SUNGLASSES

Sunglasses can be a very important fashion accessory. But their most important function is safeguarding the health of our eyes by preventing damage from the sun's ultraviolet (UV) rays. Most people, including children, should own a pair of shades, and in some cases, may need more than a single pair.

The National Eye Institute reports that an estimated 20% of cataracts cases are caused by extended UV exposure. In addition, UV exposure can cause macular degeneration which is the leading cause of blindness in the United States. In 1988, a study by Johns Hopkins University indicated that people who did not use some form of eye protection were three times more likely to suffer from eye ailments such as cancer of the eyelids than those who wore protective sunglasses. Most sunglasses will protect eyes adequately, although some styles do not include protective features. Nothing, including sunglasses, offers protection against the harm caused by looking directly into the sun. That includes before, during, and after an eclipse as witnessed in the United States in August 2017.

Choosing sunglasses for eye protection allows a wide range of choices. Selecting a pair of sunglasses based on wearer comfort and personal preference may be more difficult. Knowing what features are available will help in finding the best pair of sunglasses for the conditions in which they will be worn.

FUNCTION

Besides the infinite variety of fashion design and style, sunglasses offer a more valuable and practical purpose. Sunglasses can offer both protection and comfort for the eyes.

Eyes are bombarded with light rays of all wavelengths from the sun as well as from artificial light. However, much of the concern over eye health involves the shorter wavelengths, called ultraviolet (UV) light. UV light is further divided into two categories of shorter wavelengths (UVB) and longer wavelengths (UVA). Research has shown that UVB rays (the shorter of the two) have been found to cause more eye damage than UVA rays.

The main protection offered by sunglasses is filtering out these UV rays. How dark the lenses are does not determine how well UV light is filtered out. Blocking UV rays is often accomplished by adding chemicals to the lenses or adding a special coating. In fact, a clear lens with no tint and 100% UV protection is better for your eyes than dark, heavily tinted sunglasses without UV protection.

Sunglasses can provide other benefits than UV protection. Working or playing in bright light can cause the eyes to tire quickly or become fatigued. Wearing sunglasses while working in bright sunlight or brightly lit work areas can provide comfort and keep eyes from tiring quickly.

Sunglasses also provide some protection from dust, debris, and particles in the air. Sunglasses may serve to keep dirt from getting into the wearer's eyes and becoming uncomfortable. This is especially true for people who wear contact lenses.

LABELING

Labels should reference that the sunglasses "block 99 to 100 percent of UVA and UVB rays" or "absorbs up to 400 nm of UV radiation."

ANSI – The American National Standards Institute is a nonprofit organization that oversees development of voluntary standards for sunglasses and other products. More specifically, the reference to "ANSI Z80.3" is related to the blocking of UV rays, including UVA and UVB and the normal to strictest UV blocking requirements.

ISO – The International Standards Organization is an independent, non-governmental international organization that develops specifications for products, services and systems, to ensure quality, safety, and efficiency in almost all aspects of technology and manufacturing. Sunglasses may refer to or include labeling that includes ISO 8980-3 which relates to the "attenuation" of solar radiation (UV light). They may also be labeled with ISO 14889 as "…intended for driving."

Examples of ANSI and ISO labeling requirements related to intended use and performance claims may include absorbing, reflective, tinted, polarizing, or photosensitizing lenses to attenuate light and reduce glare.

Federal labeling requirements (U.S. Food & Drug Administration) are completely voluntary but do allow for labels that claim the sunglasses may "…reduce eye strain and/or eye fatigue due to glare."

Some recommended standards:

- Block 99% of UVB light. A UVB-blocking sunglass is adequate to protect eyes in moderately bright sunlight such as that found in low-altitude, urban areas
- A UV-blocking sunglass blocks 99% of both UVA and UVB. A UV-blocking sunglass is adequate protection in very bright sunlight like that found in low-altitude snow areas and beaches. Such sunglasses should block 60-90% of visible light to adequately reduce glare and increase visual comfort. The lenses should allow you to recognize traffic signals accurately.
- To protect eyes during prolonged daily use in extremely bright sunlight, like high-elevation snow areas and equatorial sand beaches, a UV-blocking sunglass should block 92-97% of visible light and have side shields. Goggles are also acceptable. Side shields are needed in extremely bright sunlight to prevent UV rays and light from being reflected into the eyes. These sunglasses limit a driver's ability to accurately recognize traffic signals. Side shields should not be worn when driving because they eliminate peripheral vision.
- The only medical claims allowed on sunglasses are that they prevent cataracts and photo keratitis.

FRAMES

Frame materials are generally made of plastic, nylon, metal, or metal alloy. Frames should be considered for form and function. They should also be comfortable and sturdy. You should always check your frames to ensure they have not been bent or warped out of shape during storage or transport. The frame's primary function is to hold the lenses. They should not interfere with or block the wearers vision, including peripheral. Labeling of the frame material may be a bit absent for the lower-end frames.

- Plastic frames are generally the most affordable option
- Acetate frames are a form of plastic are a bit stronger, more flexible, and lighter than standard plastic frames. They come in a huge variety of colors and textures. The color tends to stay because it is embedded in the material not painted on like other plastics.
- Polycarbonate frames are very versatile, tough plastic with impact resistance and is used in many sports. Despite their toughness, they tend to be rigid frames and are not very flexible. These are good frames for children because they can really take a lot of abuse.
- Nylon frames are very resistant to temperature fluctuations, remain very flexible, but are stiff enough for safety. These frames tend to be less expensive, lightweight, and stronger than metal frames.
- Metal frames are commonly used dur to its malleability, corrosion resistance, and east of adjustability making it very easy to tailor to many face shapes. They tend to be more expensive, less durable, and not ideal for sports. Titanium frames are more durable but tend to be more expensive.

Frame size can vary greatly between manufacturers and styles. There are several measurements that are standard on eyewear, but not all sunglasses indicate the size of the frames. The frame size may be represented by three numbers (e.g. 52 – 18 140 MM or 52 - 18 140) located on the inside of the temple or bridge of the frames. The first number is lens width (52), then bridge width (18), and the temple length (140) in millimeters. Many sunglasses are marketed on a Small, Medium, or Large scale. Knowing the dimensions of your face temple-to-temple may be useful in this regard. The frames should be wide enough to not press on the temples. However, this makes is much more difficult to select a pair of sunglasses without trying them on, making internet purchases a challenge. Another size factor is the temple length. The temples should be long enough to rest comfortably over the ears. Proper fit for comfort and function are important.
Frame function refers to the style and purpose of the sunglasses. This is the broadest of variables in selecting your sunglasses. The wearer should consider the primary use of the eyewear to determine the best frame style. The frame style may also impact the type and size of lens it will accommodate. Some frame styles are not suited for glass lenses. One distinct style is the wraparound sunglasses. They are shaped to keep light from shining around the frames and into your eyes. Studies have shown that enough UV rays enter around ordinary eyeglass frames to reduce the benefits of

protective lenses.

Large-framed wraparound sunglasses can protect your eyes from all angles. Keep in mind that frames should not obstruct your vision, or side vision. However, the main criteria for frame style is wearer preference.

Frame color is entirely at the discretion of the wearer. As long as a style is comfortable, functional, and does not block vision, then color has no real bearing aside from wearer preference.

LENSES

The materials used to make sunglass lenses varies between glass, plastic and SR-91. In fact, there are many types of glass and plastic used as lenses in sunglasses. The most common materials are identified here. Finding a pair of sunglasses that are made of unique materials may make your decision a little more difficult. Consider doing your own research on variations of these more common materials.

Glass lenses have the best optical clarity and provide a greater resistance to scratching than other materials. However, they are much heavier relative to the plastic or SR-91 lenses. Another advantage of glass lenses is they are better at retaining their shape in extreme temperatures. Specifically, leaving glass-lens sunglasses on the dash of your car in direct sunlight on a sweltering day will likely not warp or change their shape unlike plastic lenses. From a technical perspective, glass lenses tend to be thinner than plastic lenses due to their refractive index range. This is important when you are purchasing prescription sunglasses. Vision that requires greater correction requires more curvature of the lenses which results in thicker lenses. Relative to plastic lenses, glass lenses will likely be thinner due to their better refractive index range. Nonetheless, the glass lens will most likely be heavier than its plastic counterpart. One very important disadvantage of glass lenses is that they can shatter or break on impact. This is important to keep in mind depending on the application and use. As a general rule of thumb, you can expect to pay more for glass lenses than plastic lenses.

SR-91 lenses are made from a proprietary resin-based material developed by Kaenon Polarized and are exclusive to their brand of eyewear. They are considered a luxury performance brand that has the highest rating of optical clarity and acuity. In addition, SR-91 lenses pass the high-mass impact ANSI
1.1.1 testing. The SR-91 material is very light, much like plastic lenses, and are good for sporting and long wear applications. One can expect to pay more for these types of lenses than any other type of lens material including glass or plastic.

Plastic lenses can be made from several types of plastic such as acrylic, polycarbonate, plastic polymer (CR-39), or polyurethane. In general, plastic lenses are lighter and provide greater shatter-resistance than glass lenses. However, they are more susceptible to scratches. Polycarbonate plastic lenses are the lightest of the plastics and are virtually shatterproof. This makes them exceptional choices for impact protection. The most common plastic used for eyewear lenses is CR-39. This material is light, has higher scratch resistance than other plastics, and low transparency for ultraviolet and infrared radiation.

Note: Infrared wavelengths are invisible and produce heat. Sunlight has low levels of infrared rays, and the eye tolerates infrared well. Some sunglass manufacturers make health claims for their products based on infrared protection, but research has not shown a close connection between eye disease and infrared rays.

Photochromic lenses can be made of glass or plastic. Also referred to as photosensitive lenses, they darken and lighten in response to the amount of available light or type of light. For sunglasses, this may be a valuable tool for situations where the amount of light varies. This would allow a lens to get darker in brighter light. The more direct sunlight they are exposed to affects how dark the lens will become. It is important for drivers to know that these lenses will not be as dark inside the vehicle because they are not exposed to as much UV light. This may cause eye fatigue on very bright days when glasses do not darken fully. Another important characteristic is that they darken more quickly than they lighten. This may create problems when moving from direct to indirect sunlight areas. While sunglasses by nature do have a specific lightness/darkness, this lens adds variability to a pair of sunglasses. This can be a very useful option for some wearers, but not very commonly found on the market making it difficult to find.

COATINGS AND TINTS

Coatings and tints are added features that are added to lens in the manufacturing process or as part of custom lens retailers. Either way, there is a wide range of options that provide some value and style to the wearer in the appropriate situation.

Polarized lenses are specifically designed to reduce glare which is generally caused by reflected sunlight or artificial Light. Some of the most common sources of glare from bright sunlight could include light bouncing off water, pavement, glass, or other reflective surfaces. Polarized lenses also improve contrast because of the reduced glare. People involved in water sports and fishing have been taking advantage of the benefits from polarized lenses for many years. However, more and more outdoor enthusiasts have found benefit from the glare-reducing feature. Polarization is a coating or film that is added to a lens. This coating can be as part of the manufacturing process for sunglasses or can be added when ordering custom sunglasses as an added feature. Adding this coating at the time of purchase is only likely to occur among custom sunglass or optical retailers with the ability to customize lenses at the buyer's request. Your standard retailers will likely market sunglasses with a variety of styles and options with and without polarization since they do not have the ability to customize your pair of sunglasses.

Tinting is also a coating that is added to lenses. Tinting can have both aesthetic benefits or functional benefits to the wearer. If you are looking for style, there are several ways to tint lenses to make the special impression and just look great. As with other features of sunglasses, they can be purchased with as is or can be customized with specialty retailers that offer customization.

- Plain lenses are uniformly tinted throughout the lens and come in a wide range of tints or colors. The darkness of the lens has nothing to do with how well it blocks UV light, but it will make a difference in how much visible light gets seen. This may be important for eye comfort during prolonged time in bright sunlight.
- Single gradient lenses are tinted darker at the top and lighter at the bottom. They may be useful for tasks like driving, where the road is bright but the dashboard is dark. They are not very useful for places like the beach where light is reflected up from the sand. They may also be useful when walking to avoid tripping, especially when going from a bright area (outside) to a darker area (inside). The difference in tint also causes the lighting to change as the wearer moves their head which may be annoying for some. Gradients can add a unique look or style to the wearer.
- Double gradient lenses are tinted darker at the top and bottom, but lighter in the center. These are very specifically designed for sports such as sailing, skiing, and tennis, where light comes in from above and below, but the center of vision has less light coming in. These glasses are not appropriate for driving, since they darken visibility of the dashboard controls. Like the single gradients, the changing of light with head movement may be annoying to the wearer.

Anti-Reflective (AR) coating is a thin coating that eliminates or greatly reduces reflections and glare that are created by the light reflected by lenses themselves. This can occur on the front or back of the lens. However, in the case of sunglasses, the more common use of AR coating is on the back (inside) of the lens. This coating eliminates glare on the inside of the lens that may occur from light coming in from the sides, top, or bottom of the frames. AR coating works better with plastic lenses but also makes them more susceptible to scratching. Combining AR coating with scratch coating may reduce this issue but adds cost to the lenses.

Anti-Scratch coating is a film or coating that can be applied to sunglass lenses that reduces the appearance of scratches on the lens. Anti-Scratch coating does not make lenses scratchproof, it only reduces the likelihood. Scratches can impair vision depending on the location and severity of the scratch. This coating can prolong the life of your sunglasses. They are generally not an expensive option to add to your custom glasses.

Mirror or Flash lenses have a mirrored or flash coating that is reflective on the outside (front) of the lens with metallic silver, iridescent, or colored appearance. The coating makes them appear like mirrors and typically give the wearer's vision a brown or grey tint. The mirror coating decreases the amount of light passing through the tinted lens making them useful at high altitudes or in sand, water, or snow. One significant disadvantage is that they can scratch easily.

LENS COLOR

Lens color can be a dye in the lens or a coating on the lens. Color on coated lenses is more likely than dyed lenses to scratch or wear off. Coated lenses can be protected by the manufacturer through use of scratch-resistant layers. Overall, dyed lenses retain color longer.

Darkness of a lens determines how much visible light will be let in. No special instruments are needed for this—the wearer can tell just by looking through the lenses. If glasses are to be worn in very bright conditions such as for water sports, a darker lens is more practical. For everyday wear, a medium to light lens is usually sufficient and may be more versatile. The main point is to match the amount of tint to the purpose for which the glasses will be used.

At one time, amber lenses were claimed to be superior because they reduced "blue light," or shorter light rays. Because amber colored glasses reduce the transmission of blue light, they are sometimes preferred by pilots or others who need enhanced clarity of distant objects which may be obscured by a blue haze. However, no studies have proven that amber glasses provide any more protection as it relates to eye health than other colors. The amber sunglasses are popular among skiers, hunters, boaters and pilots

Lens color makes little to no difference in effectiveness of eye health. The color preference of the wearer is the main basis for color choice. Gray colored lenses offer the least color distortion to the wearer. Because of this, they are preferred by some people.

Care should always be taken when selecting colored lenses when it comes to driving. Some colored lenses affect the way traffic signals appear to the wearer. Certain colors may affect not only the recognition of specific traffic signal colors but the transition of those signals.

QUALITY

Most sunglass lenses are made of plastic which are more durable than glass lenses. Plastic lenses are lighter than glass lenses, reducing the overall weight of the glasses. Plastic lenses scratch more easily than glass lenses, but can be coated with an anti-scratch layer. One way to evaluate lens quality is to look for scratches on the lenses at the store. Many times, unpackages sunglasses on displays are handled by many people which can cause scratches. However, this might be a good indicator of quality if a certain style or brand have scratches on the lenses. If they are packaged and have scratches on the lenses, that could also be an indicator of inferior quality. Glasses that cannot survive transport without scratching will scratch easily in everyday wear.

Lens distortion occurs in both glass and plastic lenses. It means that looking at objects through the lenses causes the objects to look oddly shaped. In glass lenses, this may occur if the glass has been formed rather than ground. In plastic lenses, distortion may occur because of handling after manufacture. Either way, distortion is easy to detect. Find an object with straight lines (like floor tile) and look through the lenses at arm's length, and moving the lenses slightly up/down and left/right. If the lines warp or curve when you move the glasses, the lens is distorted. Cost is not a guarantee of distortion-free lenses or quality. Inexpensive lenses will often be free of distortion. All sunglass lenses must pass the Food & Drug Administration's safety test for breakage.

COST

Where sunglasses are concerned, there is no direct correlation between price and performance. Effective, reliable, high quality sunglasses can be found among even the most inexpensive options.

The lowest priced sunglasses may be more prone to lens distortion or scratching, but both of these conditions cans be determined by visual inspection and reading labels for protective coatings, construction materials, and ratings. High fashion and brand names may raise the price, and many times provide better labeling and information than lower priced options.

ACCESSORIES

As with most consumer products, a variety of accessories is available to go with sunglasses.

Retainers, cords, cases, pouches, visor clips, spare lenses, cleaning kits and more are all available for sale individually or come with eyewear purchases. There are infinite styles, sizes, colors, shapes, and materials of these accessories. Some of them add to the functionality of your sunglasses, while others prolong their life. Consider how the accessories add or detract from the value of your purchase.