

UMBRA IS A SHADE FOR WHOLEHEARTEDLY ARMOUR FOR BODY PROTECTION FOCUSSED BY UMBRELLEA

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ABSTRACT

An umbrella in life serves as a practical shield and a powerful metaphor for protection, preparation, and support during difficult times. It represents physical defense against the elements as well as emotional resilience and supportive relationships.

KEYWORDS: UVA, UVB, rain, storm, shield, armour, shade, metaphor, protection, umbra, penumbra

INTRODUCTION

Umbra: Latin for shadow or shade.

Umbrella: Means "little shadow" or a small device to block the sun.

Original use: First made to block the sun, not the rain.

Umbrellas vary in design according to their purpose, offering different levels of coverage and wind resistance. The primary umbrella shapes include classic dome/round, bubble, pagoda, and inverted canopies, alongside various shapes of patio umbrellas designed for outdoor living spaces.

Umbrellas usually have 8 ribs, but the count can range from 6 to 24 ribs depending on the size and type.

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Weather defense: Blocks heavy rain, harsh UV rays, and hot sun to prevent health issues. English word umbrella comes from the Latin word umbra, which means "shade" or "shadow". It literally means "little shadow" or "little shade". The word umbrella comes from the Latin word umbra, which means shade or shadow. Adding the suffix -ella turned it into "little shadow".

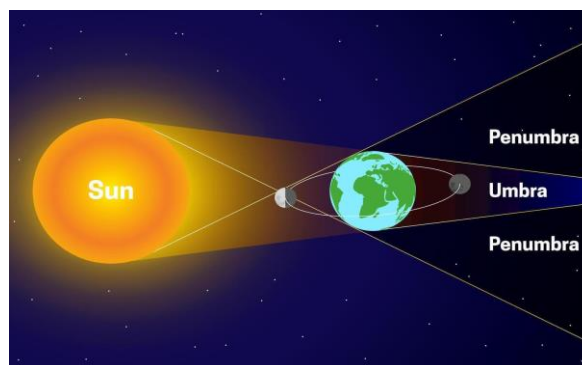


Figure 1: Umbra & Penumbra.

Common Rib

- **6 Ribs:** Found on very small, lightweight, or mini travel umbrellas to keep them light.
- **8 Ribs:** The standard and most common choice for everyday rain and folding umbrellas, offering a good balance of strength and weight.
- **10 to 12 Ribs:** Used on larger walking sticks or slim fashion umbrellas for extra shape and wind resistance.
- **16 to 24 Ribs:** Found on heavy-duty, traditional, or large patio/market umbrellas designed for maximum wind protection and a rounded dome shape.

Umbrella ribs are the hinged, radiating rods that form the framework or skeleton of an umbrella. They support the fabric canopy and give it a curved shape when opened. Typically numbering between six and twenty-four, these

ribs must be both sturdy and flexible to withstand strong winds.

Function: The ribs anchor to the central hub and work with the stretchers to expand the canopy.

1. Inner Canopy
2. Stretchers
3. Spring Mechanism Runner
4. Shaft
5. Handle
6. Open/Close Button
7. Outer Canopy
8. Ferrule (Top Tip)
9. Rib Tape
10. Umbrella Panel
11. Rib
12. Tie Wrap
13. Tip



Figure 2: Umbrella construction parts.

Construction: Umbrella fabric is a tightly woven, lightweight synthetic textile—primarily polyester, nylon, or pongee—treated with waterproof or UV-resistant coatings. Umbrellas are made up of several parts that work together to provide protection, stability, and ease of use. The canopy and panels form the main cover that shields you from rain or sun, while the ribs and stretchers give structure and support. The shaft and handle allow you to hold and carry the umbrella comfortably, and the runner and open/close button help in operating it smoothly. Additional parts like the ferrule, end tips, and tapes ensure durability and finishing. Each component plays an important role in making an umbrella functional, sturdy, and easy to use.

Canopy & Covering Parts: These parts form the fabric covering of the umbrella and are mainly responsible for protection against rain, sun, and wind.

Outer Canopy: The outer canopy is the top layer of the umbrella that directly faces rain, sunlight, and wind. It is

usually made from waterproof materials like polyester or nylon to keep you dry and protected.

Inner Canopy: The inner canopy is the underside layer of the umbrella. It provides extra strength, improves durability, and sometimes adds insulation or design aesthetics.

Umbrella Panel: Umbrella panels are the triangular fabric sections stitched together to form the canopy. These panels create the dome shape and help distribute tension evenly across the umbrella.

Rib Tape: Rib tape is a narrow strip of fabric that connects the canopy to the ribs. It helps hold the fabric in place and ensures the umbrella maintains its shape during use.

Frame & Structural Parts: These parts provide the skeleton of the umbrella, giving it shape, strength, and stability.

Rib: Ribs are the long, thin metal or fiberglass rods that extend outward from the center. They support the canopy and give the umbrella its structure and shape.

Stretchers: Stretchers are the smaller support bars that connect the ribs to the shaft. They help open and close the umbrella smoothly and keep the ribs stable.

Shaft: The shaft is the central pole of the umbrella. It holds all the parts together and provides the main support structure for the frame.

Frame & Structural Parts: These parts provide the skeleton of the umbrella, giving it shape, strength, and stability.

Materials: Common materials include steel for durability, aluminum for lightweighting, and fiberglass or carbon fiber for maximum wind resistance.

Quality & Strength: More ribs typically create a tighter, better-supported canopy, though structural resistance to wind ultimately depends on the strength of the center shaft and the flexibility of the rib materials. You can read more about how rib counts and materials affect durability.

Weather Uses

Rain protection: Keeps your head and clothing dry during wet weather downpours.

Sun shade: Blocks harsh UV rays to prevent sunburn and overheating.

Wind resistance: Built with flexible ribs to stay stable during stormy gusts.

Alternative and Creative Uses

Self-defense: Can be swung or poked defensively as an emergency tool.

Walking aid: Acts as a temporary cane or support on uneven ground.

Photography: Used as a light diffuser for soft studio lighting effects.

Gear protection: Keeps electronics, books, and clothing dry during sudden storms.

Daily readiness: Acts as a routine carry item, much like keys or a phone, ensuring uninterrupted daily movement.

Life Metaphors

The storm companion: Symbolizes people who step into your life to offer temporary comfort and strength until a personal crisis passes.

The open mind: Reminds us that the mind—like an umbrella—only works properly when it is open.

Inner strength: Represents emotional boundaries that let you walk through hard challenges without letting the negativity drench your spirit.

An inverted umbrella shape can be created by merging four hyperbolic paraboloid (hypar) quadrants. This specific geometric form is widely used in modern kinetic architecture, large outdoor canopy designs, and structural engineering.

Structural Design

Hypar geometry: Formed by joining four straight-edged hyperbolic paraboloid quadrants along their edges.

Inverted apex: Slopes downward toward a central column to efficiently drain rainwater.

Kinetic capability: Individual quadrants can fold, deploy, or hinge based on weather conditions.

Applications

Urban shading: Deployed along public waterfronts and plazas for aesthetic and functional shelter.

Storm protection: Acts as a modular coastal countermeasure against severe nearshore weather events.

Design: An umbrella with 8 ribs divides the canopy into 8 equal sectors or parts, often used in math problems to find the angle or area between consecutive ribs.

Umbrella Geometry Details

- ❖ Total degrees: 360° in a full circle
- ❖ Number of parts: 8 equal spaces
- ❖ Angle of each part: 45° ($360^\circ \div 8$)
- ❖ Example radius (r): 45 cm (common textbook value)
- ❖ Area of one part: $22275/28 \text{ cm}^2$ (approx. 795.54 cm^2)

The area between two consecutive ribs of an umbrella with 8 ribs and a radius of 45 cm is $22275/28 \text{ cm}^2$ (approx. 795.54 cm^2). This is found by treating the umbrella as a flat circle and dividing its total area by 8. Total Area: A circle with radius ($r = 45 \text{ cm}$) has an area of ($\pi r^2 = 22/7 \times 45 \times 45 = 39675/7 \text{ cm}^2$).

Number of Ribs: There are 8 equally spaced ribs, which divide the circle into 8 equal parts.

Area Between Two Ribs: Divide the total area by 8: $39675/(7 \times 8) = 39675/56 = 22275/28 \text{ cm}^2$ (approx 795.54 cm^2)

The shape of an umbrella, especially when under high tension as depicted in, exhibits interesting characteristics. Along the rib curve, the canopy surface is convex, while between the rib curves, it becomes concave, forming a saddle surface. If you are trying to solve a specific math problem about this umbrella, please share the radius or what you need to find (such as the area or edge length), and I will help you solve it step-by-step.

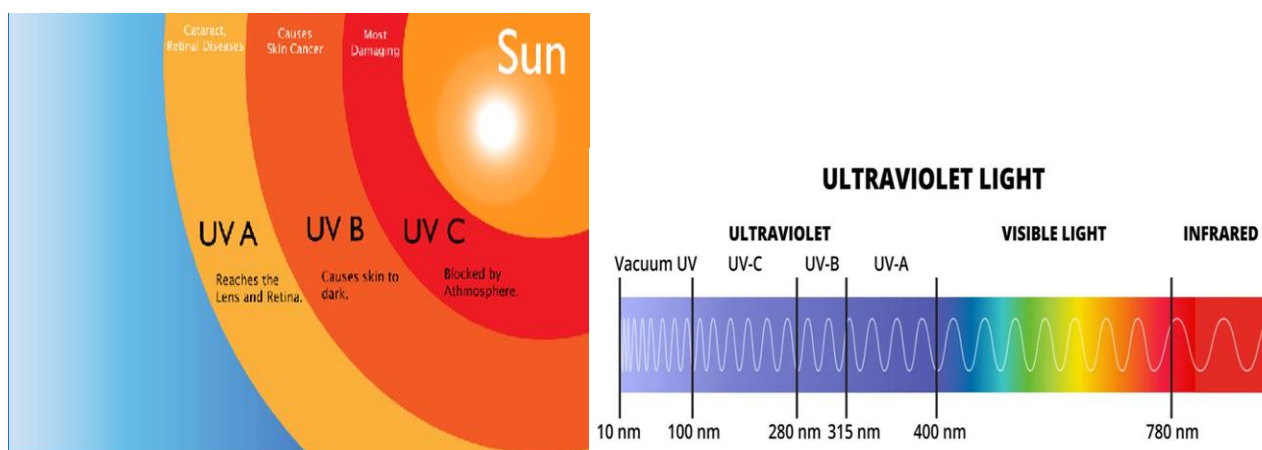


Figure 3: UVA, UVB & UVC different wavelengths.

Umbrellas vary in design according to their purpose, offering different levels of coverage and wind resistance. The primary umbrella shapes include classic dome/round, bubble, pagoda, and inverted canopies, alongside various shapes of patio umbrellas designed for outdoor living spaces. Umbrella ribs are the hinged, radiating rods that form the framework or skeleton of an umbrella. They support the fabric canopy and give it a curved shape when opened. Typically numbering between six and twenty-four, these ribs must be both sturdy and flexible to withstand strong winds.

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Origin from China. The creation of the umbrella is attributed to the wife of Lu Ban, who invented it during the Warring State Period. Some investigators have supposed that its invention was first created by tying large leaves to bough-like ribs (the branching out parts of an umbrella). An umbrella in life serves as a practical shield and a powerful metaphor for protection, preparation, and support during difficult times. It represents physical defense against the elements as well as emotional resilience and supportive relationships. An inverted umbrella shape can be created by merging four hyperbolic paraboloid (hypar) quadrants. This specific geometric form is widely used in modern kinetic architecture, large outdoor canopy designs, and structural engineering. Umbrellas vary in design according to their purpose, offering different levels of coverage and wind resistance. The primary umbrella shapes include classic dome/round, bubble, pagoda, and inverted canopies,

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Umbrellas block ultraviolet (UV) light, and their effectiveness relies on specific chemical and physical properties of the fabric. How well an umbrella stops UV radiation depends on weave density, pigment absorption, and reflective chemical coatings. Umbrellas can protect you from UV light, but only if they are specially designed. Regular rain umbrellas block visible shade, but many let through up to 20% of harmful ultraviolet rays. To get real protection, you need an umbrella with a UPF 50+ rating and a special UV-blocking or reflective coating. SPF stands for Sun Protection Factor, which measures how well a sunscreen shields your skin from UVB rays. It tells you how much longer you can stay in the sun before burning compared to wearing no protection.

Protection Levels

SPF 15: Blocks about 93% of UVB rays.

SPF 30: Blocks about 97% of UVB rays.

SPF 50: Blocks about 98% of UVB rays.

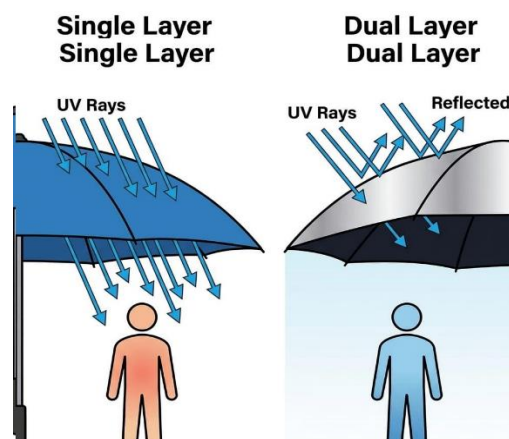


Figure 4: Effect of UV light.

Chemical and Physical Factors in UV Blocking

Reflective Coatings: Specialized UV umbrellas use external metallic or chemical layers (like titanium dioxide or silver coatings) that physically reflect photons of UV-A and UV-B away before the energy penetrates the material.

Pigment Absorption: Dyes and dark pigments (such as black or deep navy) absorb electromagnetic radiation in the UV spectrum, converting the light energy into harmless low-level heat.

Weave Density: The physical tightness of the thread count closes microscopic gaps. If light passes through the weave during a simple "light test," UV photons can slip through those same spaces.

UPF 50+ Rating: Certified fabrics block over 98% to 99% of both UVA and UVB rays.

Special Coatings: Look for options featuring a Venzina silver-coated exterior or black heat-shield lining to reflect radiation and lower the temperature underneath.

Fabric Density: Tightly woven synthetic materials like high-thread-count pongee or treated polyester stop light from leaking through.

Regular vs. UV Umbrellas

Regular Rain Umbrella: Low UV protection (estimated UPF 5 to 15), lets light pass through the weave, and can trap heat underneath. **Specialty Sun Umbrella:** High protection (UPF 50+), blocks up to 99% of rays, and uses reflective technology to keep you cooler.

CONCLUSION: UVA light is a long-wave form of ultraviolet radiation with a wavelength of 315 to 400 nanometers that makes up nearly 95% of the sun's UV rays reaching the Earth, causing skin aging, tanning, and long-term cellular damage.

Key Characteristics of UVA Wavelength: Measures between 315 nm and 400 nm, making it the longest wave type of UV radiation.

Penetration: Passes deep into the skin layers and easily penetrates through window glass.

Atmospheric Block: Passes completely through the ozone layer unaffected by atmospheric blocking.

Health and Practical Effects:

Skin Damage: Triggers premature aging, wrinkles, and indirect DNA mutations linked to skin cancer.

Tanning: Causes immediate skin darkening and tanning rather than acute painful burns.

Industrial Uses: Applied in laboratories, curing resins and inks, forensic inspections, and detecting fluorescent materials.

The main difference between UVA and UVB rays is that UVA causes skin aging and wrinkles, while UVB causes sunburn. UVA rays have longer wavelengths and make up 95% of the UV light reaching Earth, whereas UVB

rays have shorter, higher-energy wavelengths and damage the outer skin layer directly.

UVA Rays (Aging) Wavelength: Longer (315–400 nm), lower energy.

Penetration: Goes deep into the middle layer of the skin (dermis).

Effects: Causes tanning, skin aging, wrinkles, and breaks down collagen.

Presence: Passes through glass and stays strong all year.

UVB Rays (Burning) Wavelength: Shorter (280–315 nm), higher energy.

Penetration: Affects the outer layer of the skin (epidermis).

Effects: Causes sunburn, redness, and direct DNA damage leading to skin cancer.

Presence: Does not pass through glass; changes strength by season, time of day, and weather.

The full forms are Ultraviolet A (UVA), Ultraviolet B (UVB), and Ultraviolet C (UVC). They are types of invisible light energy from the sun and man-made tools sorted by their wave size.

UVA: Ultraviolet A Wavelength: 315 to 400 nm (longest waves)

Effect: Goes deep into the skin, causes aging and wrinkles.

UVB: Ultraviolet B Wavelength: 280 to 315 nm (medium waves)

Effect: Causes sunburns and harms the top layer of skin.

UVC: Ultraviolet C Wavelength: 100 to 280 nm (shortest waves)

Effect: Most dangerous, but blocked completely by the Earth's ozone layer.

REFERENCE

<https://en.wikipedia.org/wiki/Umbrella>