelength 波长 • wave equation 波速公式 • wave speed 波速

Objective

Build the skills to answer exam questions on **periodic waves**.**You must be able to:**

- define **frequency** 频率, **period** 周期, and **wavelength** 波长 of a periodic wave
- apply the **wave equation** 波速公式 $v = f\lambda$
- relate the wave speed to the properties of the medium

1 Worked examples

Study these first. Each one shows the method for a question type used later.

■ Definitions

- **Frequency** f — cycles per second (Hz).
- **Period** $T = \frac{1}{f}$ — time for one cycle.
- **Wavelength** λ — length of one full wave.

■ The wave equation

 $v = f\lambda$. The wave **speed** is set by the medium, so if f rises, λ falls to keep v fixed.

■ Example

 $f = 50$ Hz and $\lambda = 2.0$ m give $v = 100$ m s⁻¹.

2 Practice

2.1 A wave has frequency 20 Hz and wavelength 1.5 m. Find its speed. [2]

2.2 A wave has a period of 0.25 s. Find its frequency. [1]

2.3 State the wave equation.

[1]

3 Exam-style questions

3.1 The wave equation is

[1]

- **A** $v = f/\lambda$
 - **B** $v = f\lambda$
 - **C** $v = \lambda/f$
 - **D** $f = v\lambda$
-

3.2 If the frequency of a wave doubles at constant speed, the wavelength

[1]

- **A** doubles
 - **B** halves
 - **C** stays the same
 - **D** quadruples
-

3.3 A sound wave travels at 340 m s^{-1} with a frequency of 170 Hz.

(a) Find the wavelength.

[2]

(b) Find the period.

[2]

Solutions

2.1 $v = f\lambda = 20 \times 1.5 = 30 \text{ m s}^{-1}$.

2.2 $f = \frac{1}{T} = \frac{1}{0.25} = 4.0 \text{ Hz}$.

2.3 $v = f\lambda$.

3.1 B.

3.2 B.

3.3 (a) $\lambda = \frac{v}{f} = \frac{340}{170} = 2.0 \text{ m}$. (b) $T = \frac{1}{f} = \frac{1}{170} = 5.9 \times 10^{-3} \text{ s}$.