

14.8 Double-Slit Interference and Diffraction Gratings

Name: _____ Class: _____ Date: _____

Total: 10 marks

KEY WORDS diffraction grating 衍射光栅 • young's double-slit 杨氏双缝 • wave 波
• wavelength 波长 • diffraction 衍射

Objective

Build the skills to answer exam questions on **double-slit interference and diffraction gratings**.

You must be able to:

- describe **Young's double-slit** 杨氏双缝 experiment as evidence for the wave nature of light
- apply $d \sin \theta = m\lambda$ to locate bright fringes (maxima)
- explain how a **diffraction grating** 衍射光栅 produces sharp, widely spaced maxima

1 Worked examples

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

■ Young's double slit

Light passing through two close slits produces bright and dark **fringes** — clear evidence of wave interference.

■ Fringe condition

$d \sin \theta = m\lambda$, where d is the slit spacing and $m = 0, 1, 2, \dots$ labels the bright fringes.

■ Diffraction grating

A grating has many slits, so it gives very **sharp, widely spaced** maxima — ideal for measuring wavelength.

2 Practice

2.1 State what the double-slit experiment demonstrates about light.

[1]

2.2 Write the condition for bright fringes in a double-slit pattern. [1]

2.3 Light of wavelength 600 nm falls on slits 0.20 mm apart. Find the angle to the first bright fringe ($m = 1$). [2]

3 Exam-style questions

3.1 In a double-slit experiment, bright fringes occur when $d \sin \theta$ equals [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** $m\lambda$
B $(m + \frac{1}{2})\lambda$
C λ/m
D $2m\lambda$

3.2 Compared with a double slit, a diffraction grating gives maxima that are [1]

- | | |
|---|---|
| A | B |
| C | D |
- A** blurrier
B sharper and more widely spaced
C closer together
D absent

3.3 A grating has 300 lines per millimetre and is lit by light of wavelength 500 nm.

(a) Find the slit spacing d . [2]

(b) Find the angle to the first-order maximum. [2]