A concise guide to Safety Glasses, the different standards and the effects of light on the eye

Year of publication: 2010

www.NothingButSafetyGlasses.com

Contents

Links

Guide to safety glasses online resource:
http://www.nothingbutsafetyglasses.com/advice

Wikipedia on glasses:
http://en.wikipedia.org/wiki/Glasses

A history of safety glasses:
http://www.ehow.com/facts_5035011_history-safety-glasses.html

1/ Overview

Choosing the right pair of safety glasses isn't quite as straightforward as it might seem. With various frame types and lenses available we produced this section of our site to help you make the best choice and also to explain some of the more technical aspects of light and safety standards.

2// European Standards for Eye Protection

All manufacturers of safety eyewear are required to have their products independently tested against a European standard.

Firstly it is important to remember that both the Frame and Lens are tested, therefore both must include the CE symbol and the manufacturer's logo. The CE marking certifies that a product has met EU consumer safety, health or environmental requirements.

On the frame there will then be an EN standard to which the glasses are certified to. Each test is different but specific for their designed use. These are the main categories:

Basic Standard:	
EN 166	« Specifications »
EN 167	« Optical test methods »
EN 168	« Test method other than optical »

After the EN number you may well see additional markings and these will also appear on the lens.

Standards by type of application:

EN 169	« Welding filters »
EN 170	« Ultraviolet filters »
EN 171	« Infrared filters »
EN 172	« Solar protection filters for industrial use »
EN 175	« Welding work equipment »
EN 207	« Glasses for laser protection »
EN 208	« Glasses for laser adjustment »
EN 379	« Specification concerning welding filters »

They will give you additional details as to the degree of mechanical strength, the designed application and the optical glass of the lens.

Symbols for the optical class:

1	Continuous work
2	Intermittent work
3	Occasional work, but must not be worn continuously

Application symbols:

3	Liquid droplets or splashes
4	Large dust particles > 5 microns
5	Gases and small dust particles < 5 microns
8	Short circuit electric arc
9	Molten metal and hot solids

Mechanical strength symbols:

S	Extra strong, resists a 22 mm 43 g ball falling 1.30 m
F	Low energy impact, resists a 6 mm 0.86 g ball at 45 m/s
B	Medium energy impact, resists a 6 mm 0.86 g ball at 120 m/s
A	High energy impact, resists a 6 mm 0.86 g ball at 190 m/s
K	Resistance to surface deterioration by small particles (optional)
N	Resistance to misting (optional)
T	The letter T immediately after the impact letter allows a use for high speed particles at extremes of temperatures

It is important to note the frame and lens are tested separately and so each can be rated differently in mechanical strength although usually manufacturers try and match these as the overall grade of the glasses is determined by its lowest class.

3/// Lenses Available on Safety Glasses

Every set of safety eyewear on our site include high quality lenses using anti-scratch and anti-fog properties. However, many are available with different lenses, each of which is especially designed for different light conditions.

a. Clear Lens

The clear lens is the most popular as it filters out 10% or less of the visible spectrum providing as near to natural vision as possible. They also filter out 100% of harmful UV light. For lens manufacturers this is difficult since the line between harmful invisible UV light and our visible spectrum is very small.

	U.V. 280 TO 380 NM	visible 380 TO 780 NM	I.R. 780 TO 2000
 CLEAR	100 %	10 %	10 %

Getting a lens to filter one wavelength and not the other is therefore a difficult task and high quality lenses meet this thin boundary with better accuracy giving them a higher optical class. On our site you will only find safety glasses with the highest optical class of 1.

b. Smoked Lens

The smoked lens is much the same as you will find in traditional sunglasses but with the added strength and anti-fog/scratch properties. They will block out up to 87% of visible light which may sound excessive but are required when working in normal bright outdoor conditions.

	U.V. 280 TO 380 NM	visible 380 TO 780 NM	I.R. 780 TO 2000
 DARK SMOKE	100 %	87 %	10 %

c. Flash Lenses

These can be distinguished by their reflective appearance and as such have been very popular regardless of their special properties. Flash lenses are similar to smoked lens in that they filter out roughly 90% of visible light making them excellent for bright outdoor conditions. However, the special properties of this lens also filter out up to 60% of infrared radiation. Since IR light is invisible, your eyes it will not adjust to excessive exposure and yet the damaging properties of the light are still present. Flash lenses are therefore an excellent choice for outdoor use regardless of their stylish appearance.

	U.V. 280 TO 380 NM	visible 380 TO 780 NM	I.R. 780 TO 2000
 FLASH RED	100 %	87 %	60 %

d. Contrast / Light Enhancing Lens

On this site we sometimes refer to this lens as a Contract or Light Enhancing lens. Technically it does not actually enhance the light but provides additional contrast and makes it appear easier to see in low light circumstances. They are very popular when working on surfaces of a similar colour such as snow or on cloudy overcast days. During low light the surface can appear flat and the term ‘flat light’ is often used to describe this situation. This can often happen in the middle of an overcast day which makes the Contract lens highly popular in the UK.

	U.V. 280 TO 380 NM	visible 380 TO 780 NM	I.R. 780 TO 2000
CONTRAST	100 %	10-30 %	5-30 %

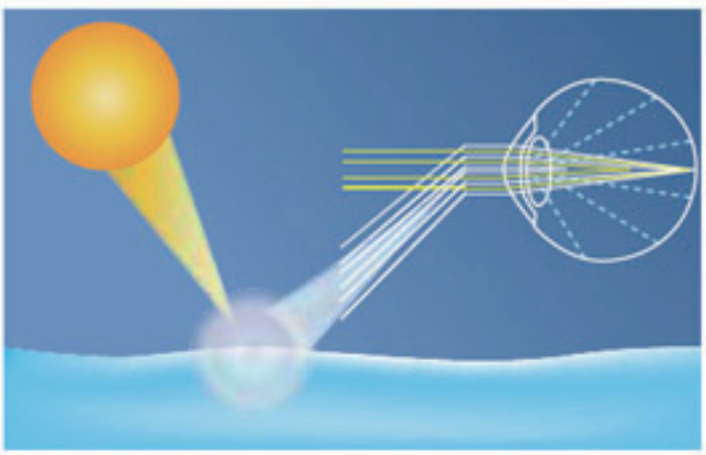
This lens also has a few other important enhancements such as a partial “Flash” coating for reflection of Infrared / heat and also a 30% blue light filtration. Blue light is part of the visible spectrum but has been proven to cause partial and total blindness over time. Although this lens does provide 100% UV protection, they do improve visible light which means they are not ideal for use in bright sunlight which could force you to squint, resulting in a headache.

e. Polarised Lens

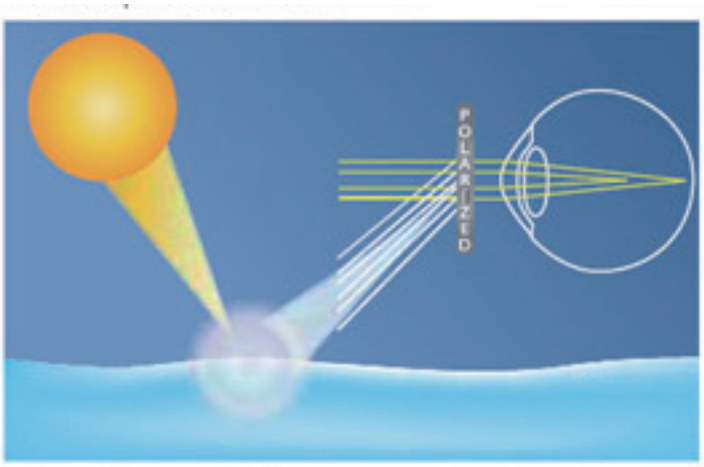
When light reflects off a surface at a low angle it reverberates. As this light enters the eye it disperses causes glare. The polarising filter minimises this reverberated light enabling better vision and reduces the need to squint through glare.

	U.V. 280 TO 380 NM	visible 380 TO 780 NM	I.R. 780 TO 2000
POLARIZED	100 %	90 %	22 %

The lenses contain specially aligned crystals which block horizontally polarized light. Acting just like a window blind to allow light through at one angle but not another. These properties make them idea for working on water, and other reflective surfaces.



Without polarized lenses



With polarized lenses

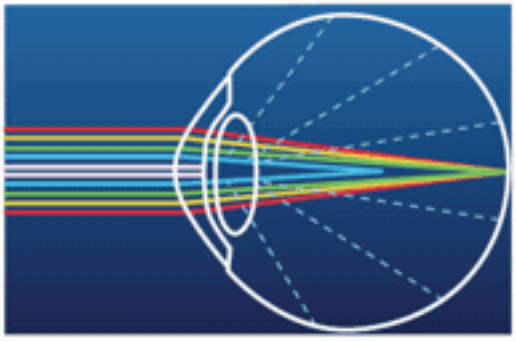
Polarised lenses maintain a 100% UV filter and also block 90% of reflected directional light in additional to 22% of Infrared radiation. Many people regard these as the best lens for overall use in various conditions.

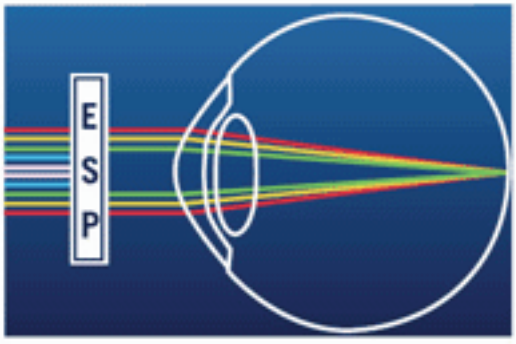
f. ESP Lenses

Extra Sensory Perception (ESP) is the name given to a type of lens that cleverly filters out the harmful blue end of the spectrum. Blue light has a smaller wave length than the other visible colours and is closest to invisible UV light than any other. It carries more energy that others colours also which makes it damaging to our eyes in the long run.

	U.V. 280 TO 380 NM	visible 380 TO 780 NM	I.R. 780 TO 2000
 ESP	100 %	63 %	25 %

Blue light radiates between 380nm – 480nm and these lenses remove this wavelength, allowing rest of the visible spectrum through. Safety glasses using these lenses are regarded as an excellent choice for people moving in and outdoors on a regular basis.



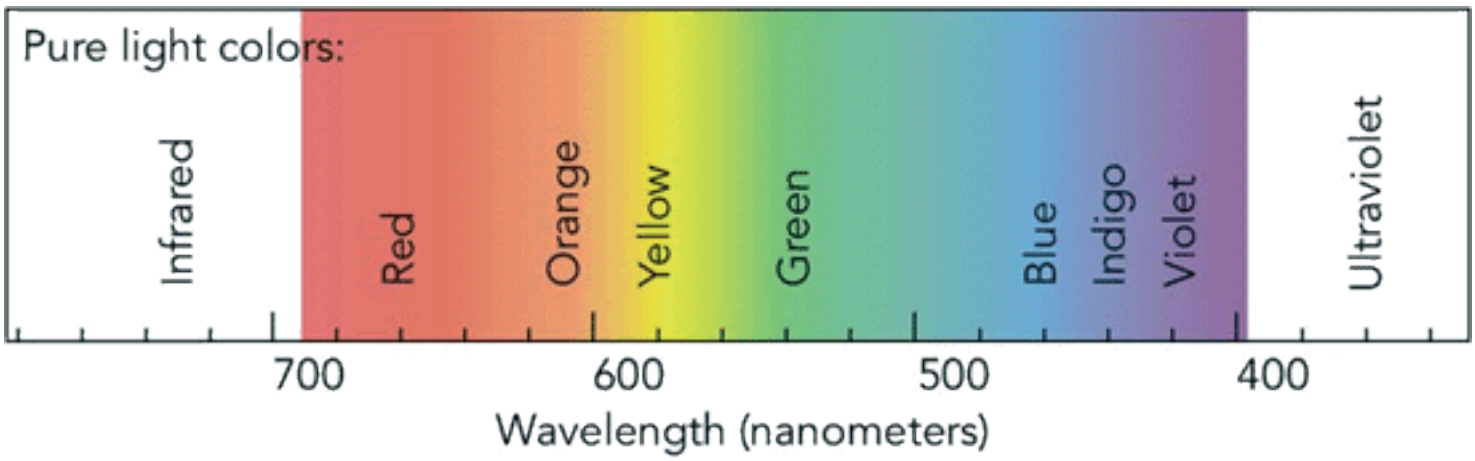


4//// How Light Interacts With Our Eyes

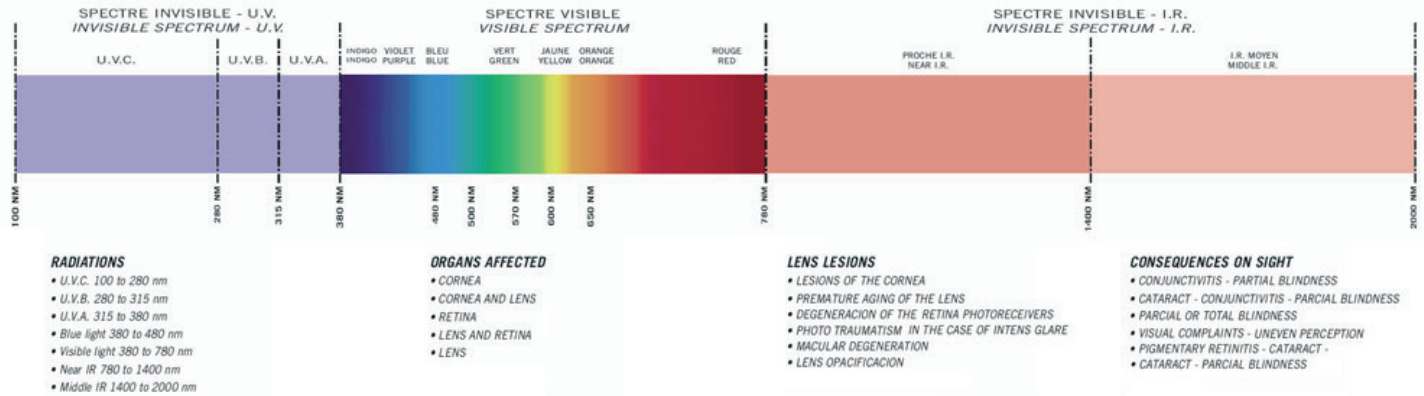
Light is made up from different wavelengths. The visible spectrum of colours is the part of light we can see whilst other waves of light such as Ultraviolet we cannot. In producing effective safety glasses it is important to understand the differences and the dangers posed by the various forms of light.

a. Wavelengths

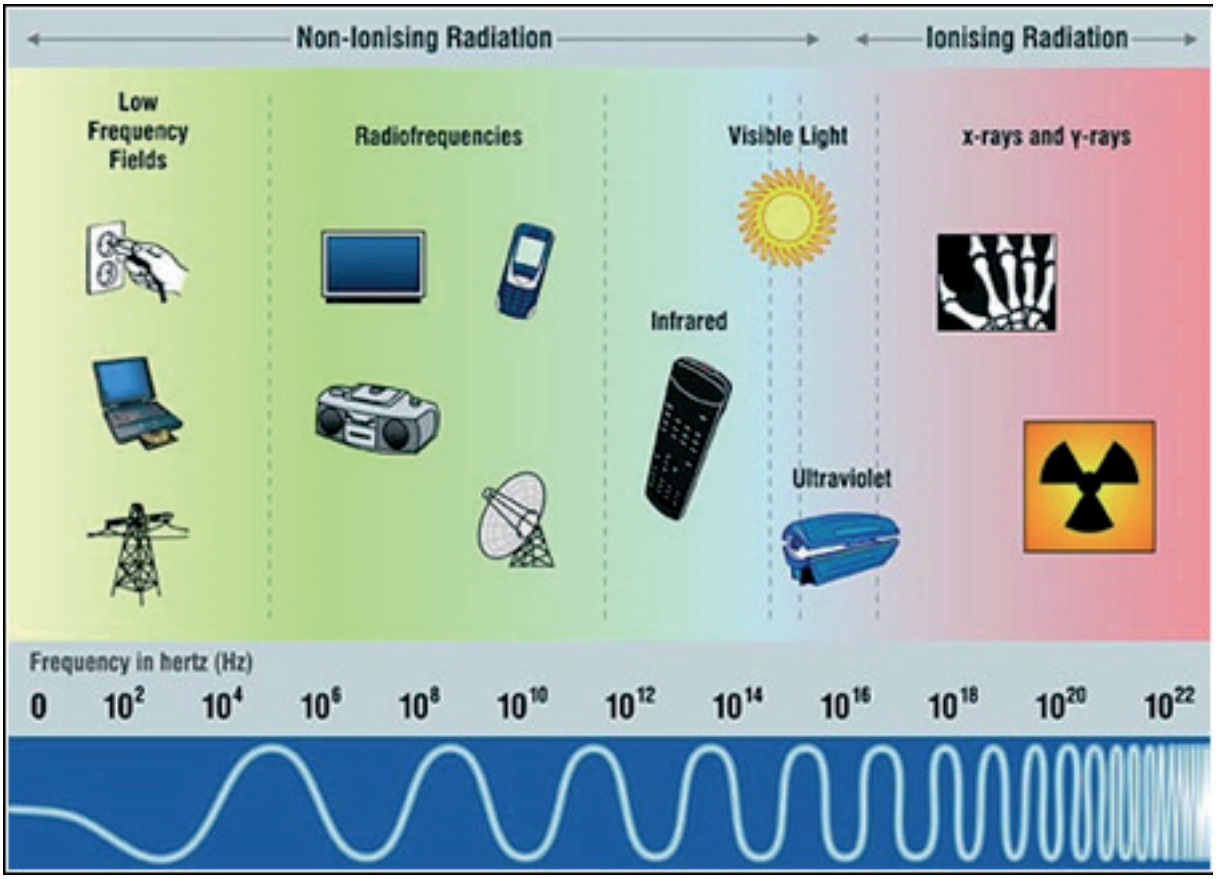
Although there are many wavelengths of energy we are only concerned with the parts that form sunlight and artificial light. These are Ultraviolet, Infrared and the visible spectrum. Humans can only detect wavelengths of between 380 and 780 nanometers which reflects off certain surfaces differently producing the visible spectrum of colours.



As the wavelength of light becomes shorter is retains more energy and can be damaging. Ultraviolet light for example has a slightly shorter wavelength than our visible spectrum and carries more energy. Everyone knows it can cause sunburn which is exactly what it can do to you eyes. Exposure to invisible UV rays will build up and eventually lead to worsening eyesight.



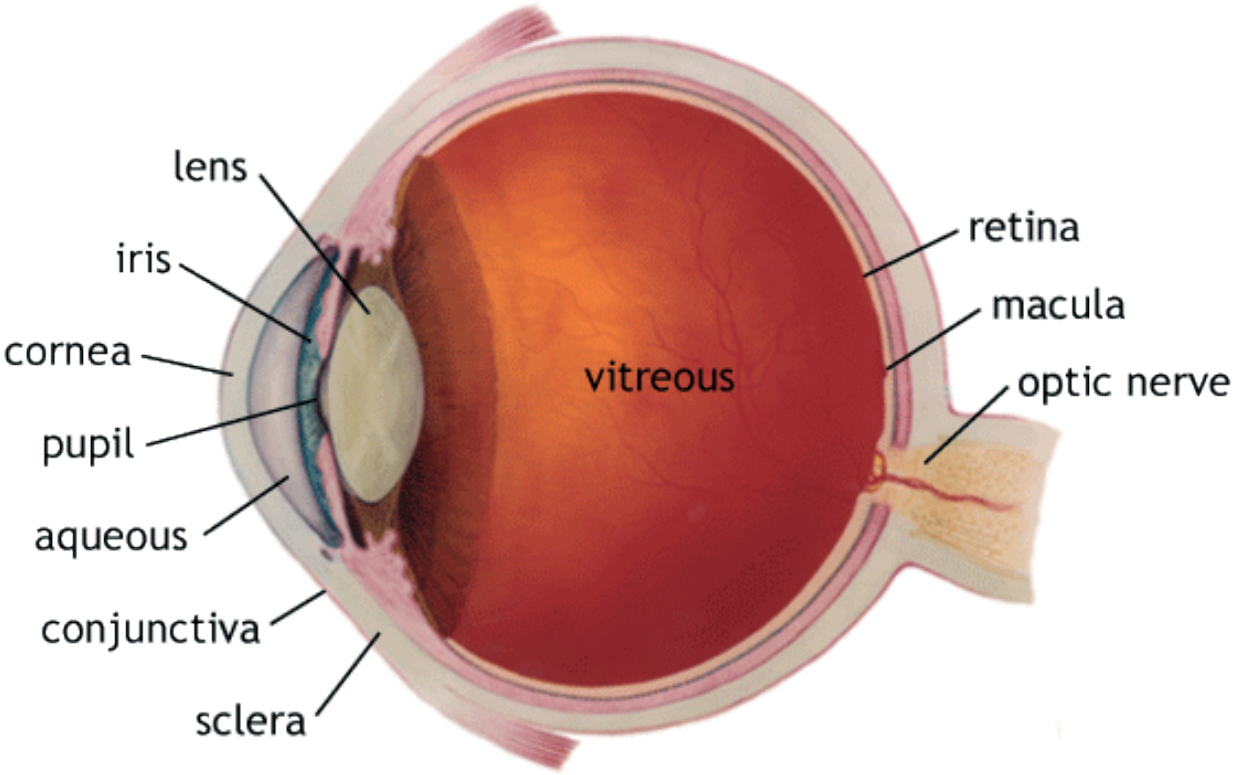
The diagram on the previous page shows how only 30% of sunlight is visible to us and how the invisible spectrum can cause varying damage to the eye. For anyone working outside regularly it is important that they protect against this continually.



Generally it is known that both UV and Infrared wavelengths can damage human eyes but it is less well known that certain parts of the visible spectrum can do the same. Blue light is the main example which has the smallest wavelength of the whole spectrum and therefore carries the most energy. Prolonged exposure to Blue light can lead to partial blindness and so special ESP lenses have been developed to filter out this part of the spectrum.

b. The different parts of the eye

Although technically there is no need for someone buying a pair of safety glasses to understand how the eye works, we thought it would at least be interested to explain the various parts of the eye and explain what they are used for.



The cornea: The front transparent part of the eye, protective envelope of the sclera or the white of the eye.

The iris: Rear part of the choroid, rich in colouring materials and blood vessels. This is the eye nourishing tissue. It contracts or expands depending on the light intensity.

The pupil: opening at the centre of the Iris, the diameter of which increases or reduces depending on the light intensity.

The retina: Nervous membrane at the back of the eye. The retina captures light rays and sends them to the brain through the optic nerve.

The lens: Bi-convex transparent lens about 9 mm diameter. It is composed of flexible fibres laid out in layers, and forces light rays to converge onto the retina to give focused vision.