

14.9 Thin-Film Interference

Name: _____ Class: _____ Date: _____

Total: 9 marks

Objective

Build the skills to answer exam questions on **thin-film interference**.

You must be able to:

- explain **thin-film interference** 薄膜干涉 as interference between light reflected from two surfaces
- account for the **phase change** 相位变化 on reflection from a denser medium
- relate film thickness to constructive or destructive interference

1 Worked examples

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

■ Thin-film interference

Light reflects from **both** the top and bottom surfaces of a thin film; the two reflected waves overlap and interfere.

■ Phase change on reflection

Reflection from a **denser** medium flips the wave by half a wavelength (a phase change of π).

■ Colours

The film **thickness** decides which wavelengths interfere constructively, giving the shifting colours of soap bubbles, oil films, and lens coatings.

2 Practice

2.1 State what causes the colours seen on a soap bubble.

[2]

2.2 State what happens to the phase of light reflecting off a denser medium.

[1]

2.3 Give one everyday example of thin-film interference. [1]

3 Exam-style questions

3.1 Thin-film interference is between light reflected from [1]

- **A** one surface only
 - **B** the top and bottom surfaces of the film
 - **C** two separate films
 - **D** a plane mirror
-

3.2 Light reflecting off a denser medium undergoes a phase change of [1]

- **A** zero
 - **B** a quarter wavelength
 - **C** half a wavelength
 - **D** a full wavelength
-

3.3 A soap film shows bands of colour that change as it drains and thins.

(a) Explain why different colours appear at different thicknesses. [2]

(b) Name the effect responsible. [1]

4 Go further

- work through the **14.9 Thin-Film Interference** lesson on the **Learn** page;
- read the **Waves and Sound** section of the AP Physics 2 handout on the **Know** page.

Solutions

2.1 light reflecting from the top and bottom surfaces of the film interferes; the thickness sets which colours interfere constructively.

2.2 it changes by half a wavelength (a phase change of π).

2.3 oil films on water, or anti-reflection coatings on lenses (any one).

3.1 B.

3.2 C.

3.3 (a) at each thickness a different wavelength interferes constructively, so a different colour is seen. (b) thin-film interference.