PSY 4036

Week 3: Contrast Sensitivity and Color Perception in Low Vision

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- Refractive errors
- Impact of reduced contrast sensitivity in low vision
- Color-vision deficits in low vision
- Cataract, U.S. and Nepal
- Achromatopsia

ViaOpta Simulator

https://apps.apple.com/us/app/viaopta-simulator/id778653985

- ViaOpta Simulator is a vision simulator app for the iPad and iPhone designed to help health care professionals educate patients about visual impairment due to the following eye diseases:
- •Wet age-related macular degeneration
- •Dry age-related macular degeneration
- •Myopic choroidal neovascularization
- •Diabetic retinopathy
- •Diabetic macular edema
- •Central retinal vein occlusion
- •Branch retinal vein occlusion
- •Glaucoma
- •Cataract
- •Vitreomacular traction/macular hole

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Types of Refractive Errors

- Myopia (nearsightedness/ short-sighted)
  - Difficulty seeing far away
- Hyperopia (farsightedness/ long-sighted)
  - Difficulty seeing close up
- Astigmatism
  - Blur due to an irregularly shaped cornea
- Presbyopia (> 40 years old)
  - Difficulty seeing close up (for near objects)

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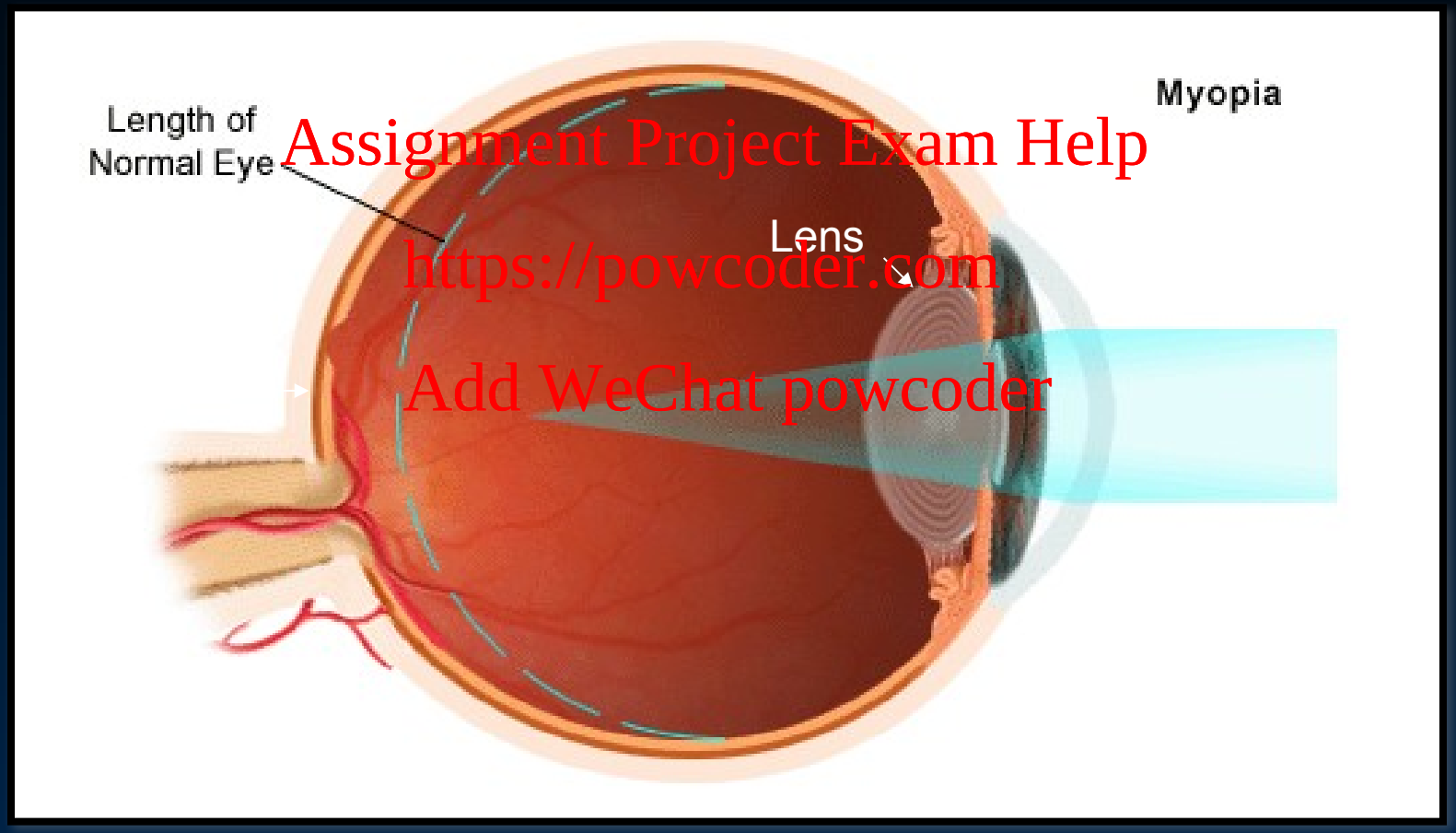
Myopia (short-sighted)



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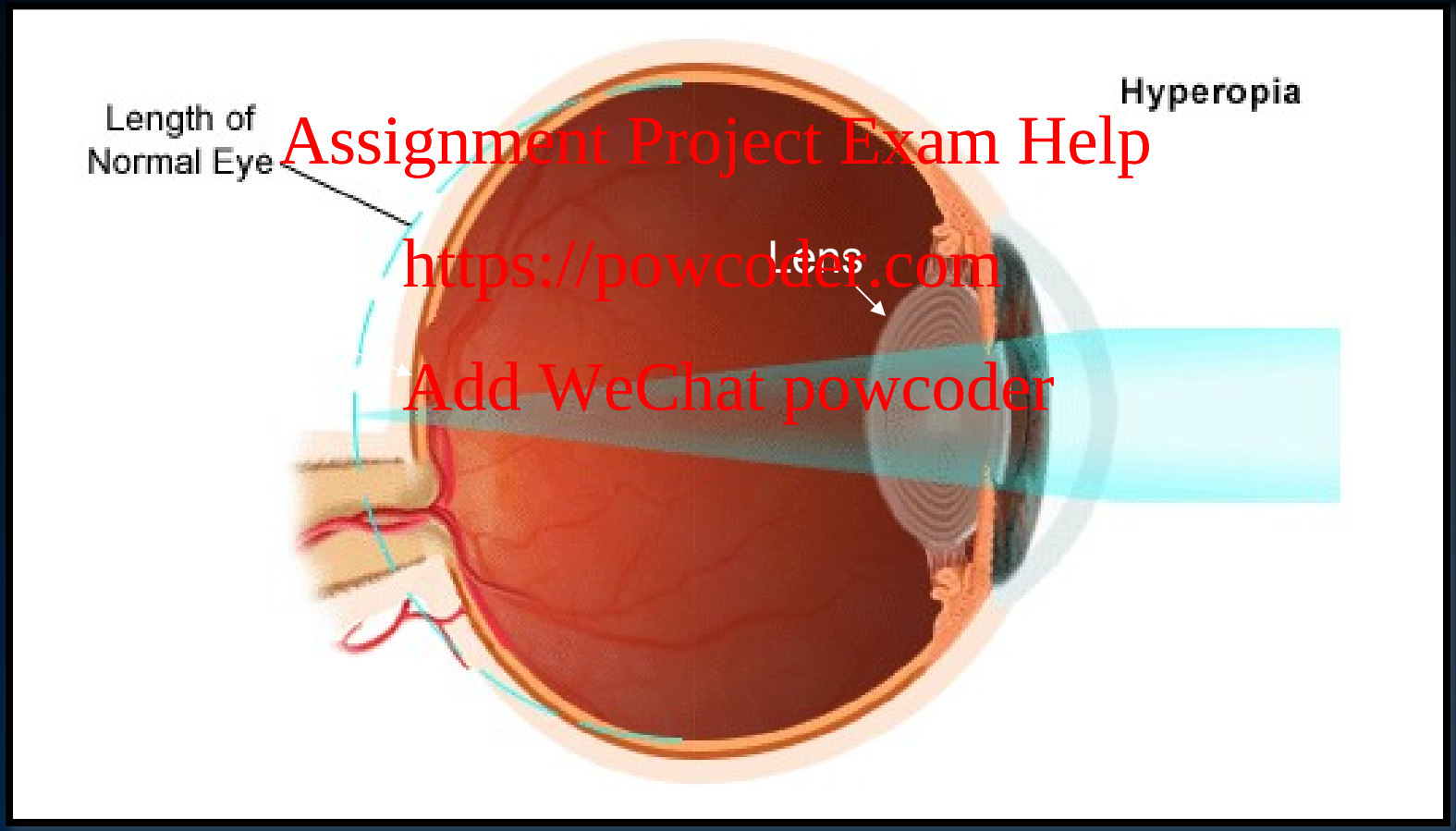
Hyperopia (long-sighted)



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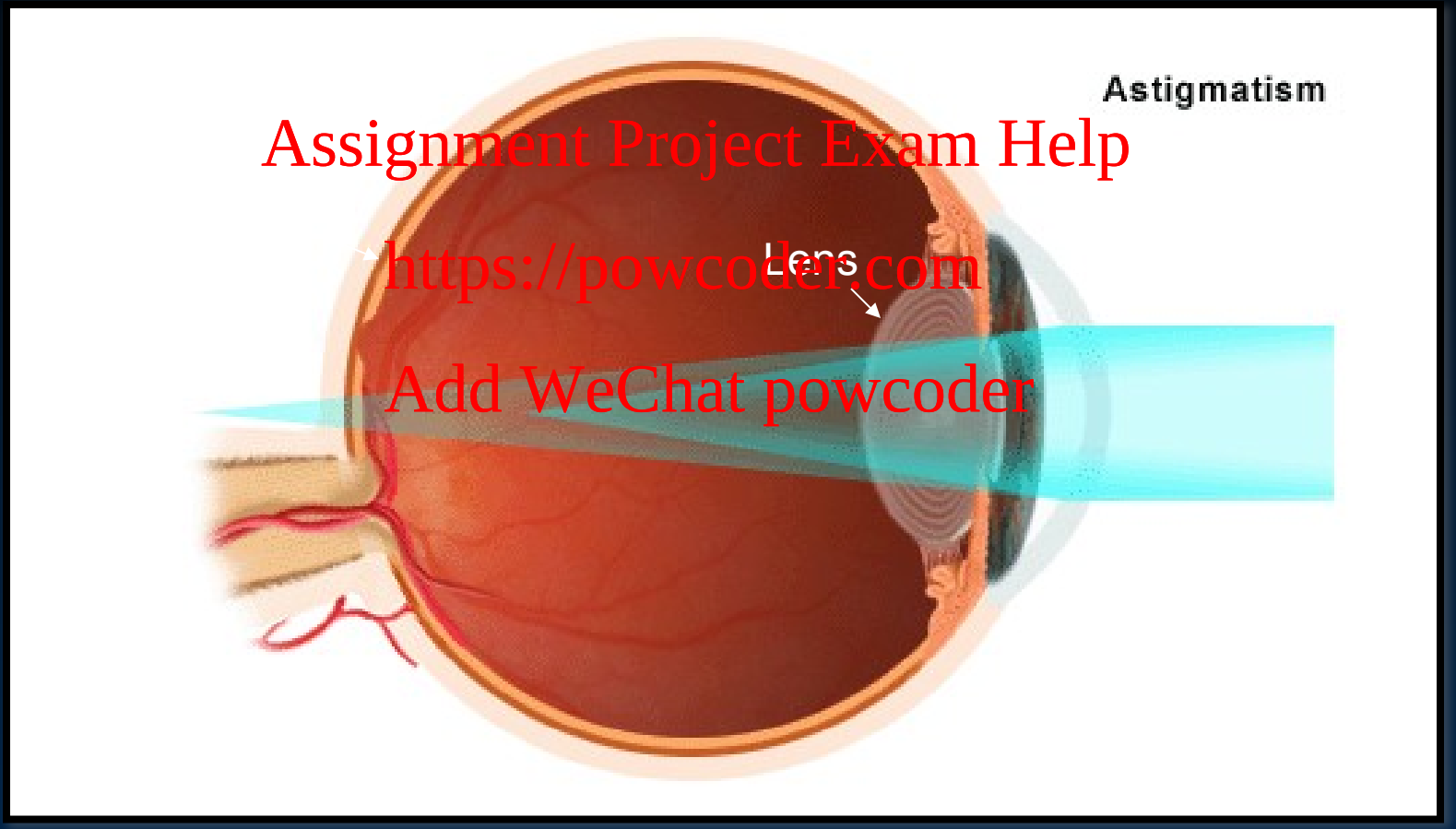
Astigmatism



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Presbyopia

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Effective Contrast

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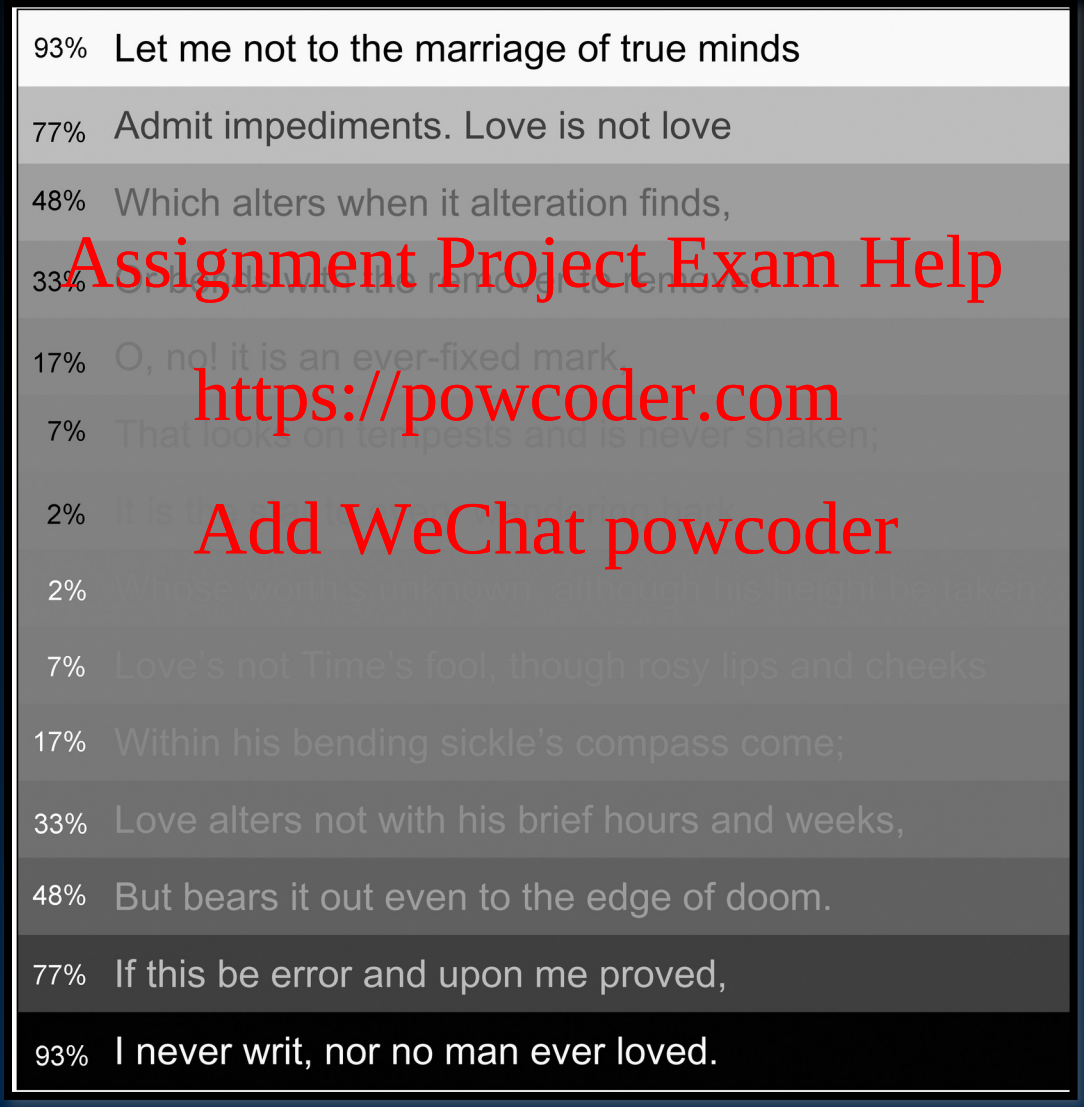
Examples of Contrast Magnitude and Contrast Polarity



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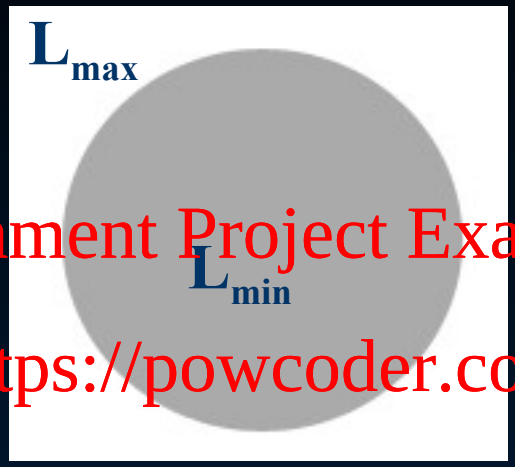
Definition of Michelson Contrast



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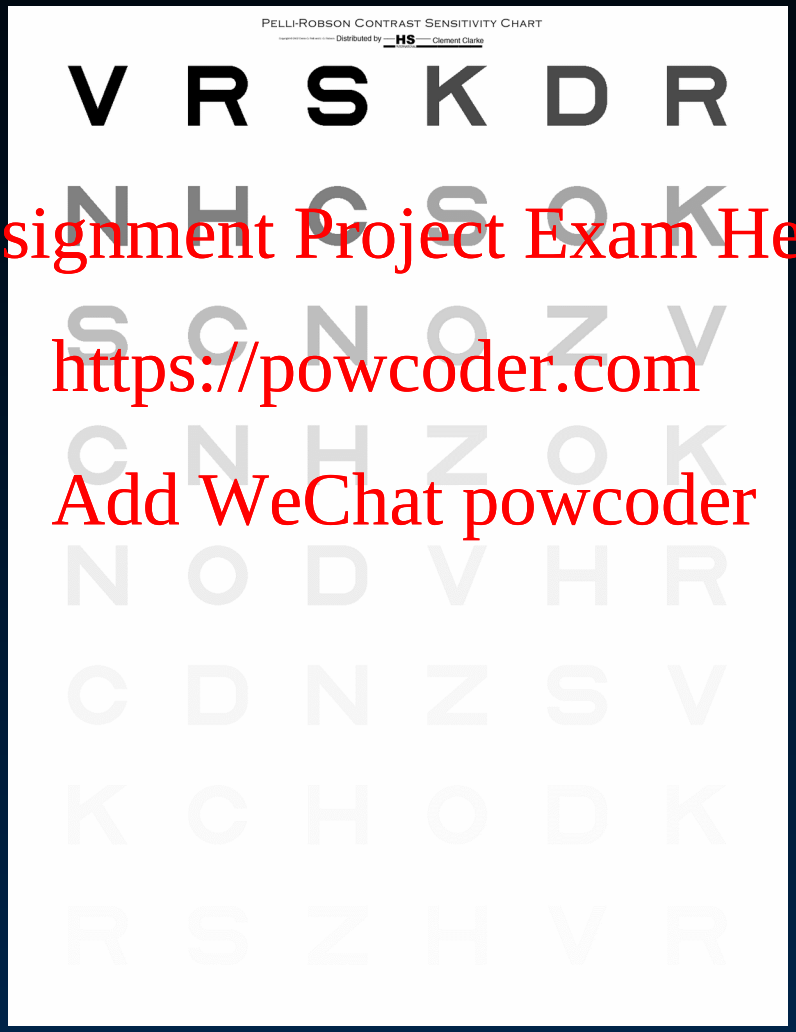
Definition of Michelson Contrast C_M:

$C_M = (L_{max} – L_{min}) / (L_{max} + L_{min})$

Michelson contrast ranges from 0 to 1.0

Pelli-Robson Contrast Sensitivity Chart



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Contrast, Contrast Threshold, and Contrast Sensitivity

- *Contrast* refers to a visual feature (especially light intensity) that distinguishes an object from its background.
- Michelson contrast ranges from 0 (no difference in light intensity between an object and its background to 1.0 (maximum black on white or white on black), and is sometimes expressed as a percentage from 0 to 100%.
- A Person's *contrast threshold* refers to the lowest contrast they can see, such as the letters with lowest contrast visible on the Pelli-Robson chart.
- A person's *contrast sensitivity* is the reciprocal of their contrast threshold:
- Contrast Sensitivity = 1 / Contrast Threshold.
- A person with high contrast sensitivity can see very low contrast; they have a low contrast threshold.

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Cataract

Normal vision

Cataract

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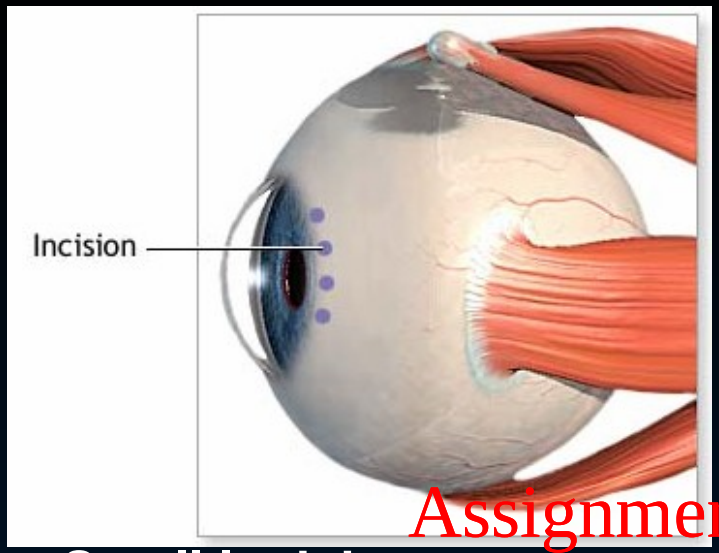
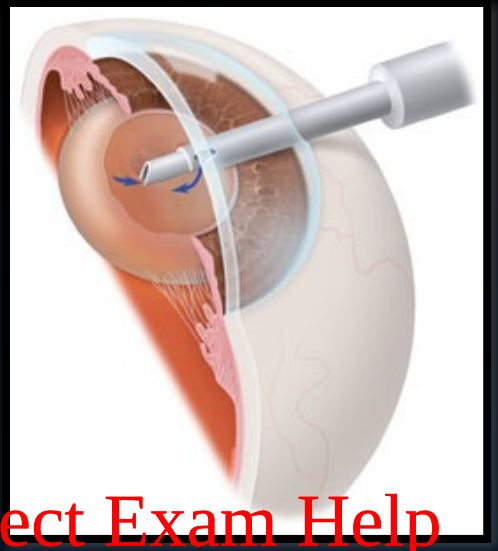


Small Incision



Cataract removal by Phacoemul-sification

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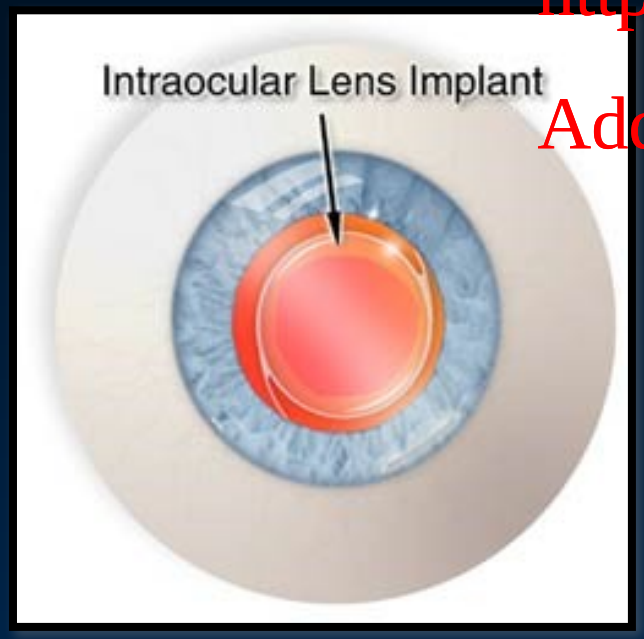

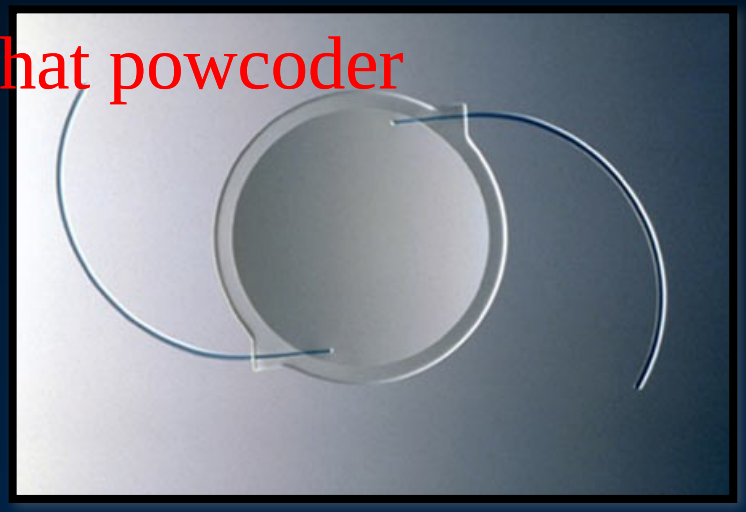

Artificial lens implant

Vision with cataract

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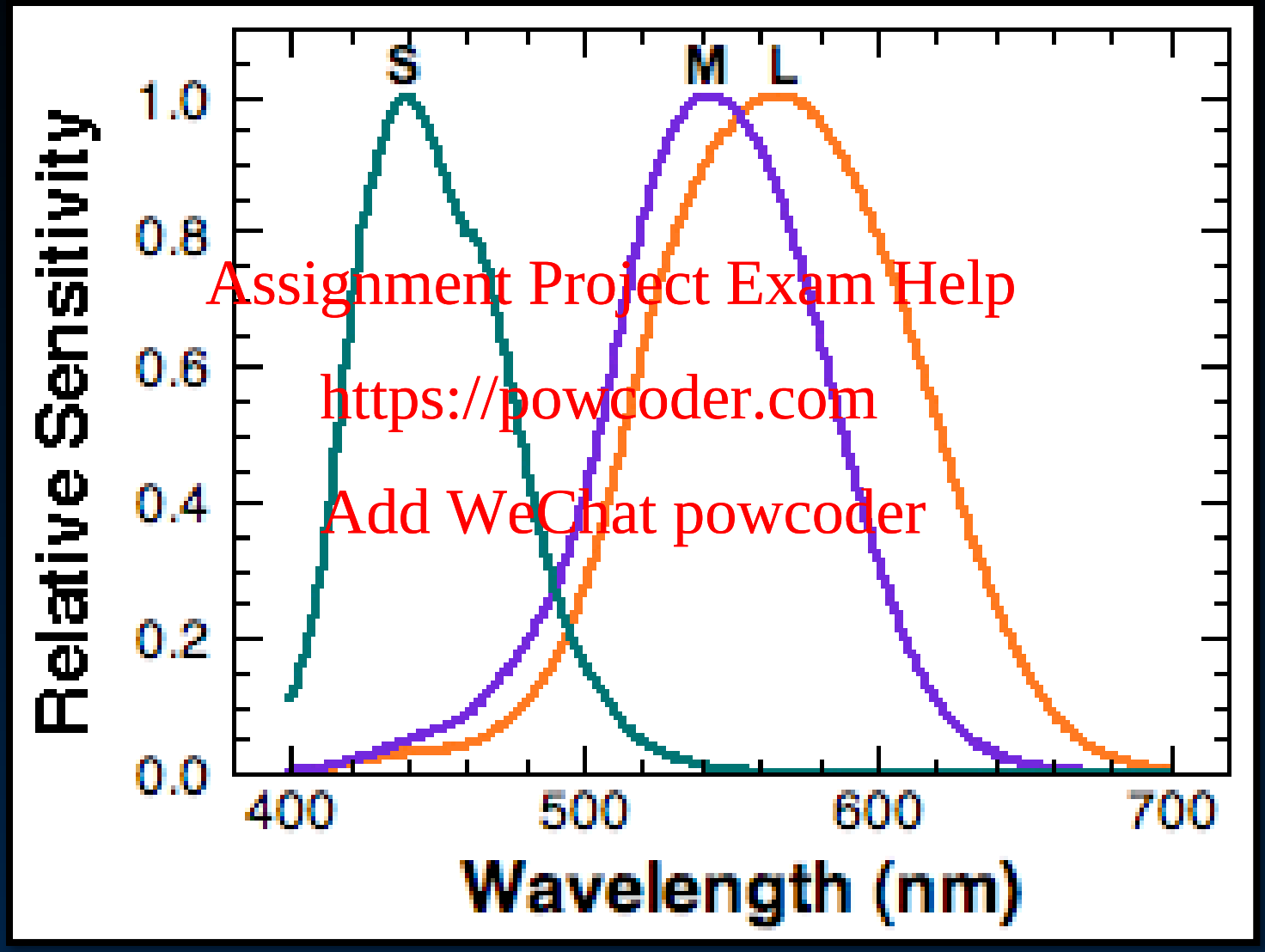
S, M and L Cones



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Butchart Gardens