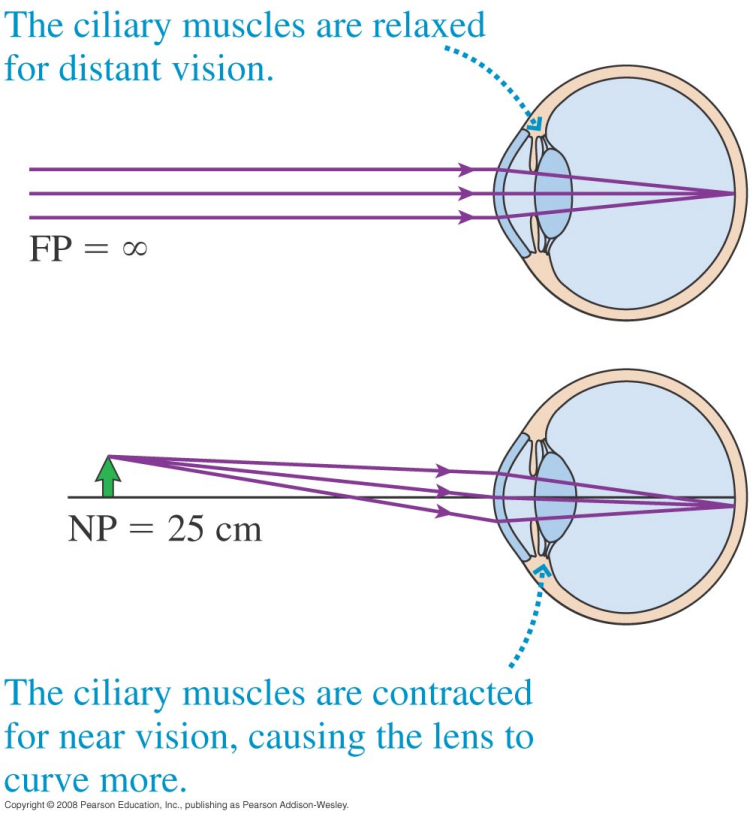
Focusing and Accomodation



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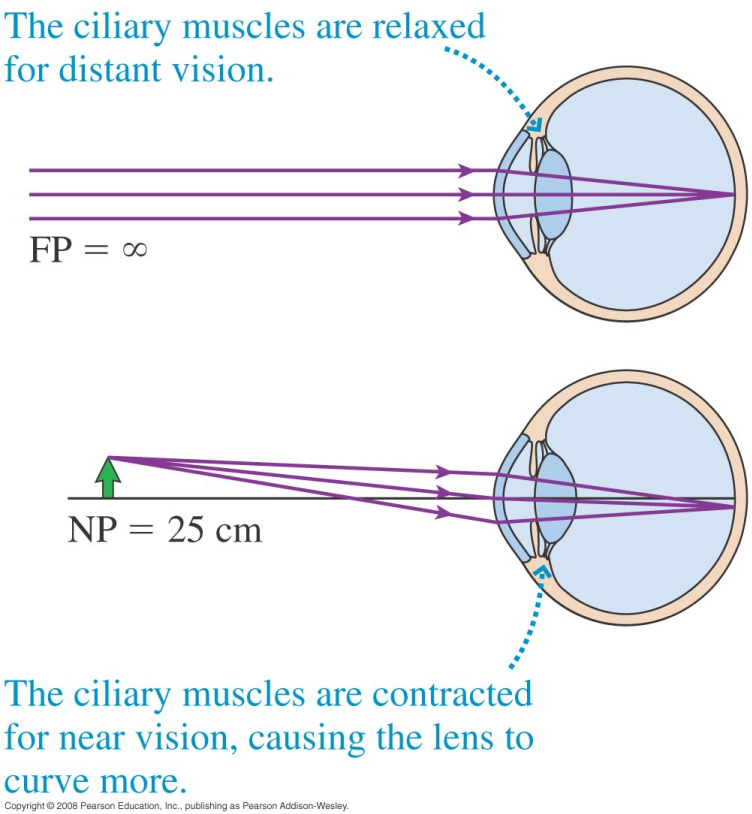

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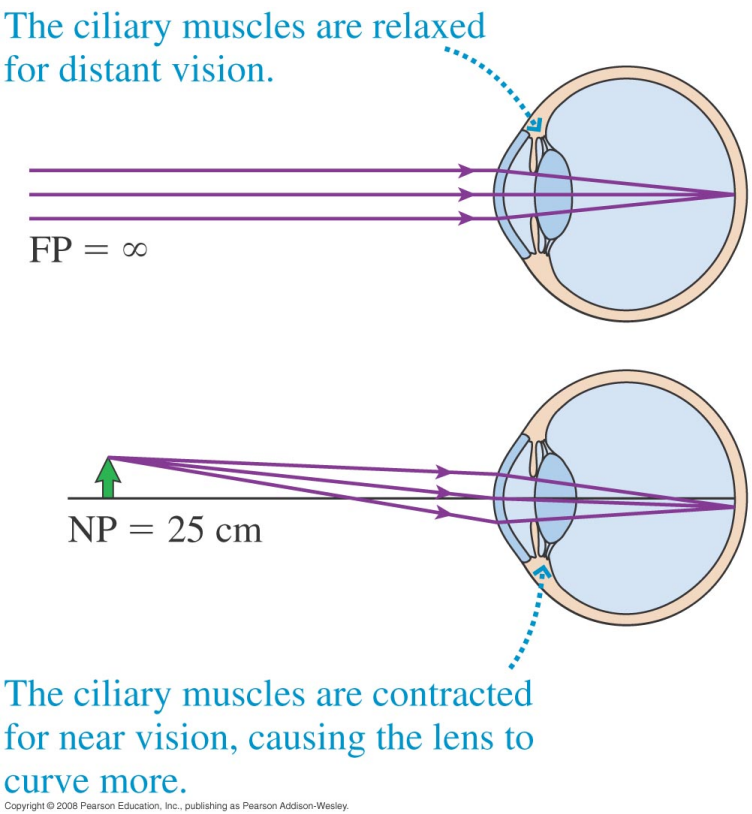

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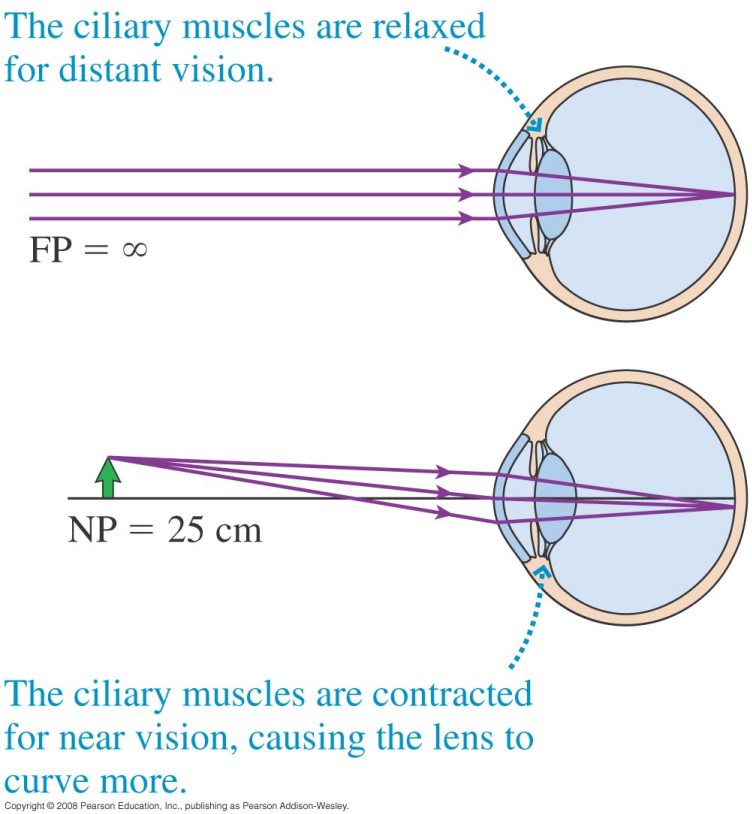

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- Relaxed muscles give a long f, contracted gives small f.

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- If you have glasses with $P = +2.5D$ you have a converging lens with focal length 0.4 m.

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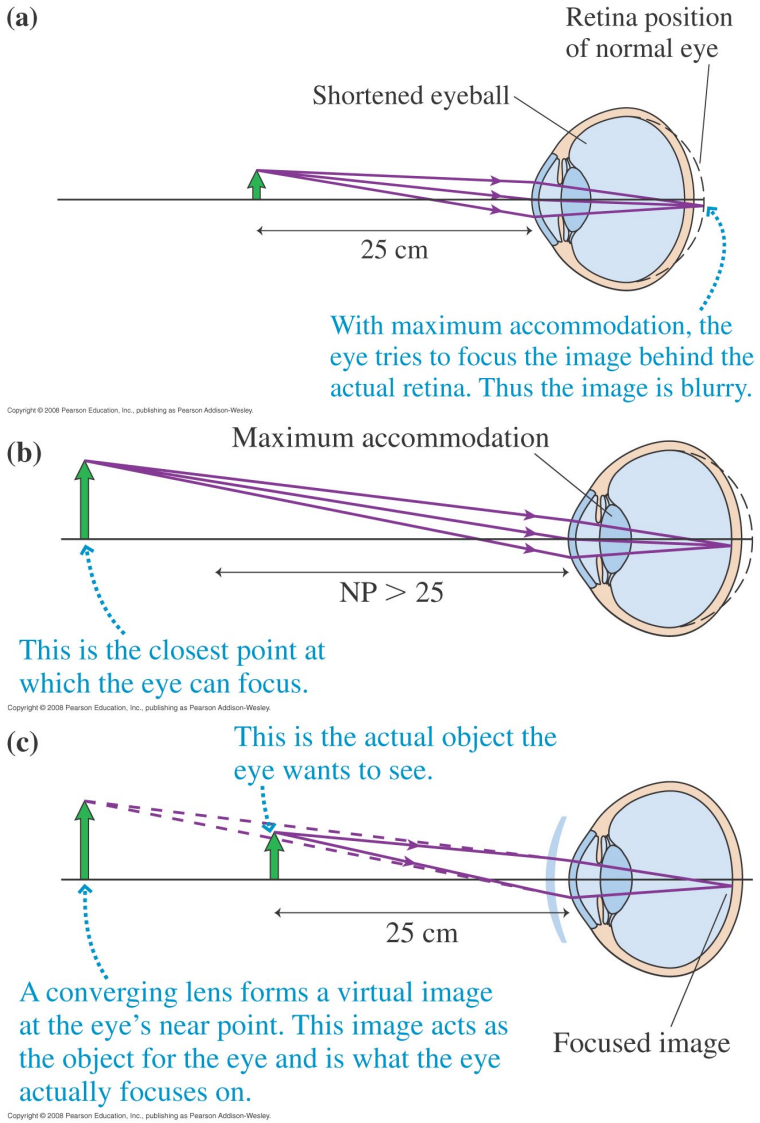

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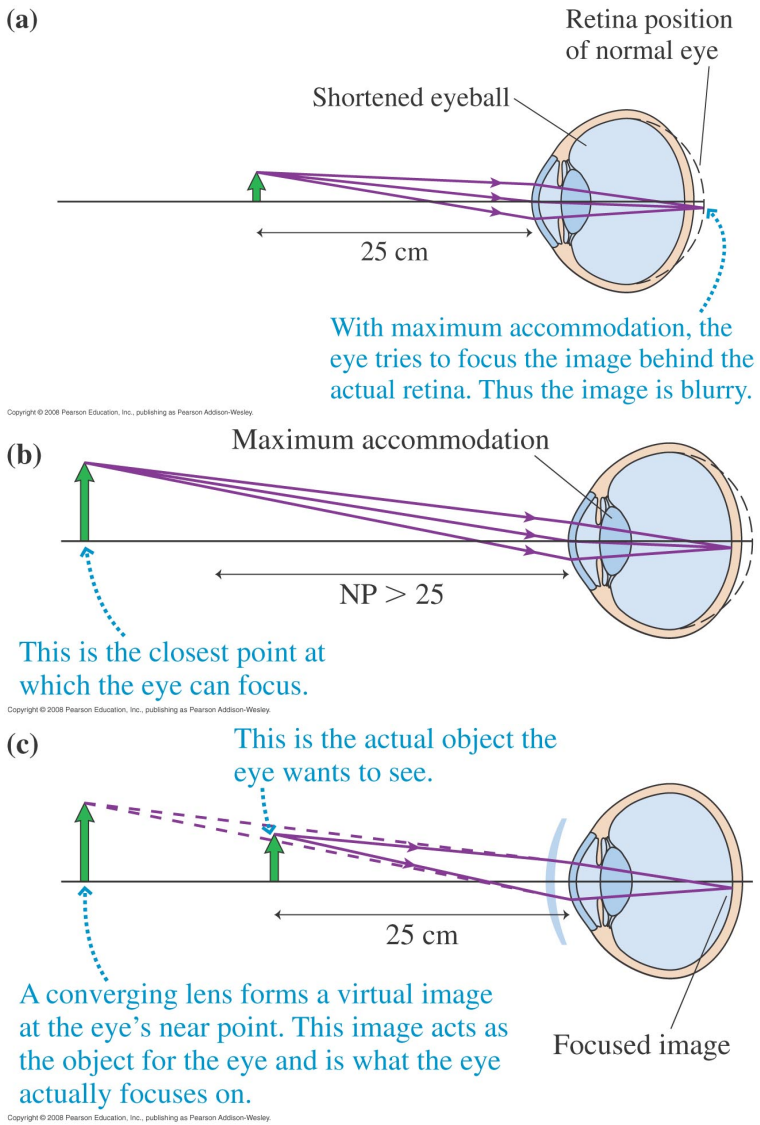

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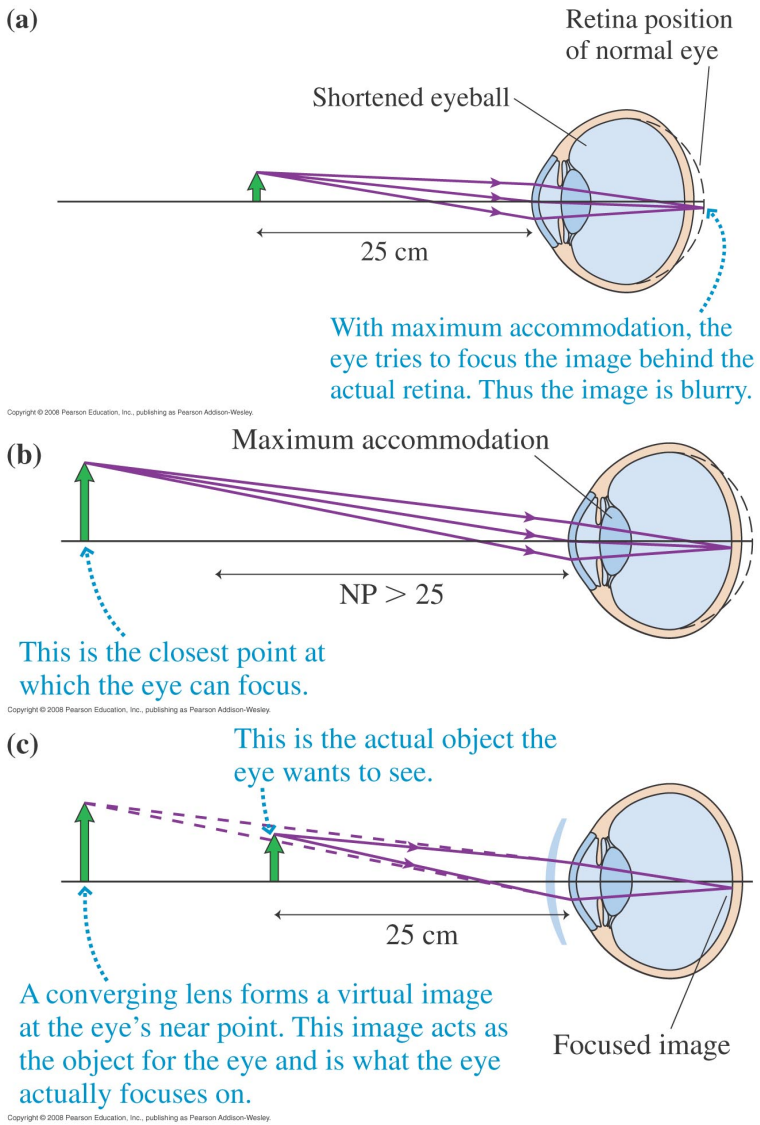

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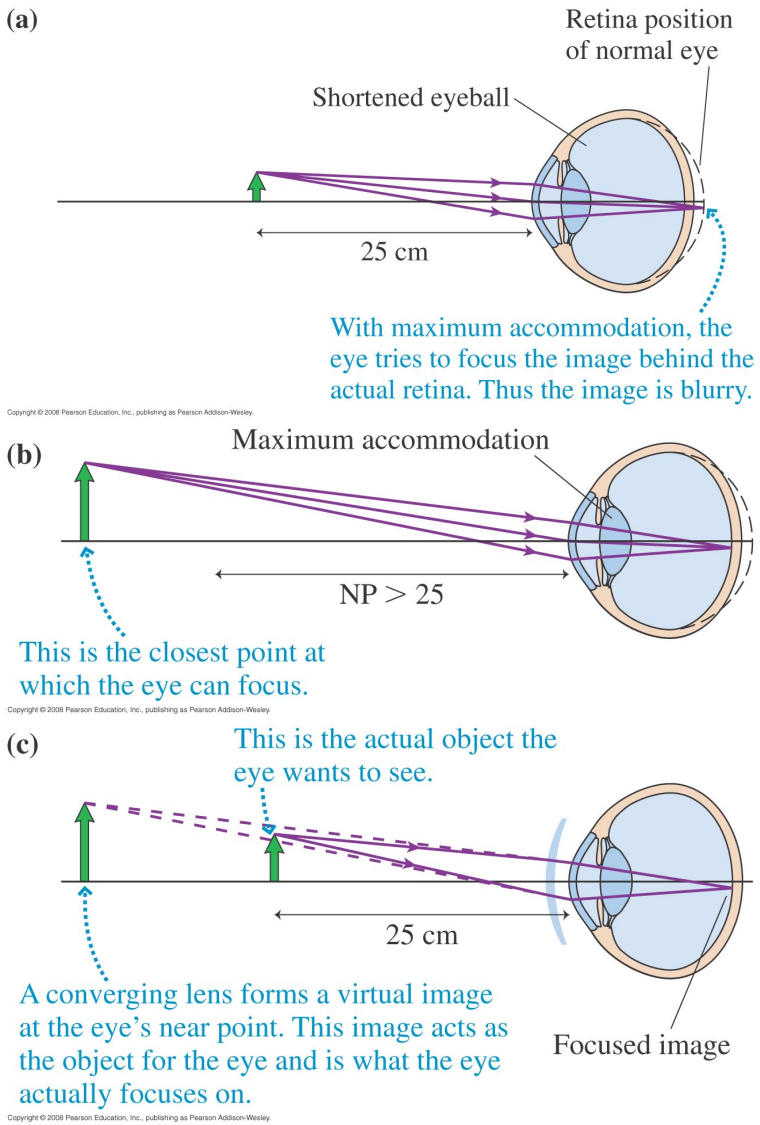

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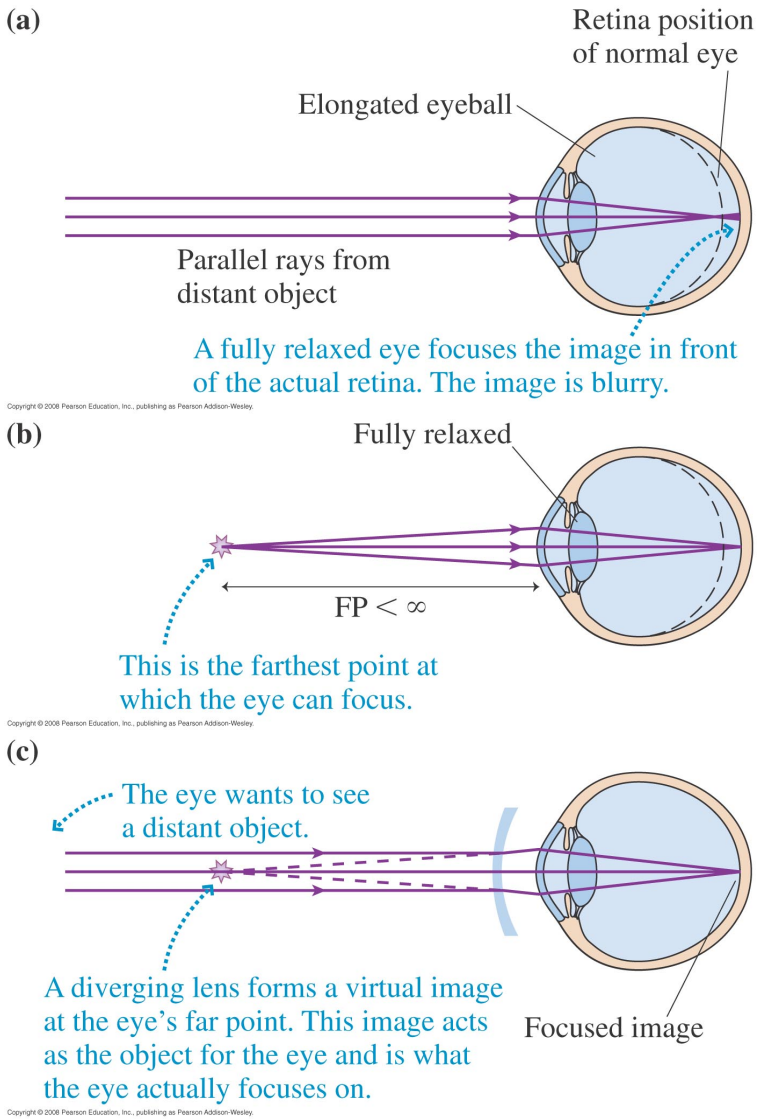

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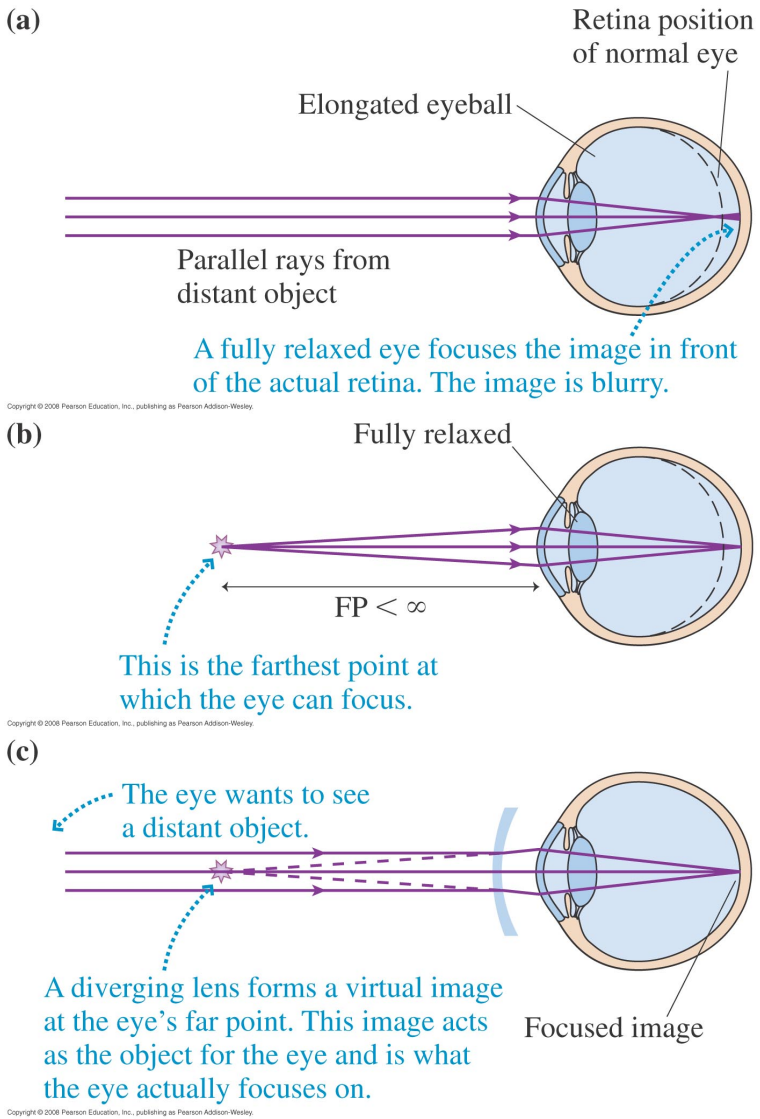

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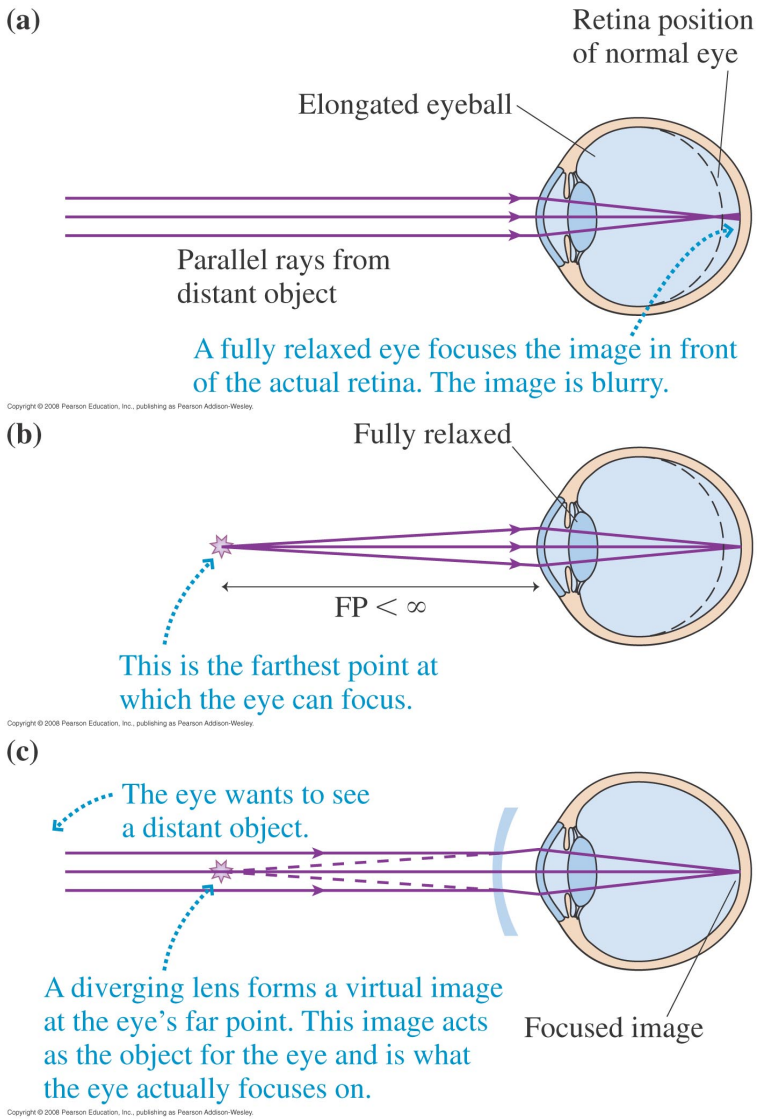

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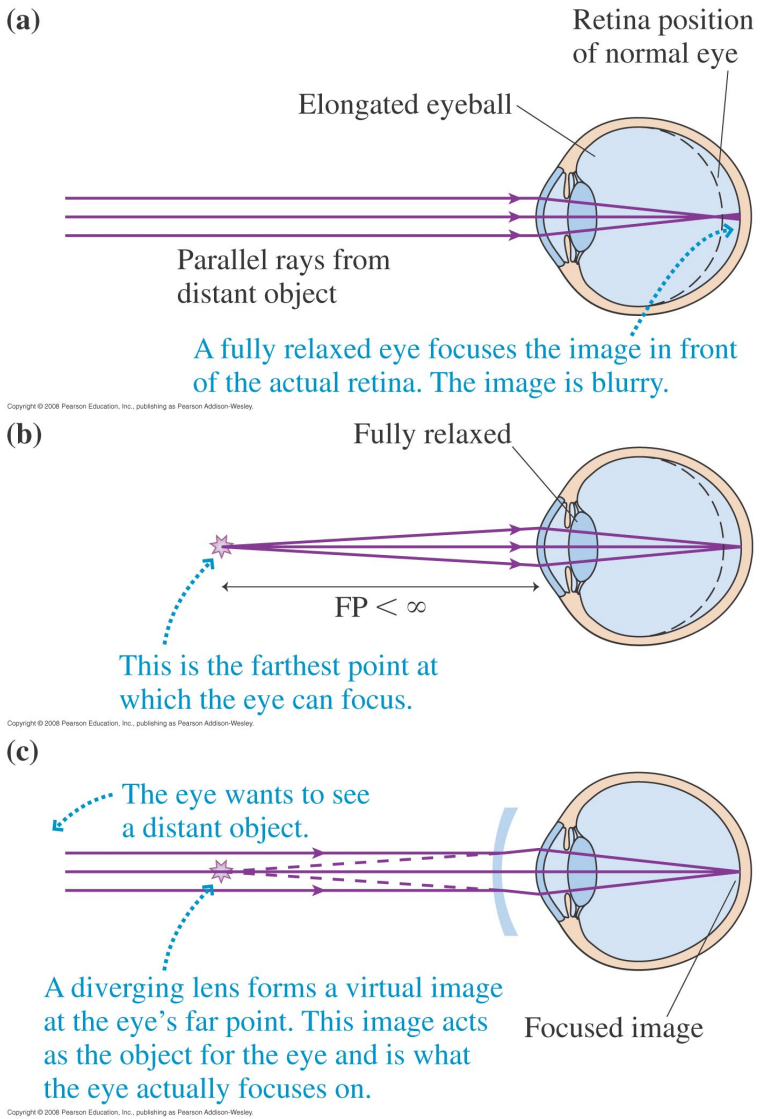

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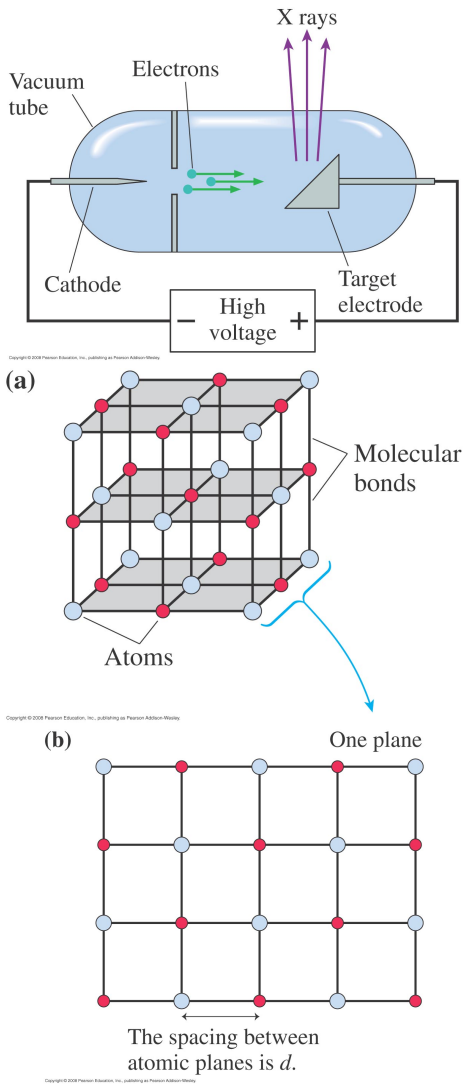
- Until now we have been treating light the way it was treated pre-1900. Experiments at that time already were challenging the way we thought about light.
- The greatest technological advances of the 20th century would not have been possible without a huge leap in our understanding of light (radiation) and matter...and the birth of Quantum Mechanics.

X-Ray Diffraction (25.2)



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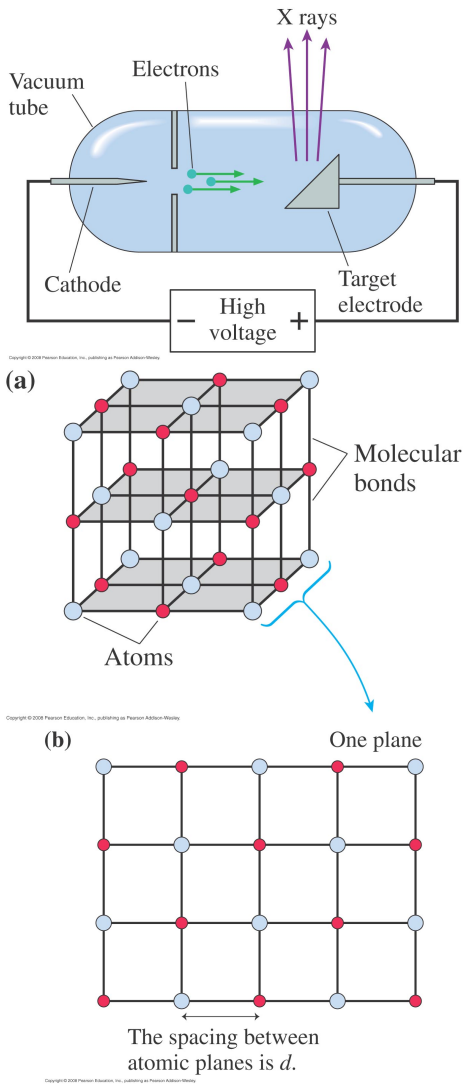

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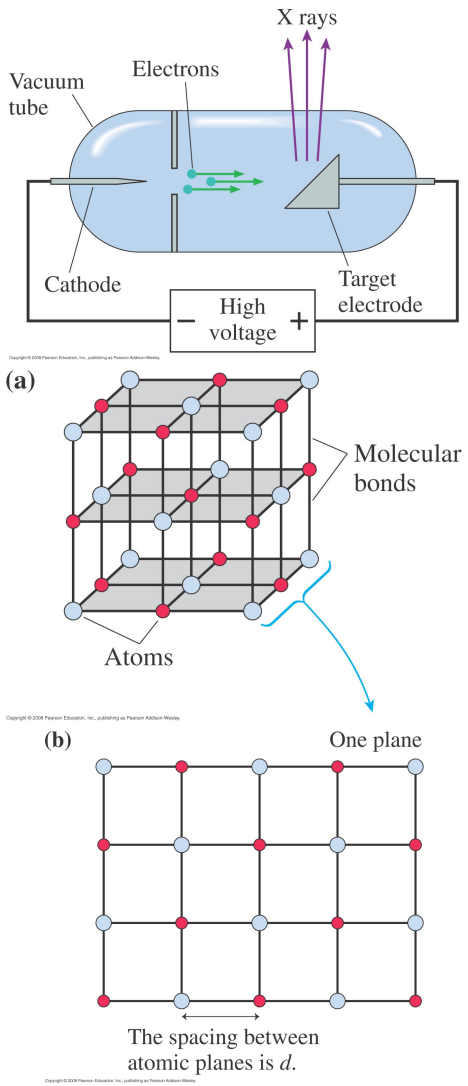

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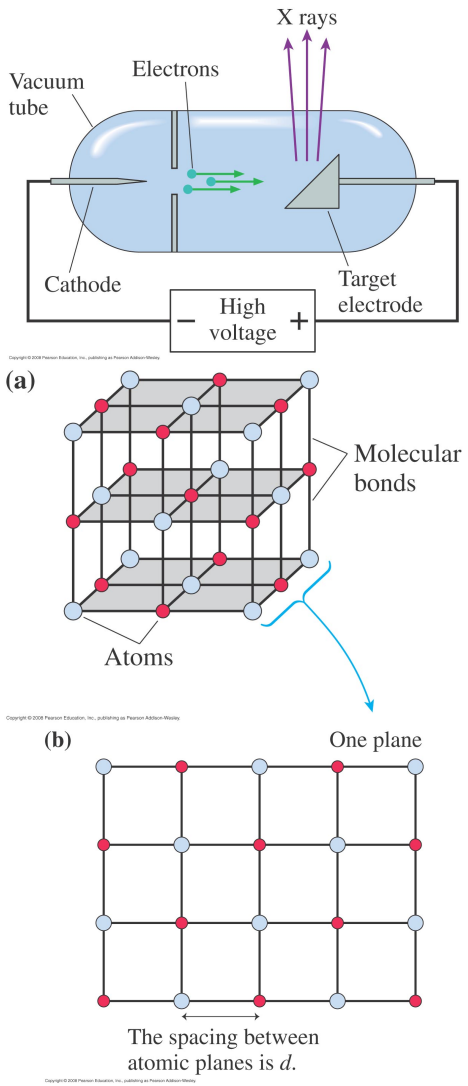

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- Luckily, people had recently discovered that solids were crystaline arrangements of atoms spaced about 1nm apart - a natural diffraction grating!!

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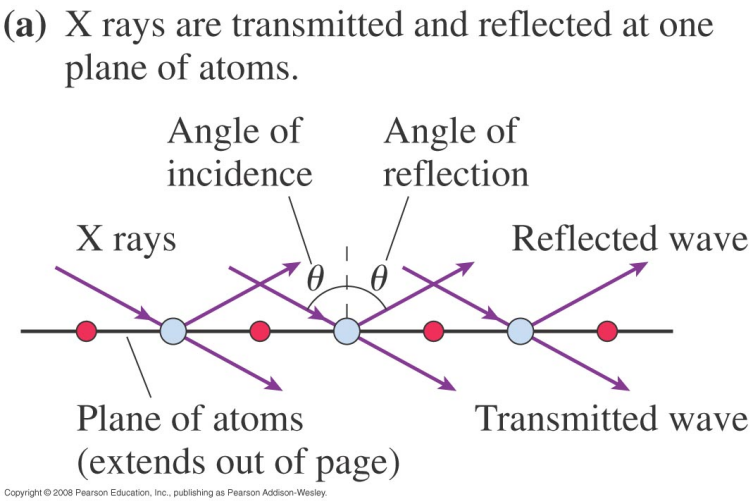

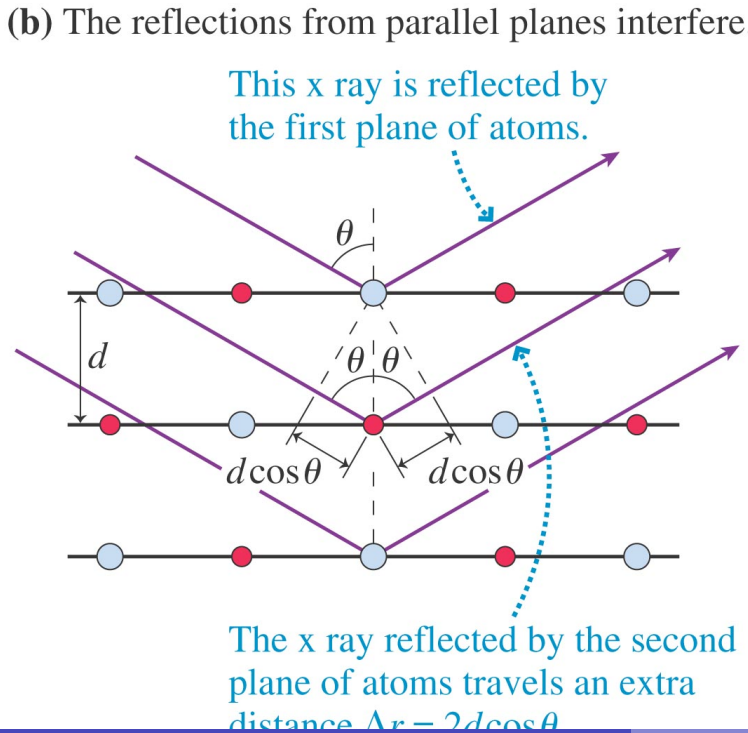

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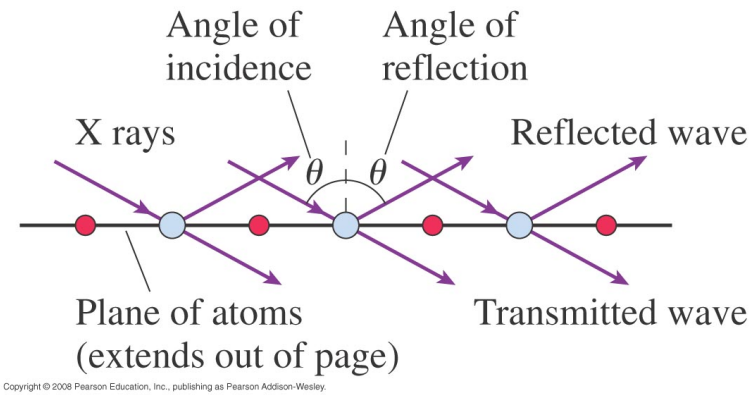
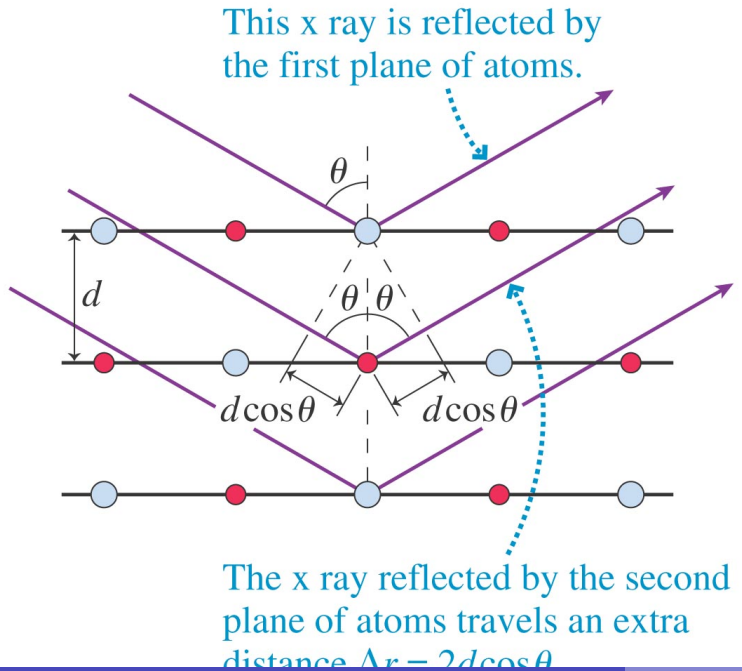
X-Ray Diffraction

(a) X rays are transmitted and reflected at one plane of atoms.



(b) The reflections from parallel planes interfere.



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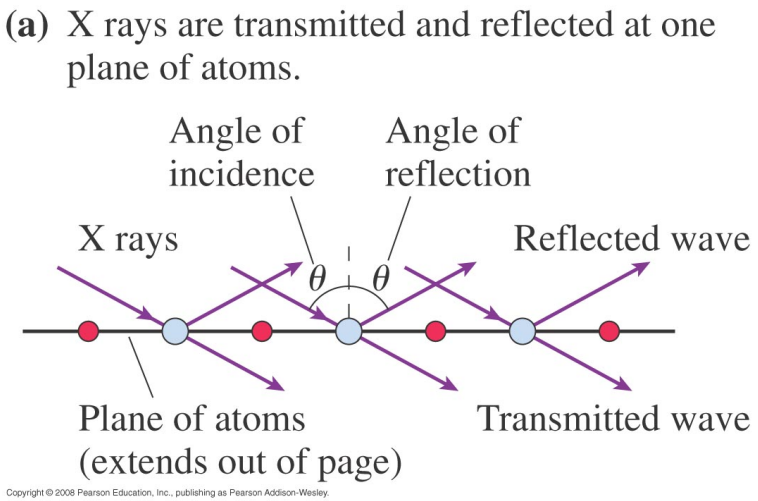

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- However, there are many parallel planes of atoms. So, destructive intereference is setup for all but a few angles. Those few angles should see constructive interference.
- We could analyze this by looking at the path-length difference between rays reflected from different planes. If d is the spacing between planes we have

$$2d\cos\theta_m = m\lambda, m = 1, 2, 3, \ldots$$

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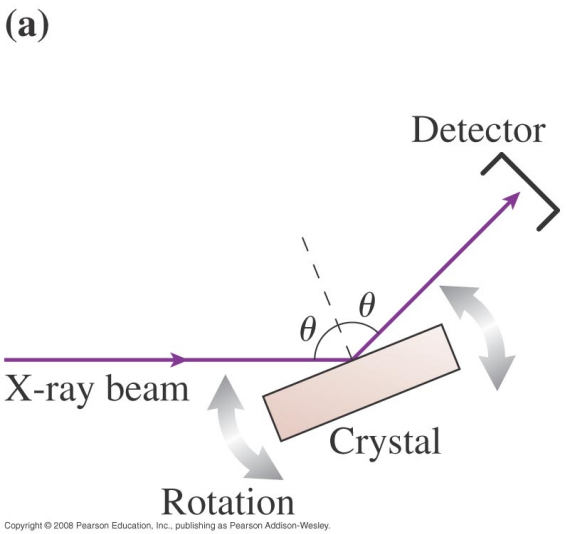

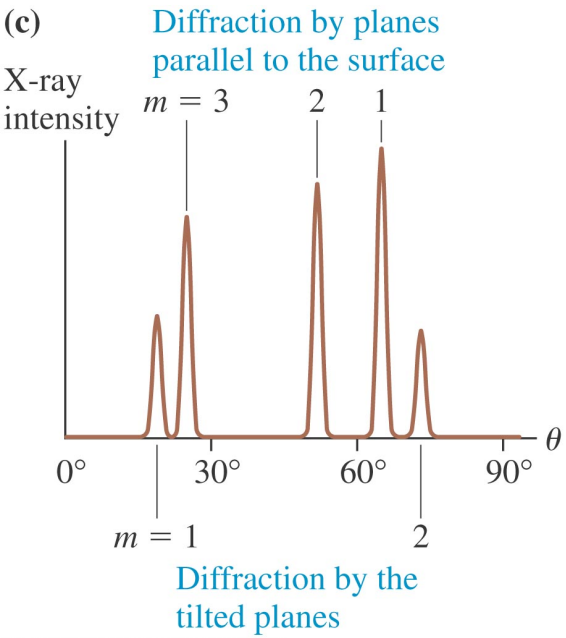

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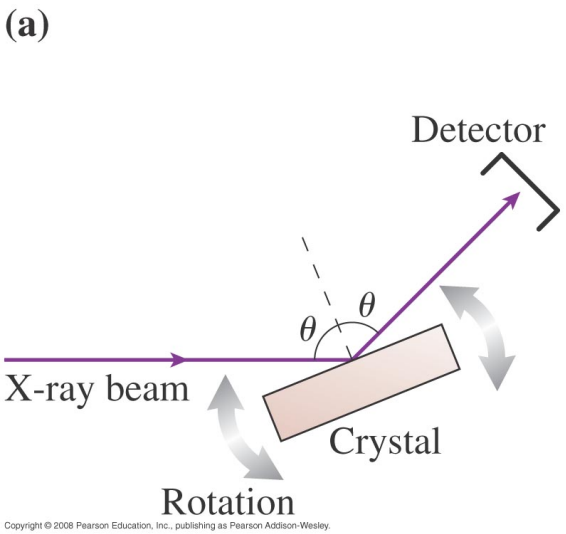

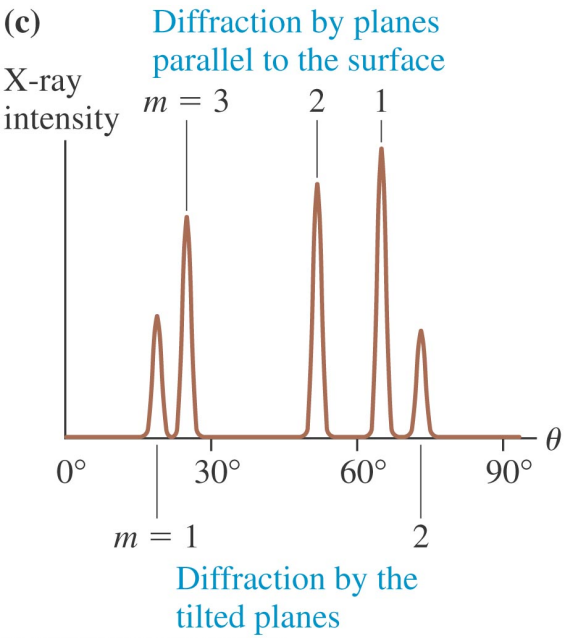

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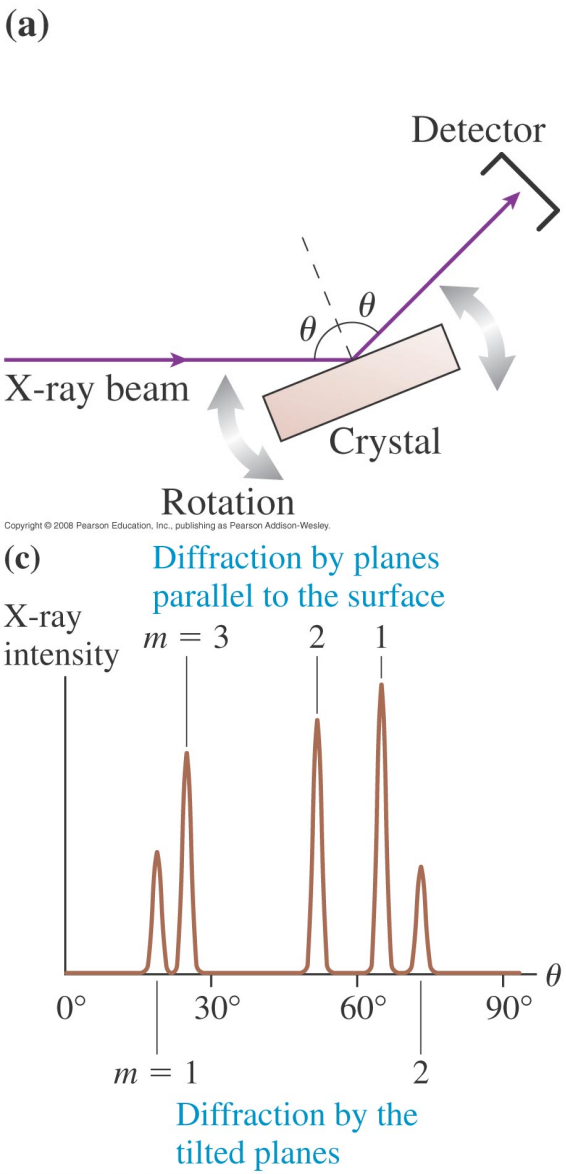

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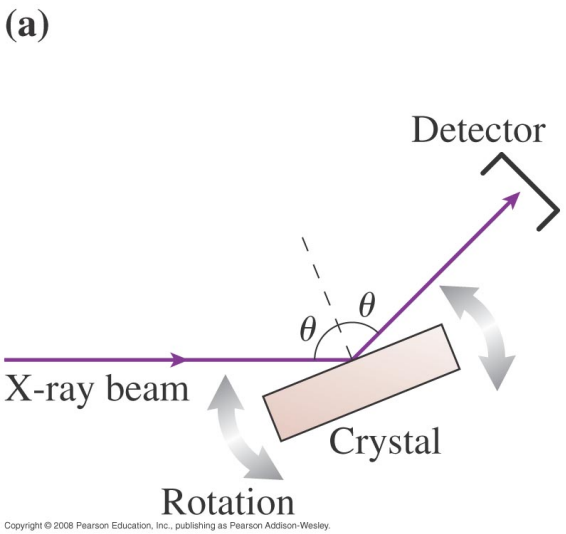

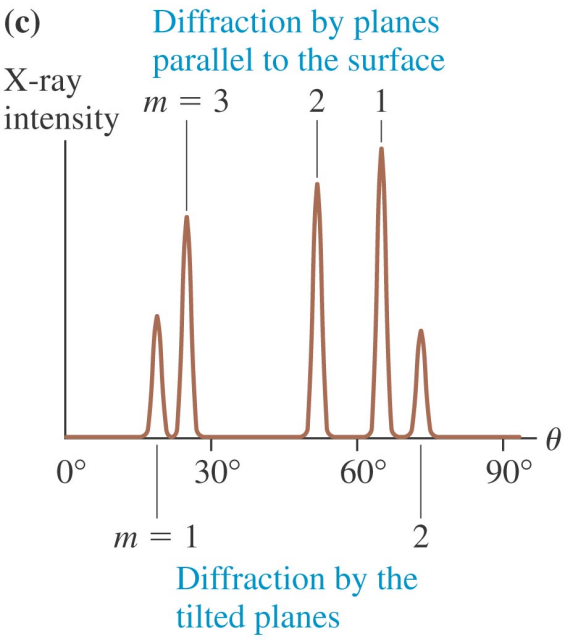

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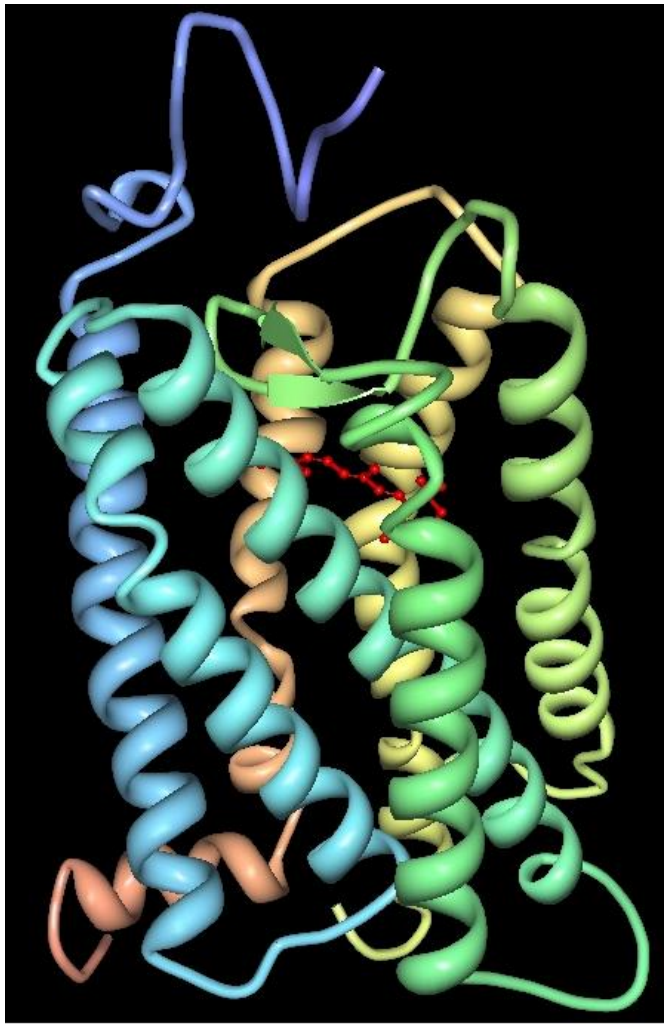
- The invention of a tool to look at the crystal strucure of matter is important. Furthermore, nature gives us pre-fabricated diffraction gratings for very small wavelengths.

X-ray Diffraction



It is by means of x-ray diffraction that we are able to determine the structures of protein molecules such as rhodopsin