

8. Superposition

Starter Quiz

A-Level Physics

Name: _____ Score: _____

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

- ☐ always the larger displacement
- ☐ always zero
- ☐ the average of the two
- ☐ the sum of their separate displacements

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

- ☐ reflection
- ☐ spreading
- ☐ speeding up
- ☐ disappearing

3. Two coherent sources have:

- ☐ different frequencies
- ☐ a constant phase difference
- ☐ randomly changing phases
- ☐ the same amplitude only

4. A diffraction grating is made of:

- ☐ a single slit
- ☐ many equally spaced slits
- ☐ exactly two slits
- ☐ 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 $2.0\text{ }\mu\text{m}$. 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. Sound of wavelength 0.75 m and light of wavelength 500 nm both pass through a doorway 0.80 m wide. Which spreads out noticeably beyond the doorway?

- ☐ neither
- ☐ the sound only
- ☐ both, equally
- ☐ the light only

8. Superposition

Answers ·

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

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

9. node

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

10. the sound only

Spreading is greatest when the gap is about one wavelength wide. The doorway is about one sound wavelength, but over a million light wavelengths, so the light goes straight through.