Exercise walk-through

Thin-Film Interference ▪ 14.9

eXercise

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

Method — Thin-film interference

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

Method — Phase change on reflection

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

Method — Colours

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

Practice 2.1 ▪ 2 marks

State what causes the colours seen on a soap bubble.

Solution 2.1

Method: Colours

Worked steps

light reflecting from the top and bottom surfaces of the film interferes B1; the thickness sets which colours interfere constructively B1.

Practice 2.2 ▪ 1 mark

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

Solution 2.2

Method: Phase change on reflection

Worked steps

it changes by half a wavelength (a phase change of π) B1.

Practice 2.3 ▪ 1 mark

Give one everyday example of thin-film interference.

Solution 2.3

Method: Thin-film interference

Worked steps

oil films on water, or anti-reflection coatings on lenses (any one) B1.

Exam-style 3.1 ▪ 1 mark

Thin-film interference is between light reflected from

A one surface only

B the top and bottom surfaces of the film

C two separate films

D a plane mirror

Solution 3.1

Method: Thin-film interference

A one surface only

B the top and bottom surfaces of the film ✓

C two separate films

D a plane mirror

Worked steps

B.

Exam-style 3.2 ▪ 1 mark

Light reflecting off a denser medium undergoes a phase change of

A zero

B a quarter wavelength

C half a wavelength

D a full wavelength

Solution 3.2

Method: Phase change on reflection

A zero

B a quarter wavelength

C half a wavelength ✓

D a full wavelength

Worked steps

C.

Exam-style 3.3 ▪ 2 marks

A soap film shows bands of colour that change as it drains and thins.
(a) Explain why different colours appear at different thicknesses.
(b) Name the effect responsible.

Solution 3.3

Method: Colours

Worked steps

(a) at each thickness a different wavelength interferes constructively B1, so a different colour is seen B1. (b) thin-film interference B1.