

8.2 Diffraction

Name: _____ Class: _____ Date: _____

Total: 13 marks

Objective

Build the skills to answer exam questions on **diffraction** 衍射—what it is and how it depends on the gap width.

You must be able to:

- explain **diffraction** and where it occurs
- describe how the **gap width** relative to the **wavelength** changes the spreading

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.

■ Diffraction

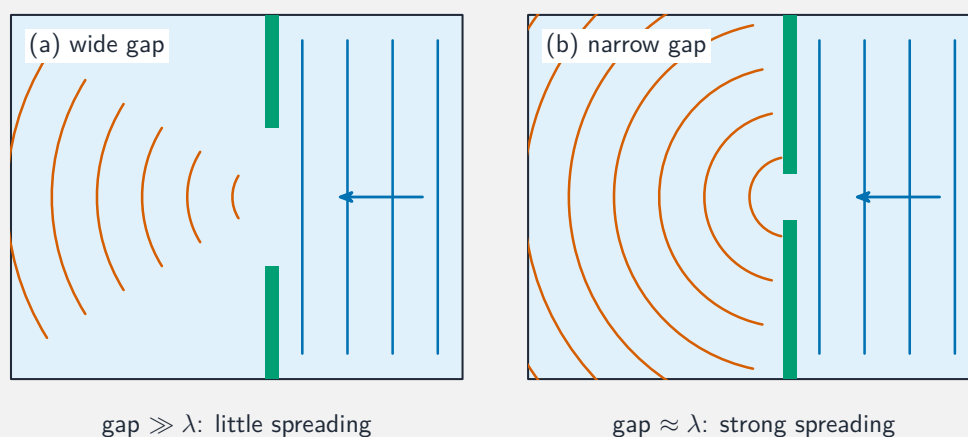
Diffraction is the **spreading** of a wave as it passes through a gap or around an obstacle. **All** waves diffract. The spreading depends on the **gap width compared with the wavelength**:



(a) wide gap



(b) narrow gap



Diffraction of waves through a gap

- gap **much wider** than $\lambda \rightarrow$ little spreading;
- gap **about** $\lambda \rightarrow$ strong spreading.

This is why you can **hear** around a corner (sound $\lambda \approx 1$ m, near a doorway's width) but cannot **see** around it (light $\lambda \approx 500$ nm, far smaller). The wavelength and speed are **unchanged** by diffraction.

2 Practice

Now apply the methods above.

2.1 Define **diffraction**.

[1]

2.2 State what happens to the amount of diffraction as a gap is made **narrower** (towards the size of λ).

[1]

2.3 State why you can **hear** but not **see** around a corner.

[2]

2.4 State which kinds of wave can **diffract**.

[1]

3 Exam-style questions

3.1 Noticeable diffraction occurs when the gap width is: [1]

- **A** much larger than the wavelength
 - **B** about the same as the wavelength
 - **C** exactly zero
 - **D** a thousand times the wavelength
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3.2 Explain, using diffraction, why **sound** passes through a doorway and spreads into the room, but **light** does not noticeably spread. [3]

3.3 Describe a **ripple-tank** experiment to show that diffraction depends on the gap width. [3]

3.4 State the effect of diffraction on the **wavelength** and **speed** of the wave. [1]

4 Go further

You are now ready for the real exam questions on this subtopic. Open the **8.2 Diffraction** past-paper sheet in the Library, or try these in **Practice mode**:

- 9702/13 J25 —Q30 (ripple-tank diffraction)
- 9702/14 J25 —Q26 (diffraction through a gap)
- 9702/13 N25 —Q24 (diffraction)
- 9702/14 N25 —Q26 (diffraction of waves)
- 9702/23 J25 —Q6 (diffraction, structured)

Solutions

2.1 The **spreading** of a wave as it passes through a gap or around an obstacle.

2.2 The diffraction (spreading) **increases**.

2.3 Sound has a wavelength **close to** the doorway/gap size, so it diffracts a lot; light's wavelength is **far smaller** than the gap, so it diffracts negligibly.

2.4 **All** waves (water, sound, light, microwaves, ...).

3.1 **B** —about the same as the wavelength.

3.2 Sound's wavelength is **similar** to the doorway width, so it diffracts strongly and spreads into the room; light's wavelength is **much smaller** than the doorway, so its diffraction is negligible.

3.3 Send straight water waves at a barrier with a gap; observe how much they spread after the gap; make the gap narrower and see the waves spread **more** (compare wide vs narrow gap).

3.4 Both the **wavelength** and the **speed** are **unchanged**.