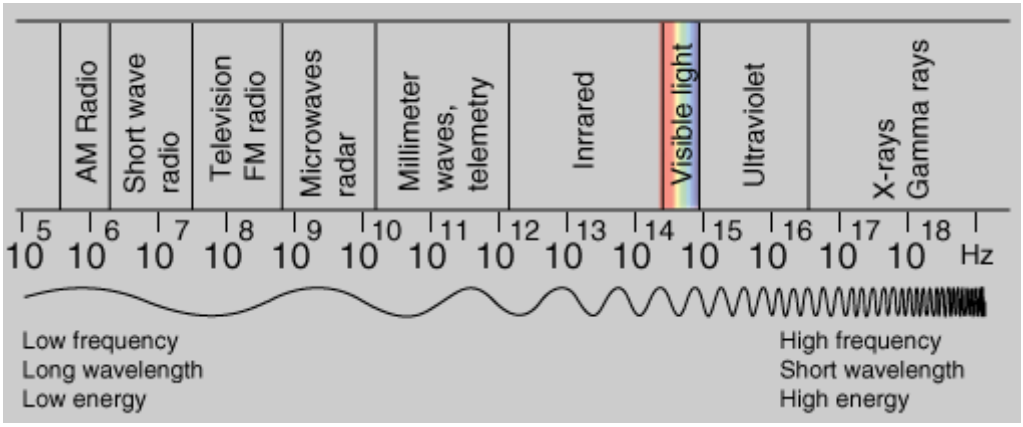
TECHNICAL BRIEF

Light, Heat, Glare and Glass Selection

Light and heat both form a small part of what is commonly known as the Electromagnetic Spectrum. This spectrum encompasses all the known forms of energy emitted (radiated) by the sun. This is why light is often called radiant energy or more simply radiation.

Diagram of Electromagnetic Spectrum

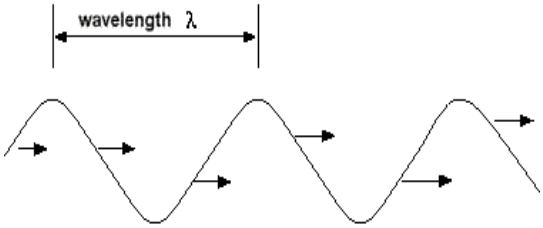


All of these different forms or types of light have two things in common:

1. They are composed of discrete particles known as photons.
2. These photons all transcribe a wavelike oscillation.

The length of one complete oscillation is known as its **wavelength** (often represented by the symbol (☐).

Representation of the Wavelength (☐) of an Oscillation



Each wavelength also has its own characteristic frequency and energy. The number of photons each wavelength contains therefore is equal to the total amount of energy that light beam will contain.

What is the Difference between Light and Heat?

Heat is a term used to describe wavelengths within the infrared region (IR) of the spectrum. The human body absorbs light in this region. Consequently when we are

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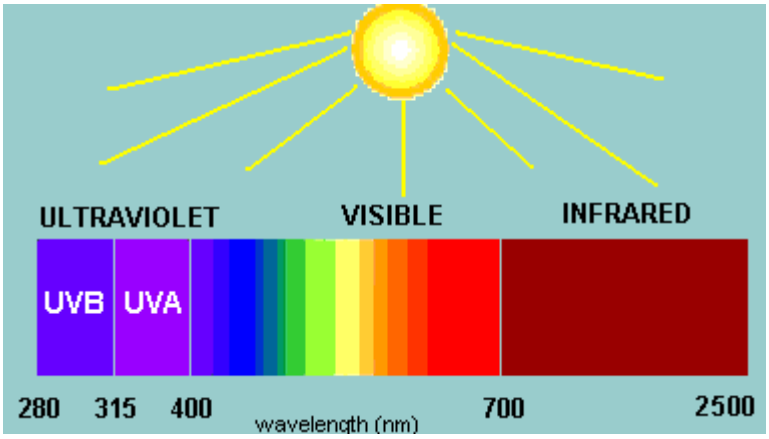
struck with IR radiation our skin heats up due to the absorption of photons, until we feel discomfort or "hot". This happens when you stand in the sun or in front of a heater or a stove all of which are emitting infrared radiation.

Light however describes all the forms of energy across the entire electromagnetic spectrum. Therefore the term light can be applied to infrared "heat" but the term heat cannot be used to describe other forms of light.

Sunlight And Heat

Of the energy emitted by the sun only a small fraction reaches the surface of the earth. The earth's atmosphere filters out many of the harmful wavelengths leaving us with essentially just the ultraviolet (UV), visible and infrared (IR) regions of the spectrum.

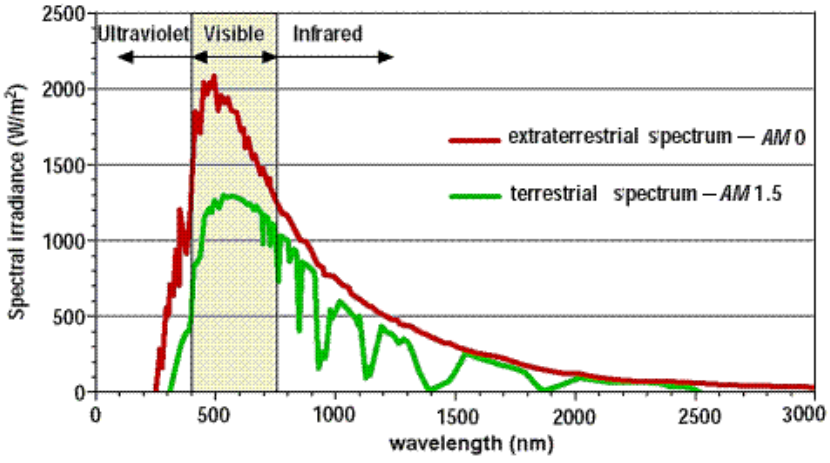
Wavelength Regions Striking The Earths Surface



What distribution of these wavelengths is actually striking the earth's surface?

The diagram below illustrates both the energy distribution of sunlight outside of the earth's atmosphere (extraterrestrial or Air Mass (AM) =0) and the energy distribution of sunlight after atmospheric absorption (terrestrial or AM=1.5).

Terrestrial and Extraterrestrial Spectral Distributions



Why do I need to Control the Light entering my Home?

The answer to this question is **thermal comfort**. Unfortunately thermal comfort is a nebulous term that is inherently difficult to define. The term thermal comfort is designed to reflect the general happiness of the people inside the structure. Generally most people don't notice if the environment is pleasant but they are acutely aware of discomfort – think back to the last time the air conditioning broke down at an office block.

The thermal comfort of the occupants is influenced by numerous factors including:

- Air temperature
- Relative humidity
- Air movement (breezes & drafts)
- Amount of direct sunlight
- The activity level of the occupants
- Type of clothing the occupants wear

Thermal comfort can to a large extent be achieved by mechanical means, such as air conditioning, heaters etc. The cost of achieving this comfort can form a large proportion of the operating ongoing expenses for the building.

Advances in materials and design, as indeed a greater understanding of the interactions between these two, has allowed thermal comfort to be achieved many cases by more environmentally passive means.

Modern glass and glazing products now have the ability to control the movement of both light and heat through them. Consequently windows and doors can now play a large role in the future comfort of the users / occupiers of a structure.

For example in hot humid climates, it is important to prevent the passage of direct sunlight through the glazings, while still allowing a mechanism for cooling breezes to be enjoyed when available. In the late afternoon and evening it is important for these structures to be able to lose the heat that they have absorbed during the day. So that more pleasant conditions are possible in the evening.

In contrast, in more mild climates the radiant heat from the sun can reduce will reduce the amount of extra heating required to maintain comfort. If the heat retention of the structure is also improved, large energy savings can be achieved.

Unfortunately as we all know too well, the more populated regions of Australia tend to be a mixture of both of these extremes. Consequently the overall design and its glazing selections are of particular importance for the thermal comfort of its occupants. The glazing selections will also dictate, to a large extent, the ongoing energy expenses of its users.

Modern glazing products can:

- Provide passive heating
- Selectively exclude the heat (infrared) component of sunlight
- Increase the insulation of the structure
- Provide an additional heat loss mechanism
- Reduce radiant heat loss
- Decrease glare
- Provide visual comfort
- Reduce sound infiltration

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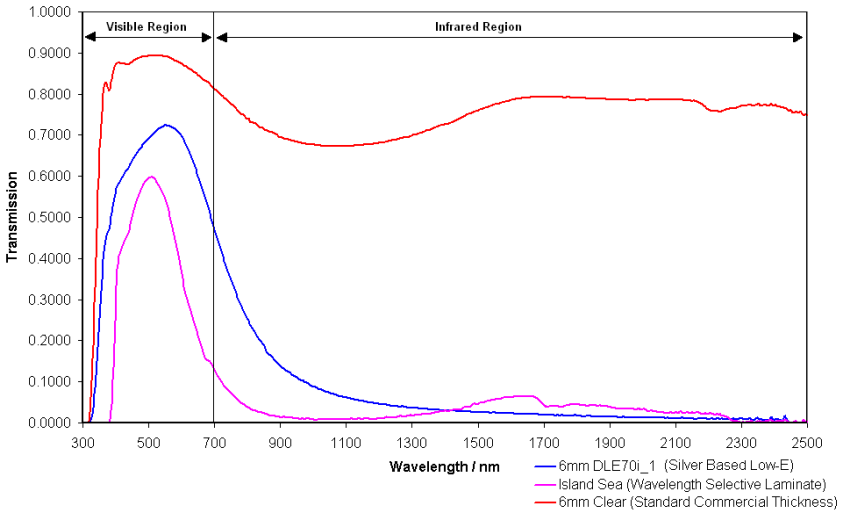
Transmittance of Three Glass Products

N.B. The difference in Infrared transmission between the three products (700nm to 2500nm)



Light and Glare

One, often ignored, component of light is glare. Glare is a term used to describe high levels of uncomfortably intense or bright light. One example of glare is light shining off the ocean on a bight sunny day at times this light can be quite blinding and uncomfortable to stare at.

Australia is geographically located so that it receives a large amount of sunlight each day. The Australian continents latitude is the reason why our daytime temperatures are considerably higher and more constant throughout the year than the majority of Europe and indeed even many parts of the USA.

One recent architectural design trend had been the transition to relatively low reflectance, "clear" structures. While this design trend is popular and aesthetically pleasing it is important to design for a visible light transmittance level suitable for our latitude.

G.James' experience with both commercial and residential constructions has indicated that a visible transmittance in excess of 40% will not be suitable for glazings in either the Australian or South-East Asian markets where glare is likely to be an issue. The glare levels passing through the glass at and above this transmittance level will be too high for most occupants. This is particularly an issue when the views are a selling feature of the property, or if computer screens will be used in the vicinity of the glazings.

The result of too high a visible transmittance is all to often that the blinds or curtains will remaining shut during the majority of the day.

Generally G.James would advise a 30% or lower visible transmission glass be used in areas with the potential for glare. Reducing the necessity for blinds and curtains to remain closed for visually comfortable environment.

Common sense dictates that the performance requirements of the glass are highly dependent on the overall design of the building or structure as well as its intended use. G.James technical staff are always available to discuss your projects requirements, so that viable and cost effective glazing options can be provided.