

Interference and Diffraction (MCQ Only)

Q1.

In an experiment to determine the wavelength of light, a diffraction grating is illuminated with light from a monochromatic source. A series of bright spots is observed.

The experiment is repeated and the distance between consecutive bright spots increases.

Select the row of the table that gives two changes to the experimental set up which would both cause the distance between consecutive bright spots to increase.

(1)

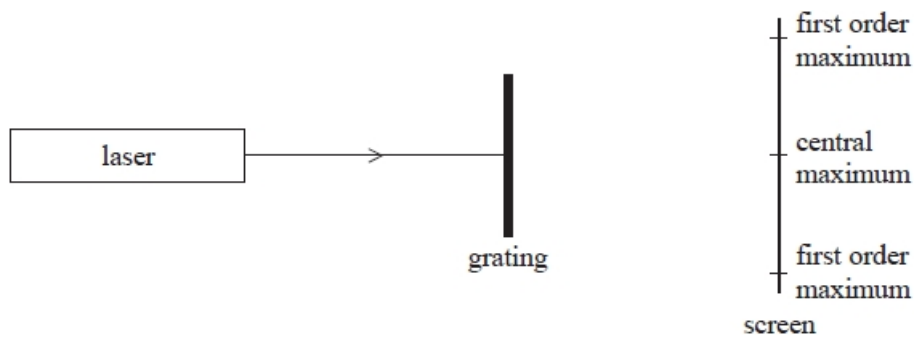
	Number of slits per mm in the diffraction grating	Wavelength of the light source
<input type="checkbox"/> A	Increased	Increased
<input type="checkbox"/> B	Increased	Decreased
<input type="checkbox"/> C	Decreased	Increased
<input type="checkbox"/> D	Decreased	Decreased

(Total for question = 1 mark)

Q2.

A beam of light from a laser is directed at a diffraction grating.

The diagram shows the positions of the central maximum and the first order maxima on a screen.



Which of the following would cause the first order maxima to be closer to the central maximum on the screen?

(1)

- A moving the laser closer to the grating
- B moving the screen further from the grating
- C using a grating with more lines per metre
- D using laser light with a higher frequency

(Total for question = 1 mark)

Q3.

For two waves of light to be coherent the waves must

(1)

- A** always have a phase difference equal to 0.
- B** oscillate in the same plane.
- C** have a similar amplitude.
- D** originate from one source.

(Total for question = 1 mark)

Q4.

In everyday life the effect of diffraction is more significant for sound than for light.

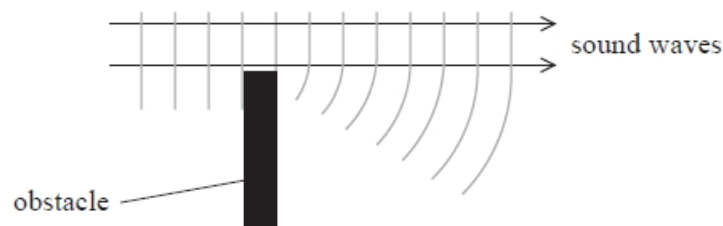
This is because

- A** light has a much shorter wavelength than sound.
- B** light is a transverse wave but sound is a longitudinal wave.
- C** light is an electromagnetic wave but sound is a mechanical wave.
- D** the speed of light in air is much higher than the speed of sound.

(Total for question = 1 mark)

Q5.

Sound waves can diffract around obstacles as shown in the diagram.



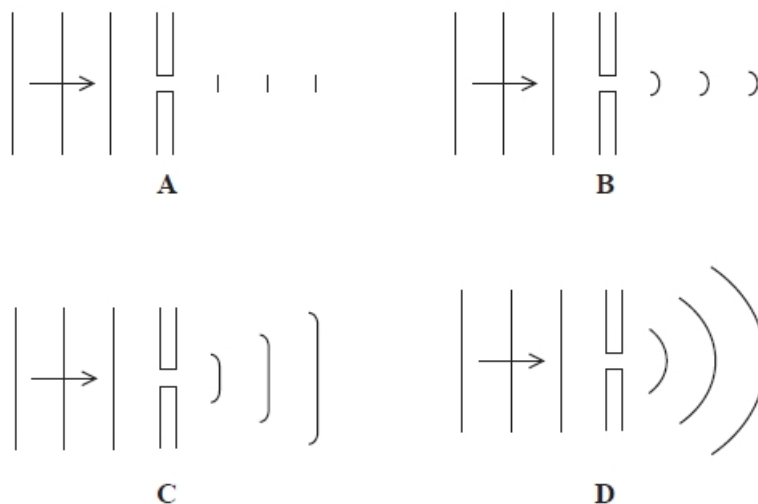
The diffraction effect is

- A** greater for large amplitude sound waves.
- B** greater for low frequency sound waves.
- C** independent of the frequency of the sound waves.
- D** independent of the speed of the sound waves.

(Total for question = 1 mark)

Q6.

Plane wavefronts pass through a gap in a barrier. The gap is much smaller than the wavelength of the wave.



Which diagram best shows the resultant shape of the wavefronts?

- A
- B
- C
- D

(Total for question = 1 mark)

Q7.

In a concert hall, sound waves produced by an instrument are reflected from different parts of the hall. Two coherent sound waves meet at a point where their phase difference is π .

What is the smallest possible path difference to produce this phase difference?

- A $\lambda / 4$
- B $\lambda / 2$
- C $3 \lambda / 4$
- D λ

(Total for question = 1 mark)

Q8.

A stationary interference pattern is created by the superposition of waves from two sources which are close together.

For this to occur the waves must

- A** be in phase with each other.
- B** be transverse.
- C** have the same amplitude.
- D** have the same frequency.

(Total for question = 1 mark)

Q9.

A monochromatic beam of light of wavelength λ from a laser is directed at a diffraction grating of line spacing d .

A student calculates the value of d/λ in order to determine the expected number of visible maxima.

The calculated value of d/λ is 4.7

How many maxima are visible?

- A** 4
- B** 5
- C** 9
- D** 11

(Total for question = 1 mark)

Mark Scheme – Interference and Diffraction (MCQ Only)

Q1.

Question Number	Answer	Mark				
	A Using $n\lambda = d\sin\theta$	1				
	<table border="1"> <tr> <td>Number of slits per mm in the diffraction grating</td> <td>Wavelength of the light source</td> </tr> <tr> <td>Increased</td> <td>Increased</td> </tr> </table>		Number of slits per mm in the diffraction grating	Wavelength of the light source	Increased	Increased
Number of slits per mm in the diffraction grating	Wavelength of the light source					
Increased	Increased					
	Incorrect Answers: B – wavelength decreasing would cause d to decrease C – number of slits/mm decreasing would cause d to decrease D – both decreasing causes d to decrease					

Q2.

Question Number	Answer	Mark
	D – using laser light with a higher frequency	1
	Incorrect Answers: A – this would have no effect B – this would make the maxima further from the central maximum C – this would make the maxima further from the central maximum	

Q3.

Question Number	Answer	Mark
	D originate from one source	1
	Incorrect Answers: A – coherence requires a constant phase difference not necessarily 0 B – planes not relevant C – amplitude not relevant	

Q4.

Question Number	Acceptable Answers	Additional Guidance	Mark
	A		1

Q5.

Question Number	Answers	Mark
	<p>The only correct answer is B</p> <p><i>A is incorrect because amplitude does not affect the diffraction effect</i></p> <p><i>C is incorrect because frequency affects the wavelength and hence the diffraction effect</i></p> <p><i>D is incorrect because the speed of sound affects the wavelength and hence the diffraction effect</i></p>	1

Q6.

Question Number	Answer	Additional guidance	Mark
	D		(1)

Q7.

Question Number	Answer	Additional guidance	Mark
	B	$(\lambda / 2)$	(1)

Q8.

Question Number	Answers	Additional Guidance	Mark
	D	have the same frequency	(1)

Q9.

Question Number	Acceptable answers	Additional guidance	Mark
	<p>The only correct answer is C because the maximum order reached corresponds to the highest integer value less than or equal to line spacing divided by wavelength, which is 4, and there are that many orders either side of the maximum plus a central order</p> <p>A is not correct because the maximum order reached corresponds to the highest integer value less than or equal to line spacing divided by wavelength, which is 4, and there are that many orders either side of the maximum plus a central order, but this answer only gives the number of orders on one side of the central order</p> <p>B is not correct because the maximum order reached corresponds to the highest integer value less than or equal to line spacing divided by wavelength, which is 4, but this order rounds 4.7 to 5 and doesn't consider the central maximum or that there are orders on either side</p> <p>D is not correct because the maximum order reached corresponds to the highest integer value less than or equal to line spacing divided by wavelength, which is 4, but this order rounds 4.7 to 5 and then adds the orders on the other side and the central maximum</p>		1