# Higher
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# Past Paper questions
# 2000 - 2010
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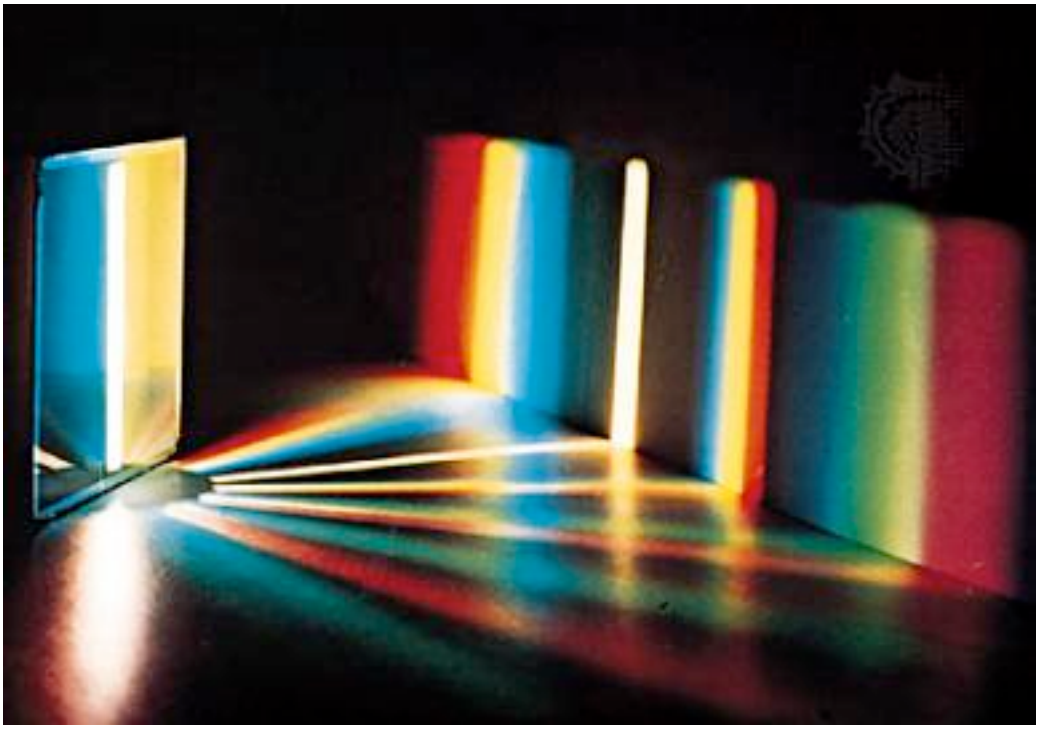
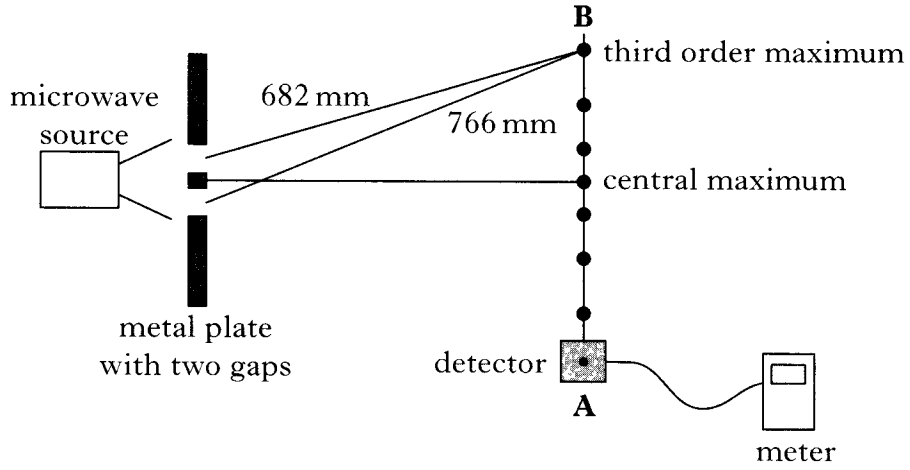
# 3.1 Diffraction



**2003 Q28 (a)**

(a) An experiment with microwaves is set up as shown below.

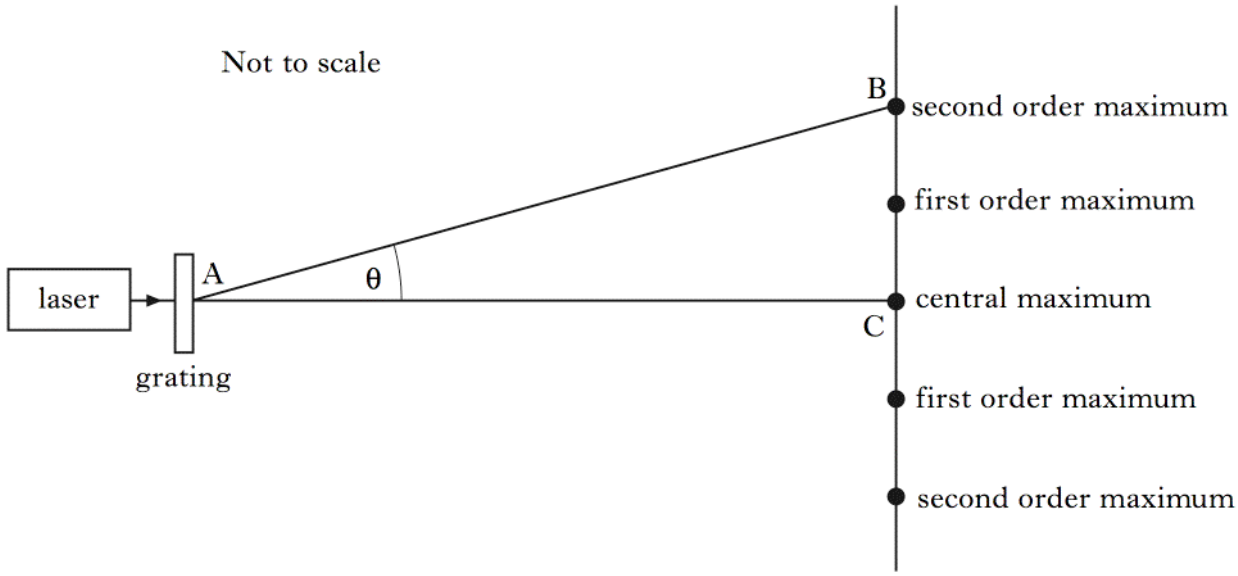



(i) As the detector is moved from A to B, the reading on the meter increases and decreases several times.
Explain, in terms of waves, how the pattern of maxima and minima is produced.

(ii) The measurements of the distance from each gap to a third order maximum are shown.
Calculate the wavelength of the microwaves.

**2007 Q28.**

An experiment to determine the wavelength of light from a laser is shown.




A **second** order maximum is observed at point B.

(a) Explain in terms of waves how a maximum is formed.

(b) Distance AB is measured six times.
The results are shown.

1.11 m  1.08 m  1.10 m  1.13 m  1.11 m  1.07 m

(i) Calculate:
(A) the mean value for distance AB;
(B) the approximate random uncertainty in this value.

(ii) Distance BC is measured as (270 ± 10) mm.
Show whether AB or BC has the larger percentage uncertainty.

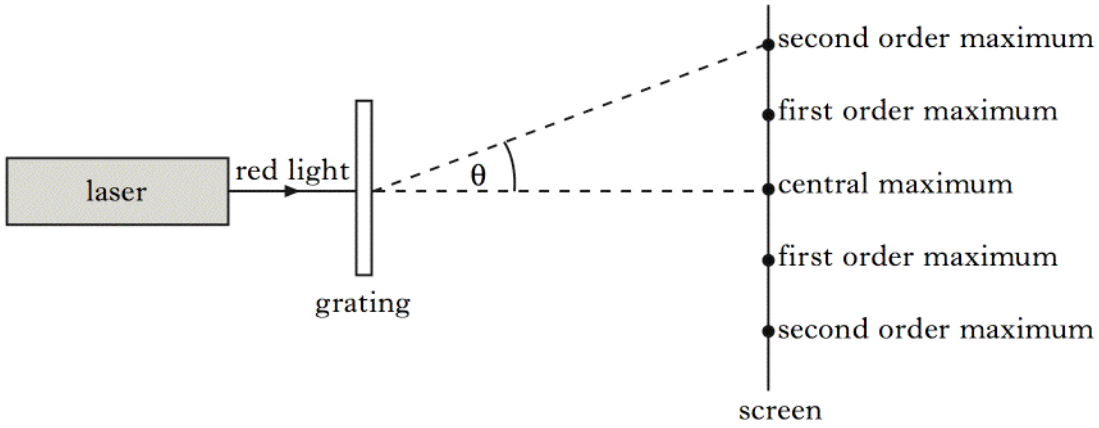
(iii) The spacing between the lines on the grating is $4.00 \times 10^{6}$ m.
Calculate the wavelength of the light from the laser.
Express your answer in the form

wavelength ± **absolute** uncertainty

**2009 Q27.**

A laser produces a narrow beam of monochromatic light.

(a) Red light from a laser passes through a grating as shown.




A series of maxima and minima is observed.

Explain in terms of waves how a **minimum** is produced.

(b) The laser is now replaced by a second laser, which emits blue light. Explain why the observed maxima are now closer together.

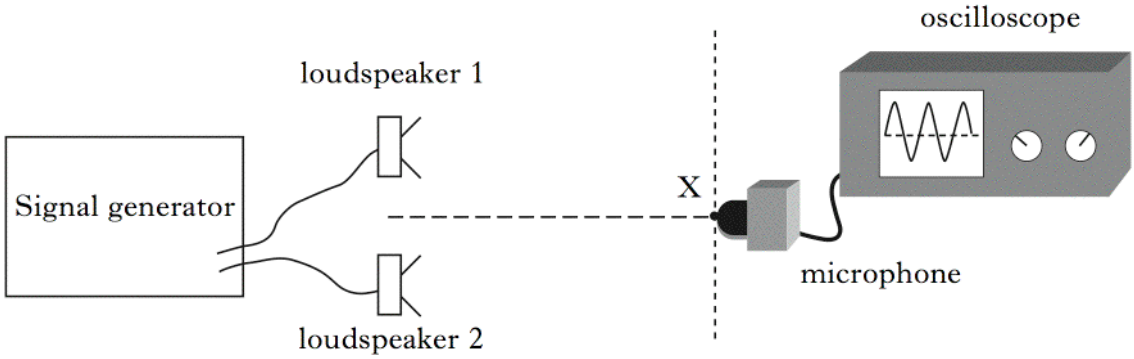
(c) The wavelength of the blue light from the second laser is $4.73 \times 10^{-7}$ m.

The spacing between the lines on the grating is $2.00 \times 10^{-6}$ m.

Calculate the angle between the central maximum and the second order maximum.

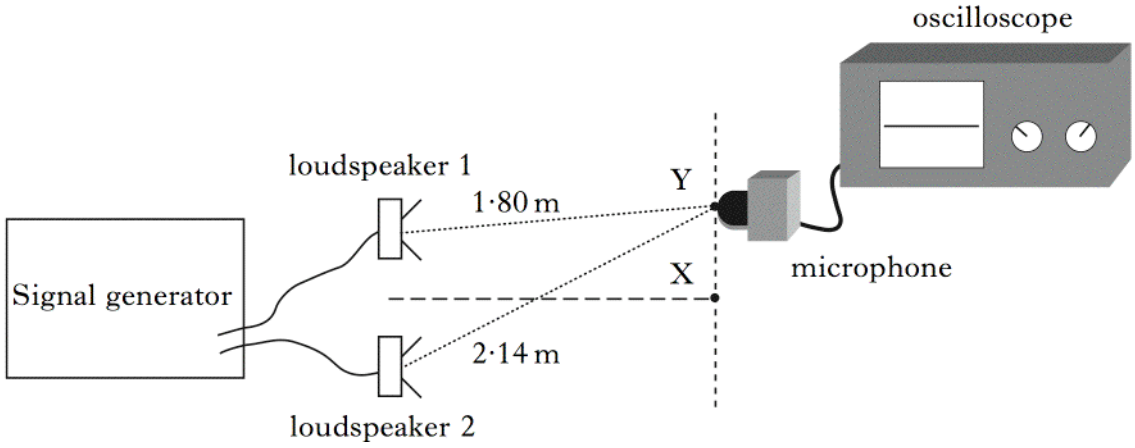
**2010 Q27.**

A student is carrying out an experiment to investigate the interference of sound waves.
She sets up the following apparatus.




The microphone is initially placed at point x which is the same distance from each loudspeaker.
A maximum is detected at X.

(a) The microphone is now moved to the first minimum at Y as shown.

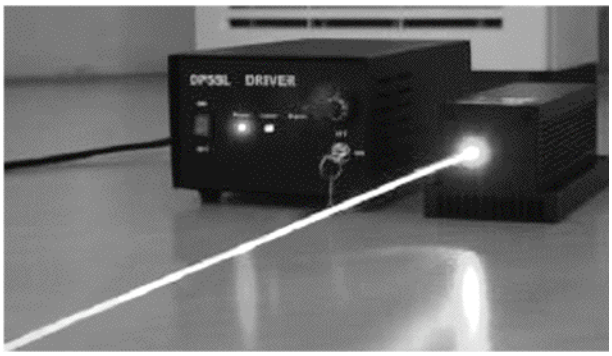



Calculate the wavelength of the sound waves.

(b) Loudspeaker 1 is now disconnected.
What happens to the amplitude of the sound detected by the microphone at Y?
Explain your answer.

**2010 Q29.**

A laser produces a beam of light with a frequency of $4.74 \times 10^{14}$ Hz.

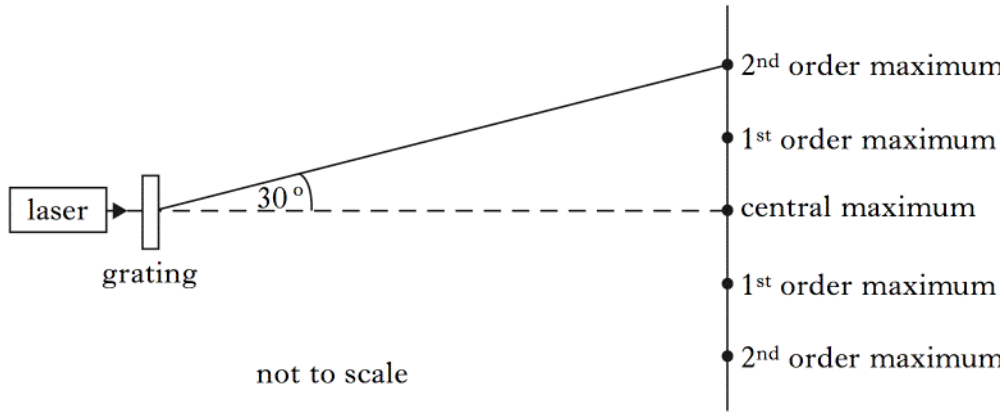



(a) The laser has a power of 0.10 mW.
Explain why light from this laser can cause eye damage.

(b) Calculate the energy of each photon in the laser beam.

(c) Inside the laser, photons stimulate the emission of more photons.
State **two** ways in which the stimulated photons are identical to the photons producing them.

(d) This laser beam is now incident on a grating as shown below.




The second order maximum is detected at an angle of 30º from the central maximum.
Calculate the separation of the slits on the grating.