

9.4 Resolution

Question Paper

Course	DPIB Physics
Section	9. Wave Phenomena (HL only)
Topic	9.4 Resolution
Difficulty	Easy

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

Question 1

Which statement is not true about circular apertures?

- A. Circular apertures allow a cone of light to enter a region behind the aperture
- B. Circular apertures allow light to act like a point source
- C. The diffraction of light through a circular aperture produces a diffuse disc surrounded by fainter concentric circular rings
- D. The diffraction pattern produced by circular apertures produces a central linear fringe with subsequent alternating dark and light fringes

[1 mark]

Question 2

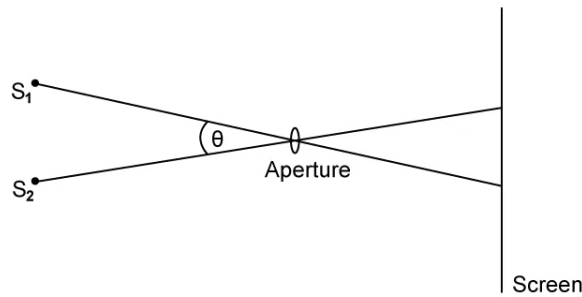
What does the Rayleigh criterion describe?

- A. The diffraction of light through a single slit
- B. The diffraction of light through a double slit
- C. The diffraction of light through multiple slits
- D. The minimum separation between two light sources that can be resolved into two distinct objects

[1 mark]

Question 3

The diagram below shows the light from two point sources, s_1 and s_2 passing through a circular aperture.



What name is given to the angle shown as θ ?

- A. Angular separation
- B. Angle of diffraction
- C. Angle of incidence
- D. Angle of reflection

[1 mark]

Question 4

Light from two sources with wavelength λ is passed through a circular aperture with diameter b , producing an angle of diffraction θ .

According to the Rayleigh criterion, how would the angle of diffraction be affected if the diameter of the aperture was doubled?

- A. 0.25θ
- B. 0.50θ
- C. θ
- D. 2θ

[1 mark]

Question 5

Which of the following options would not increase the resolution of two objects?

- A. Decreasing the wavelength of the light
- B. Increasing the angular separation of the objects
- C. Increasing the diameter of the aperture
- D. Increasing the angle of diffraction

[1 mark]

Question 6

The Rayleigh criterion can be presented as:

$$\frac{s}{d} \geq 1.22 \frac{\lambda}{b}$$

Which option provides the correct quantities represented in the expression?

	s	d	λ	b
A.	Distance between sources	Distance between source and aperture	Wavelength	Diameter of aperture
B.	Distance between source and aperture	Distance between sources	Wavelength	Diameter of aperture
C.	Wavelength	Diameter of aperture	Distance between sources	Distance between source and aperture
D.	Diameter of aperture	Wavelength	Distance between source and aperture	Distance between sources

[1 mark]

Question 7

The Rayleigh criterion can also be applied to diffraction gratings.

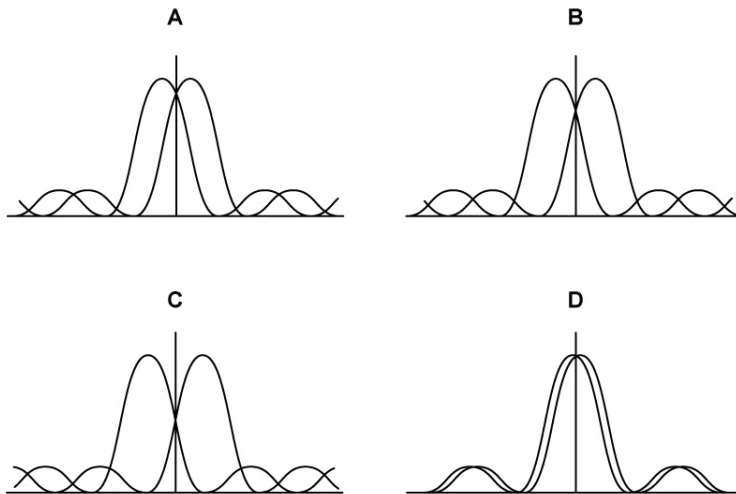
Incident light with an average wavelength of 600 nm is incident on a diffraction grating. The difference between the wavelengths is 25 nm. How many slits would the grating need to have to resolve fully the second order of diffraction?

- A. 24
- B. 25
- C. 12
- D. 50

[1 mark]

Question 8

Which of the following objects can be resolved according to the Rayleigh criterion?



[1 mark]

Question 9

The Rayleigh criterion can be expressed as:

$$\frac{s}{d} \geq 1.22 \frac{\lambda}{b}$$

A telescope is aimed at two objects that are known to be 10 cm apart. The angle of diffraction is 4.5×10^{-5} rad.

Can the objects be resolved at a distance of 10 km?

- A. Yes, because $1 \times 10^{-5} > 4.5 \times 10^{-5}$
- B. No, because $1 \times 10^{-5} < 4.5 \times 10^{-5}$
- C. Yes, because $1 \times 10^{-3} > 4.5 \times 10^{-5}$
- D. No, because $1 \times 10^{-3} < 4.5 \times 10^{-5}$

[1 mark]

Question 10

It is not possible to view an object smaller than the wavelength used to see it.

Which of the following can be used to resolve objects smaller than the wavelengths of visible light, such as atoms?

- A. Sodium ions
- B. Electrons
- C. Gold atoms
- D. Water molecules

[1 mark]