

# 9.3 Interference

## Question Paper

Course	DPIB Physics
Section	9. Wave Phenomena (HL only)
Topic	9.3 Interference
Difficulty	Easy

**Time allowed:** 20  
**Score:** /10  
**Percentage:** /100

### Question 1

When light from two sources produces an observable interference pattern it is necessary that:

- A. The light emitted from the sources is monochromatic
- B. The light emitted from the sources is in phase
- C. The light emitted from each source is of the same intensity
- D. The light from both sources is coherent

[1 mark]

### Question 2

Monochromatic light of wavelength  $\lambda$  is incident on a double slit of width  $d$  and the diffraction pattern is observed on the screen some distance  $D$  away.

What is the equation used to calculate the fringe spacing  $s$  observed on the screen?

- A.  $\theta = 1.22 \frac{\lambda}{b}$
- B.  $s = \frac{\lambda D}{d}$
- C.  $n\lambda = d \sin \theta$
- D.  $\theta = \frac{\lambda}{b}$

[1 mark]

### Question 3

Which of the following is a safety consideration whilst using lasers in a laboratory?

- A. Only one laser can be used at a time to avoid overheating
- B. Lasers must be of class 4 strength or below
- C. Lasers must only be used in a room with a blackout blinds
- D. Lasers must not be shone into anyone's eyes

[1 mark]

### Question 4

Monochromatic light is incident on a double slit which produces an interference pattern on a screen some distance away. How is the brightness of each of the fringes related?

- A. The fringes increase in brightness by a factor of two as the diffraction pattern moves further away from the central maximum
- B. The bright fringes become dimmer by a factor of  $\frac{1}{\textit{slit width}}$  as the diffraction pattern moves further away from the maximum
- C. The central maximum is brighter than the subsequent maxima by a factor of two
- D. Each fringe has equal brightness and therefore equal intensity

[1 mark]

### Question 5

Light from a single source passes first through a single slit and then through a double slit. A diffraction pattern is observed on the screen and a resulting interference pattern is obtained. This interference pattern has been modulated.

What is modulation?

- A. An interference pattern created from a combination of interference through both a double slit and a single slit.
- B. An interference pattern that contains both constructive and destructive interference
- C. A change in frequency of the incident light on the single and double slits
- D. The phase difference that is calculated from the interference pattern at the first minimum

[1 mark]

### Question 6

Monochromatic light incident on a diffraction grating creates both primary and secondary maxima in the diffraction pattern.

What is the relationship between the number of slits in the diffraction grating, when the number of slits is less than 20, and the number of secondary maxima that can be observed on the screen?

- A. The number of primary and secondary maxima in each diffraction pattern is the same
- B. The number of secondary maxima in the diffraction pattern is always one less than the number of primary maxima.
- C. The number of secondary maxima in the diffraction pattern is always the same as the number of slits in the diffraction grating
- D. The number of secondary maxima between the primary maxima is always two less than the number of slits in the diffraction grating

[1 mark]

**Question 7**

What is a diffraction grating?

- A. Two slits created as two gaps within a material through which waves can be diffracted
- B. A plate consisting of a very large number of parallel, identical, closely-spaced slits
- C. A circular aperture through which light can be diffracted and then images resolved
- D. A photographic filter that allows light in only one plane to pass through

[1 mark]

**Question 8**

What is the equation used to calculate the angular separation between the order of maxima for a diffraction grating?

A.  $\theta = \frac{\lambda}{b}$

B.  $s = \frac{\lambda D}{d}$

C.  $v = f\lambda$

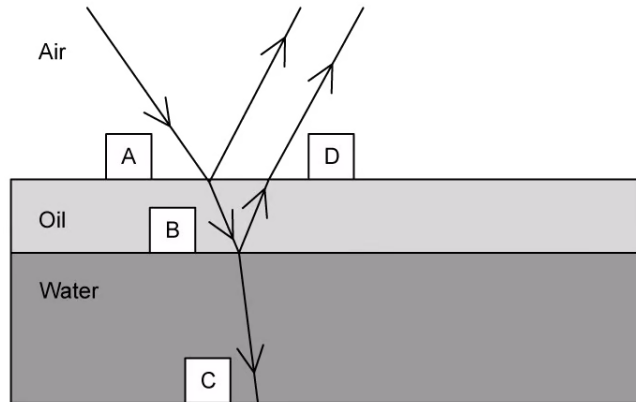
D.  $n\lambda = d\sin\theta$

[1 mark]

### Question 9

A ray of light is incident on a thin film of oil sitting on top of a puddle of water.

The refractive index of air is 1, the refractive index of oil is 1.45 and the refractive index of water is 1.33.



At which boundary is there a phase change in the wave reflected?

[1 mark]

### Question 10

A ray of light incident on the boundary between a less dense to a more dense material undergoes a phase change when reflected.

What is the value of this phase change?

- A.  $\lambda$
- B.  $\frac{\pi}{2}$
- C.  $\frac{\lambda}{2}$
- D.  $360^\circ$

[1 mark]