



# Spectacles

By Dr. Zubaida Saad Al-Kazzaz



# Plastic(resin) lenses:

- made up of small molecular units called **monomers** which link together to form long chain known as **polymers** and the process of linking the monomers together is known as **polymerization**

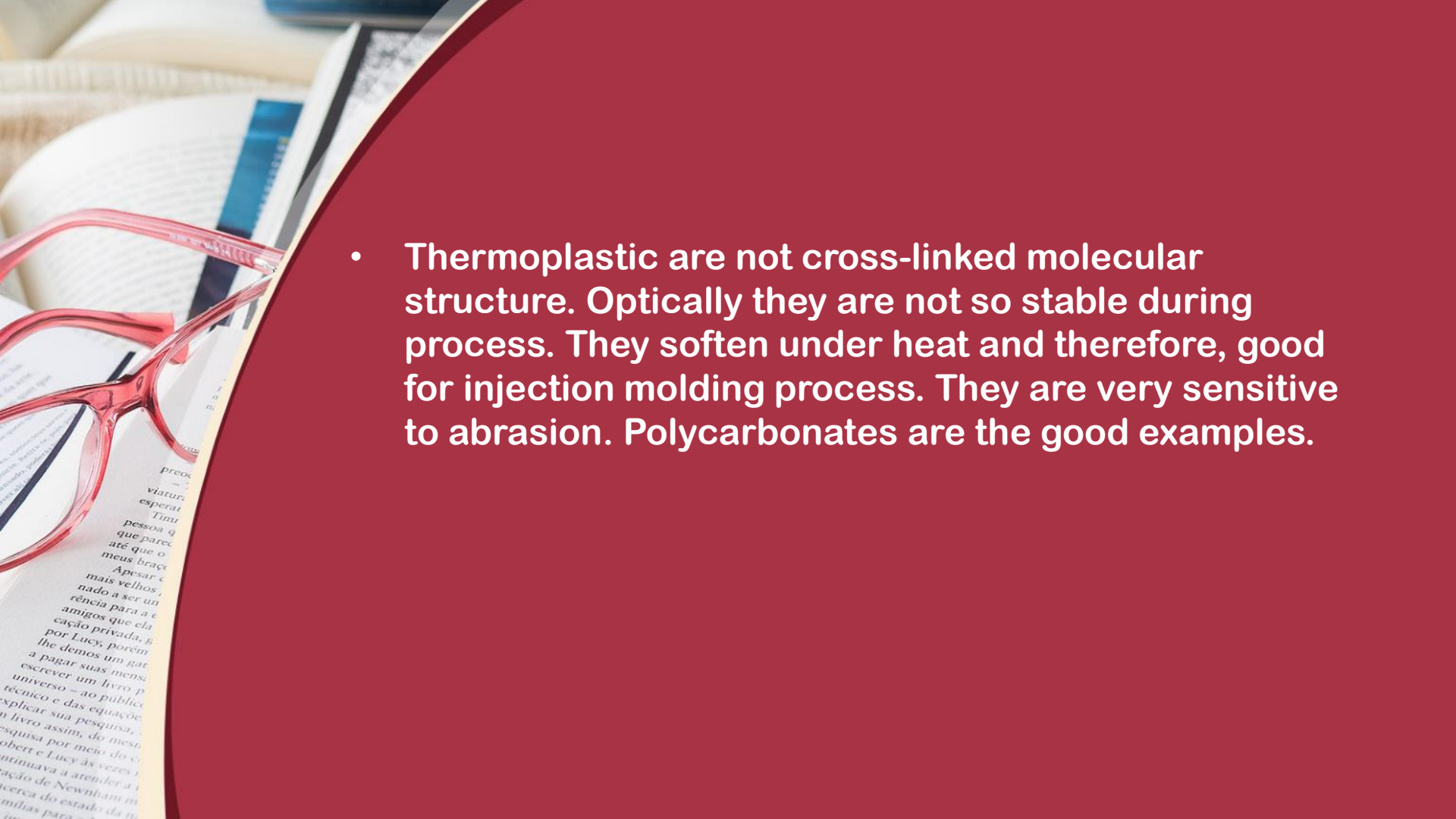


There are two processes to make resin lenses:

1. Thermosetting.....CR39

2. Thermoplastic..... polycarbonates

Thermosetting are cross- linked molecular structure, resembles a ladder with extra rungs. They do not melt or flow when heat is applied and makes the material less flexible. Therefore, allows for superior optical processing. CR39 is the good example.



- Thermoplastic are not cross-linked molecular structure. Optically they are not so stable during process. They soften under heat and therefore, good for injection molding process. They are very sensitive to abrasion. Polycarbonates are the good examples.



Plastic

Standard  
plastic  
**CR39**

Polycarbonates

Trivex

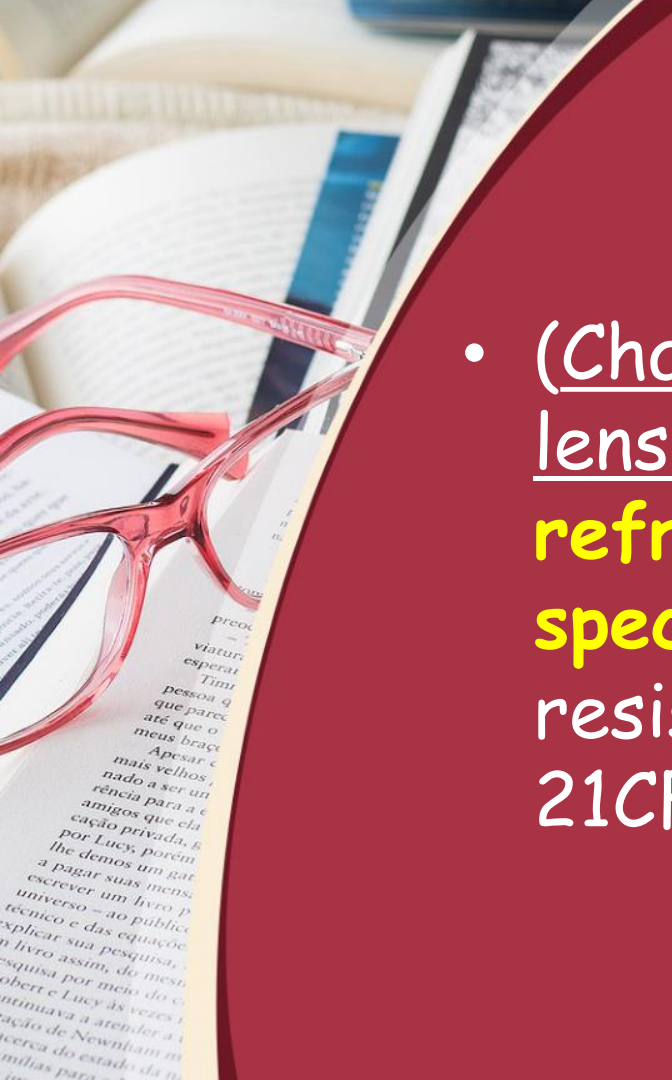
## Standard plastic CR39

- Is the most commonly used lens material
- high optical quality
- light weight 50%  
(low specific gravity)
- inexpensive





- Standard plastic lenses are almost 50% lighter than glass lenses owing to the lower specific gravity of their material.
- They block 80% of UV light without treatment, can be tinted easily if desired, and can be coated to resist scratching and to provide further UV-light blocking.
- The index of refraction is not high, so the lenses are not thin.
- CR-39 lenses do not have the shatter resistance of polycarbonate or Trivex & is weak resistant to abrasion

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- (Characteristics of standard plastic lenses are as follows: **index of refraction, 1.49; Abbe number, 58; specific gravity, 1.32; impact resistance, pass FDA 21CFR801.410.**)

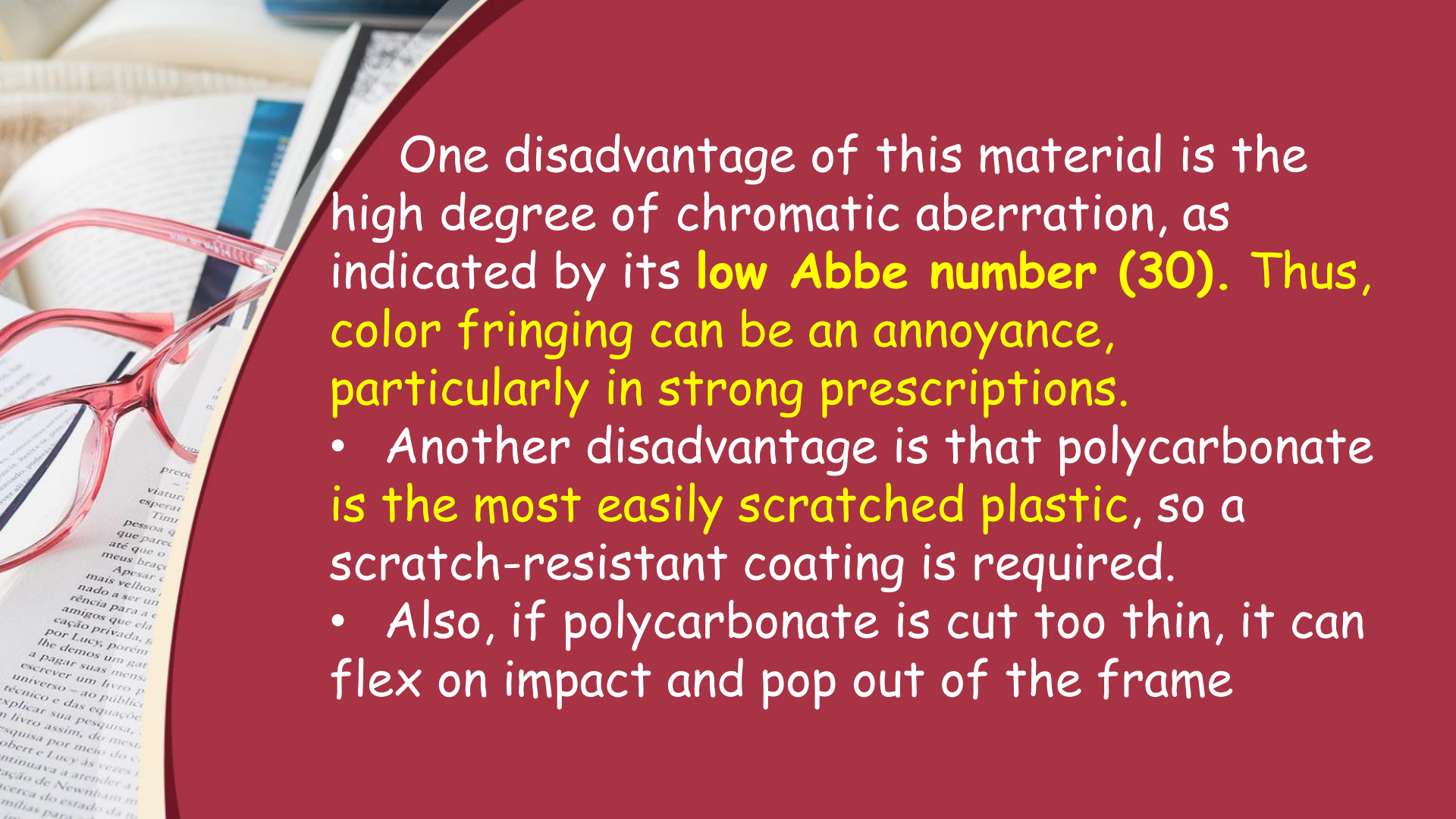




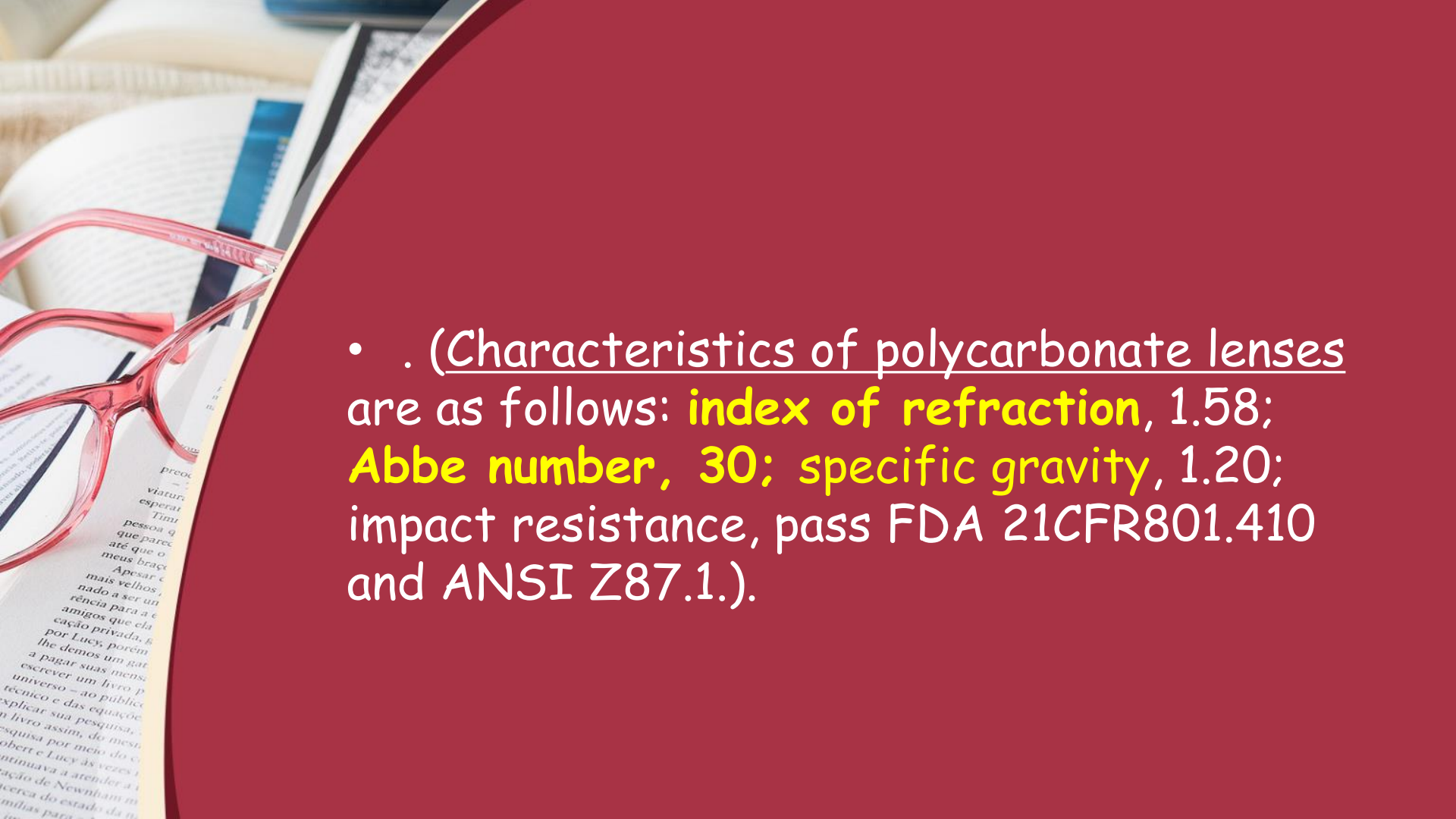
## Polycarbonates

- The high-index plastic material polycarbonate has a low specific gravity and a higher refractive index, which allow for a light, thin lens.
- It is at least ten times more impact resistant than CR39.

Polycarbonate is also durable and meets the high-velocity impact standard (ANSI Z87.1)



- One disadvantage of this material is the high degree of chromatic aberration, as indicated by its **low Abbe number (30)**. Thus, **color fringing can be an annoyance, particularly in strong prescriptions.**
- Another disadvantage is that polycarbonate **is the most easily scratched plastic**, so a scratch-resistant coating is required.
- Also, if polycarbonate is cut too thin, it can flex on impact and pop out of the frame

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- . (Characteristics of polycarbonate lenses are as follows: **index of refraction**, 1.58; **Abbe number**, 30; **specific gravity**, 1.20; impact resistance, pass FDA 21CFR801.410 and ANSI Z87.1.).

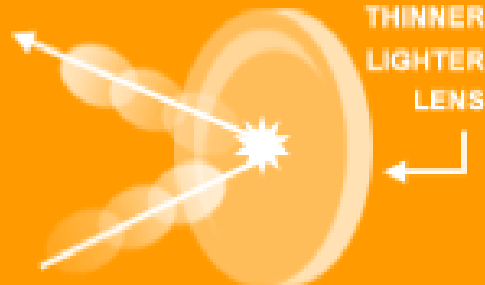
## STANDARD PLASTIC



STANDARD  
LENS  
THICKNESS

**BASIC LENSES**  
Common Worldwide

## POLYCARBONATE



THINNER  
LIGHTER  
LENS

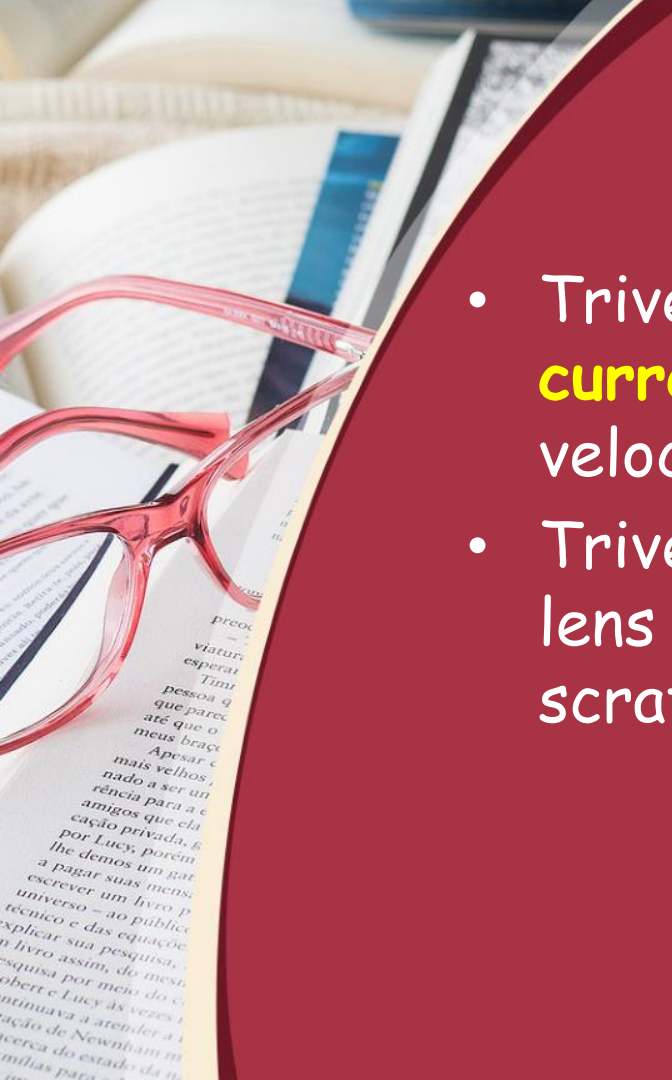
**IMPACT-RESISTANT**  
Active Lifestyles & Children



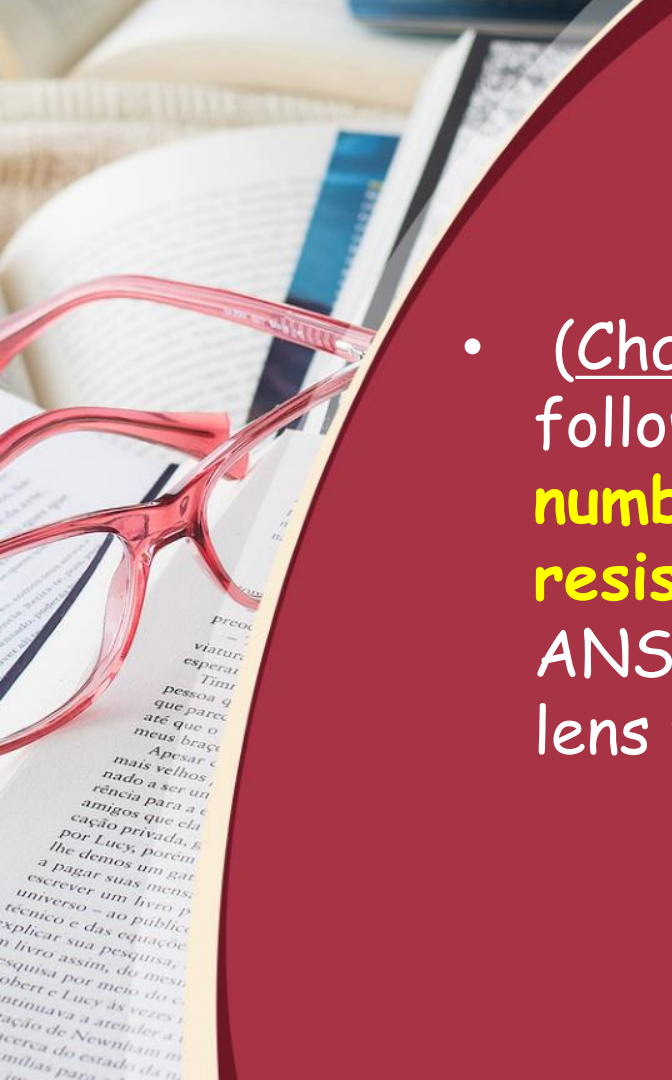
## Trivex

- Is a partially cross-linked material and uses the best attributes of thermoplastic and thermosetting processes.
- Trivex is **a highly impact-resistant**, low-density material that delivers strong optical performance and provides clear vision because of its **high Abbe number**. Its impact resistance is close to that of polycarbonate, and it blocks all UV light. **Its index of refraction is not high**, however, so the lenses are not thin.





- Trivex is the **lightest lens material currently available** and meets the high-velocity impact standard (ANSI Z87.1).
- Trivex material allows a comparably thin lens for the  $\pm 3.00$  D prescription range. A scratch-resistant coating is required.

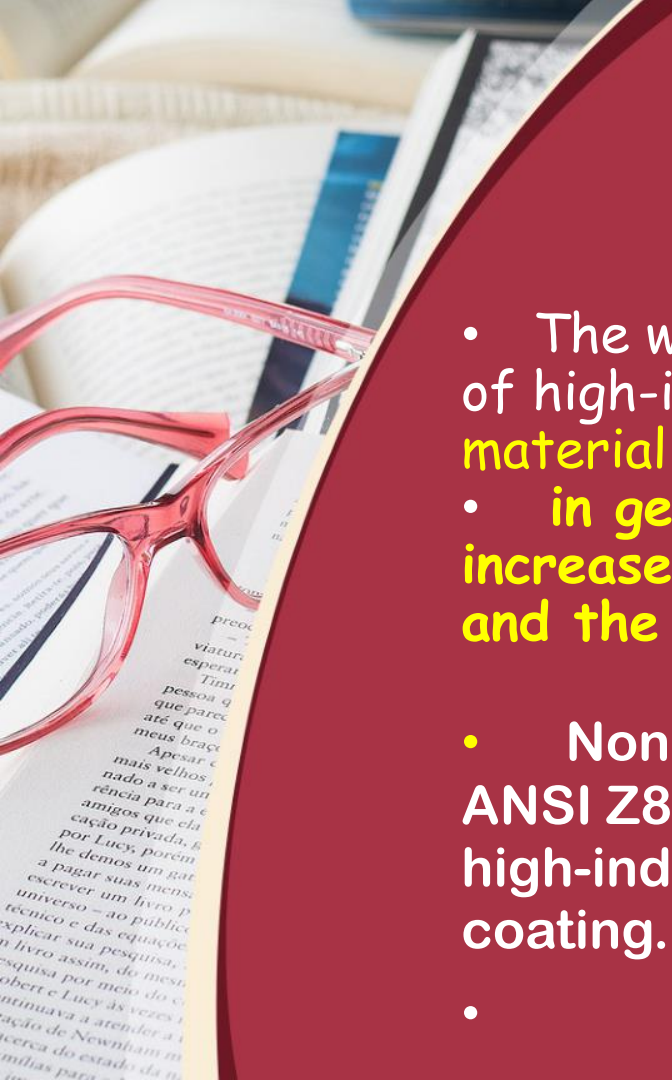


- (Characteristics of Trivex lenses are as follows: **index of refraction**, 1.53; **Abbe number**, 45; **specific gravity**, 1.11; **impact resistance**, pass FDA 21CFR801.410 and ANSI Z87.1.). Probably, this is the only lens which is best for rimless frame.



# High-index materials

- A lens with a refractive index of 1.60 or higher is referred to as a high-index lens.
- High-index materials can be either glass or plastic and are most often used for higher-power prescriptions to create thin, cosmetically attractive lenses.



- The weight, optical clarity, and impact resistance of high-index lenses vary depending on the **specific material used and the refractive index**
- **in general, as the index of refraction increases, the weight of the material increases and the optical clarity (Abbe number) decreases.**
- None of the high-index materials passes the ANSI Z87.1 standard for impact resistance. Plastic high-index materials require a scratch-resistant coating.
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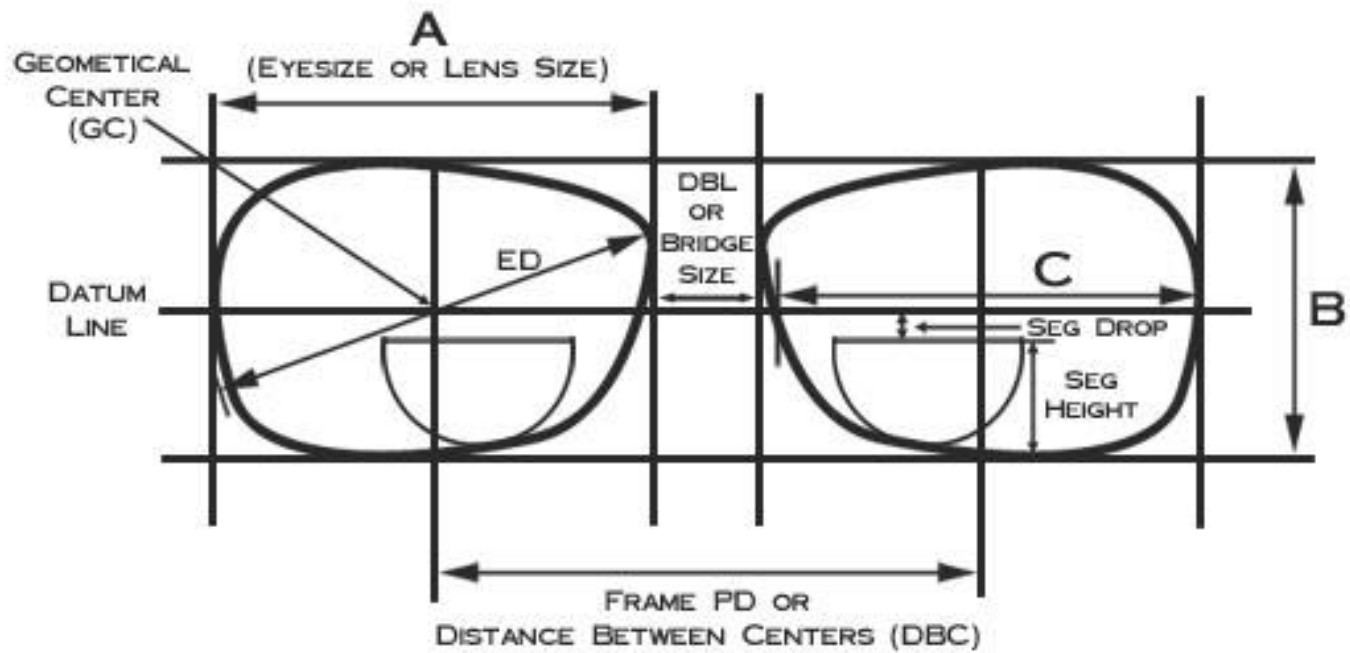
Thank you.....



# **The Frame**

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# BOXING SYSTEM



- **Horizontal Midline**
- There is a horizontal line halfway between the top and bottom of the lens. In the boxing system, this line is commonly referred to as the horizontal midline or the 180-degree line.
- **Geometric Center**
- The center of the lens is the point on the horizontal midline halfway between the two lens-bordering vertical lines. It is known as the geometric center or boxing center of the edged lens. This term does not imply anything about the optical positioning of the lens.

**letter “A”:** The horizontal length is now commonly referred to as the eye size when referring to the frame and the lens size when referring to the lenses. Both are measured in millimeters.

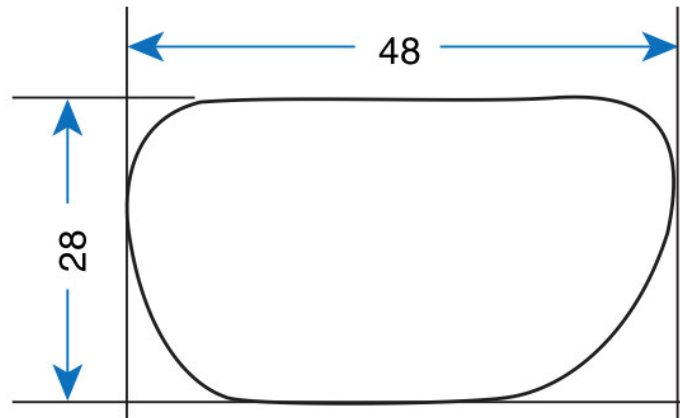
**The letter “B”** denotes the vertical measure of the box enclosing the lens.

**The letter “C”** refers to the width of the lens itself along the horizontal midline.

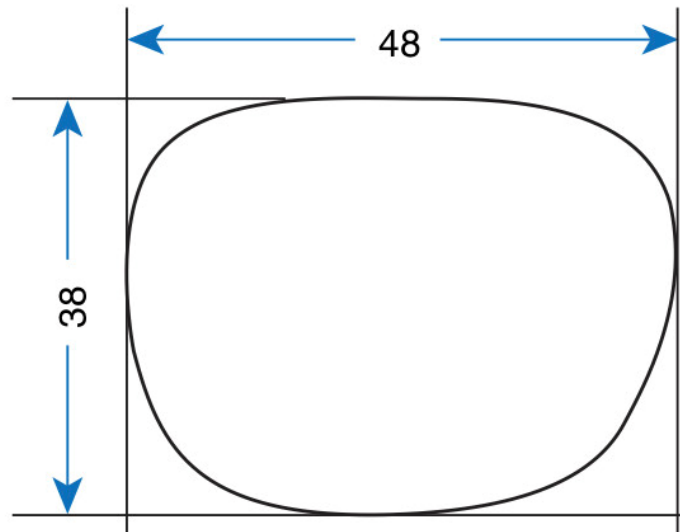
- **Effective Diameter**
- The effective diameter of a lens is found by doubling the distance from the geometric center of the lens to the apex of the lens bevel farthest from it.
- This measurement helps determine the smallest lens blank from which the lens can be cut.
- **Frame Difference**
- The difference between the horizontal and the vertical measurements is known as the frame difference and is measured in millimeters



Frame difference  
of 20



Frame difference  
of 10



- **Distance Between Lenses (DBL) or Bridge Size**
- The boxing system also makes it possible to define the distance between lenses (DBL). The DBL is the distance between the two boxes when both lenses are boxed off in the frame. This is usually synonymous
- with bridge size.
- Bridge size or DBL is measured on the frame as the distance from the
- inside nasal eyewire grooves across the bridge area at the narrowest point. This distance is measured in millimeters.

- **Geometric Center Distance (GCD)**
- The distance between the two geometric centers of the lenses is known as the geometric center distance (GCD). It can be measured more easily as the distance from the far left side of one lens opening to the far left side of the other (i.e., from the left side of one “box” to the left side of the other “box.”) Or the geometric center distance can be calculated by simply adding the eye size to the DBL. The result is the same.
- The GCD is also known by three other names:
  - 1. Distance between centers (DBC)
  - 2. Frame center distance
  - 3. Frame PD

- **Safety Frame Markings**
- The standard is numbered as **Z87.1**. If a pair of glasses has safety lenses, but is not in a frame marked “**Z87**” or “**Z87-2**,” the glasses are not safety glasses.