8. Superposition

Starter Quiz · 课前小测

A-Level Physics Name: _____ Score: _____

1. When two waves overlap at a point, the resultant displacement is:

   ☐ the sum of their separate displacements

   ☐ always the larger displacement

   ☐ always zero

   ☐ the average of the two

2. Diffraction is the _____ of a wave as it passes through a gap.

   ☐ spreading

   ☐ speeding up

   ☐ reflection

   ☐ disappearing

3. Two coherent sources have:

   ☐ a constant phase difference

   ☐ the same amplitude only

   ☐ randomly changing phases

   ☐ different frequencies

4. A diffraction grating is made of:

   ☐ many equally spaced slits

   ☐ exactly two slits

   ☐ a single slit

   ☐ a curved mirror

5. Two equal waves meeting in phase give four times the intensity of one wave alone.

   ☐ True ☐ False

6. All waves can diffract.

   ☐ True ☐ False

7. Two separate lamps make a steady, visible interference pattern.

   ☐ True ☐ False

8. Light hits a grating of slit spacing 2.0 μm. The first-order ($n = 1$) maximum is where $\sin\theta = 0.30$. Find the wavelength, in nm.

   _____ nm

9. A point on a stationary wave that is always at zero displacement is called a _____.

   _____

10. A wave spreads out the most when the gap is:

    ☐ about the same size as the wavelength

    ☐ much wider than the wavelength

    ☐ made of metal

    ☐ perfectly square

8. Superposition

Answers · 答案

A-Level Physics

1. **the sum of their separate displacements**

   That is the principle of superposition — displacements add (as vectors) at each point.

2. **spreading**

   Diffraction is the spreading (bending) of a wave at a gap or obstacle.

3. **a constant phase difference**

   Coherence means a constant phase difference (and so the same frequency) — needed for a steady pattern.

4. **many equally spaced slits**

   Hundreds or thousands of equally spaced slits, each acting as a coherent source.

5. **True**

   The amplitude doubles to $2A$, and $I \propto A^2$, so $I \propto (2A)^2 = 4A^2$.

6. **True**

   Yes — water, sound, light and microwaves all spread at a gap or edge.

7. **False**

   No — their phase difference changes randomly, so any pattern flickers too fast to see.

8. **600 nm**

   $\lambda = \dfrac{d \sin\theta}{n} = \dfrac{2.0 \times 10^{-6} \times 0.30}{1} = 6.0 \times 10^{-7}\ \text{m} = 600\ \text{nm}.$

9. **node**

   At a node the two waves always cancel. Halfway between nodes is an antinode (biggest swing).

10. **about the same size as the wavelength**

    When the gap ≈ the wavelength, the wave fans out strongly; a much wider gap lets it pass nearly straight.