



## Dressing up for the mountain

It is probably easier to dress up for a theme party than for a cold weather trekking. One may be tempted to put on one thick and bulky jacket to keep warm, so to avoid having to bring more. But in actual fact, the best way to protect you from cold is to wear multiple layers which you can remove or add on depending on the weather conditions you are in. This is called the “layering system”.

Note: All Pictures shown in this document are for illustration purpose only

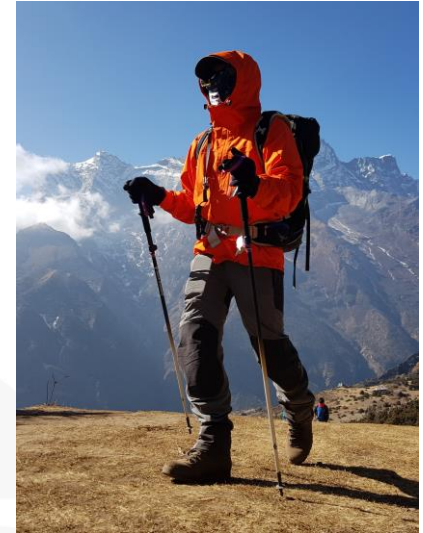


## The Layering Concept

The “layering system” is simply a way of wearing more than 1 piece of clothes to ensure you stay protected in extreme condition. This layering system usually refers to upper body attire; you can also apply this system to your legs, hands and feet. This system is not only useful to mountain climbers, it can be applied to skiers, snowboarders, and anyone who plan to visit cold places.

The guiding principle of layering is that you are regularly adding and removing layers to keep your body temperature even. An example, you may start off on a chilly morning hike wearing a base layer and a light fleece. As the body warms up, you remove the fleece. At lunch break, on a breezy ridge, you immediately put the fleece back on, and possibly the outer shell to cut the wind. After lunch, it all comes off (except the base layer) as you start hiking. Afternoon thunderstorm rolls in. You throw on your shell and open up the pit zips (underarm vents) and continue hiking.

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**ALWAYS** make sure that your extra layers are conveniently located in your pack, so that you can always easily reach them.

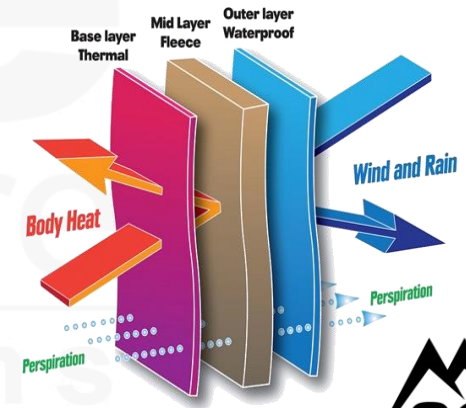
There are three main components to a layering system.

### ① First Layer - Moisture Management - Base / Inner / Skin Layer (Thermal)

Worn directly against the skin, this layer's primary function is wick away moisture towards the outer 2 layers where it will eventually evaporate to keep the body dry. When the body or the base / inner / skin layer is wet, no amount of insulating layers or warm clothing piled on is able to keep the body warm or prevent hyperthermia. Keeping dry helps you maintain a cool body temperature in the summer and avoid hypothermia in the winter.



1



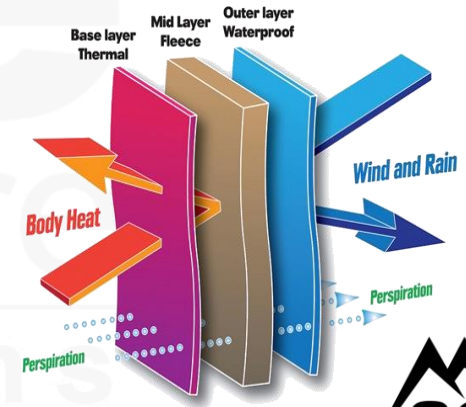


### ② Second Layer – Insulation - Insulating / Middle Layer (Fleece / Down Jacket)

This layer's function is to insulate heat to maximize warmth. It helps to retain heat by trapping air close to your body. It also helps facilitate the transfer of moisture wicked by the base layer on to the outer layer. For very cold and dry weather, especially those with temperature ranging below sub-zero, a down jacket is the best and sometimes wore over the base layer rather than a fleece or over the base layer and fleece.



2



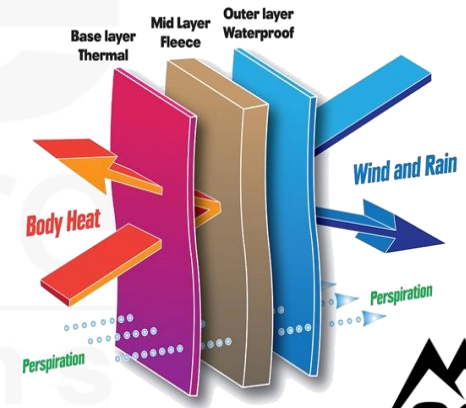
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### ③ Third Layer - Weather Protection - Shell / Outer Layer (Hard shell Jacket)

As the name suggests, this layer's function is to provide protection against the weather elements (wind and/or rain and snow) while also allowing the moisture received from the middle layer to be wicked away and ultimately evaporate. You may get away with a wind-breaker, but for more challenging weather, you want a waterproof and breathable jacket that keeps water out, yet let sweat vapour escape. You do not want to get wet from perspiration inside your layering system.



3



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### Here, we shall discuss the types of layers that are suitable for cold weather hiking/trekking/climbing:

The function of the **first layer** is to wick the sweat from your skin and dry quickly so you do not get chilled. **Cotton** is a good absorbent but it does not dry quickly, thus weighing you down and can actually cause a chill. **Wool** is efficient in keeping warm in the cold, but wool also tends to dry slowly when it gets wet. Some people with sensitive skin often find wool itchy on the skin. **Synthetic** (polyesters) make good base layers, it is lightweight, very capable of moisture wicking and can add much warmth while remaining breathable. The only down side of it is that it tends to stink easily. **Merino** wool is soft and helps to regulate body temperature, it helps to draw away excess heat from the body to prevent overheating when you engage in prolonged vigorous exercises. It has natural UV resistance which is ideal for cold but sunny environment. One of the best properties of merino wool is that it retains heat and their thermal properties even when wet and also wicks effectively well and strongly resists odour. **Bamboo** material is a relatively new invention made from bamboo extracts, sometimes combined with fibres such as cotton, Lycra, and even merino wool. A bamboo base layer is usually a tighter fit than other materials and holds their shape better. The super soft material is also ideal for those with sensitive skin who finds wool uncomfortable to wear. For cool conditions, the first layer (base or skin layer) is usually available in light-weight, mid-weight, or expedition-weight (heavy). Choose the weight that best matches your activity and temperature.

1



Synthetic (Polyesters)



Wool



Merino wool + Bamboo

Here is a simple comparison chart:

	PROs	CONs
<b>Cotton</b>	<ul style="list-style-type: none"> <li>- Keeps warm relatively well</li> <li>- Affordable</li> </ul>	<ul style="list-style-type: none"> <li>- Heavy</li> <li>- Soaks up moisture , unable to dry fast</li> <li>- Stinks easily</li> </ul>
<b>Wool</b>	<ul style="list-style-type: none"> <li>- Keeps warm very well</li> </ul>	<ul style="list-style-type: none"> <li>- Heavy</li> <li>- Unable to dry fast</li> <li>- Itchy on sensitive skin</li> </ul>
<b>Synthetic</b>	<ul style="list-style-type: none"> <li>- Lightweight</li> <li>- High wicking / quick dry</li> <li>- Relatively cheap</li> </ul>	<ul style="list-style-type: none"> <li>- Not antibacterial (stinks easily)</li> <li>- Not as warm as merino</li> </ul>
<b>Merino Wool</b>	<ul style="list-style-type: none"> <li>- Warmer than synthetic</li> <li>- Retains thermal properties even when wet</li> <li>- Soft feel</li> <li>- Natural antibacterial &amp; UV resistance</li> <li>- High wicking</li> <li>- Breathable</li> </ul>	<ul style="list-style-type: none"> <li>- May not wick as well as synthetic</li> <li>- Could shrink</li> <li>- More expensive</li> </ul>
<b>Bamboo</b>	<ul style="list-style-type: none"> <li>- Quick dry</li> <li>- High resistance to abrasions – will not fray easily</li> <li>- Soft feel</li> <li>- Less itchy – ideal for sensitive skin</li> <li>- Anti-static</li> <li>- Closer fitting than merino</li> <li>- Eco friendly (bamboo is sustainable)</li> </ul>	<ul style="list-style-type: none"> <li>- Not widely/easily available</li> <li>- Performance can vary greatly between brands</li> <li>- More expensive</li> </ul>

1

The **second layer**, insulating layer, helps you retain heat by trapping air close to your body. Natural fibre like wool and goose down are good insulators. There are a few types of material that you can choose from, depending on the activities that you are engaging in and the weather conditions.

**Merino** wool shirts offer soft and reliable warmth, keep insulating even when wet.

**Fleece** is lightweight, breathable; they also dry faster and have a higher warmth-to-weight ratio than wool. The drawbacks are that fleece is wind permeable and bulky (less compressible). Like base layer, fleece tops and pants (may not be as easily available as tops) are available in 3 weights – Light-Mid-Expedition.

**Goose down** is the best for very cold and dry conditions. It offers an unbeatable warmth-to-weight ratio and is highly compressible. You can also find duck down material; however they are usually heavier than goose down. Down's main drawback is that it must be kept dry to maintain its insulating ability.



Merino wool jacket



Fleece jacket



Goose down jacket



The **third layer**, outer shell or jacket (also commonly known as hardshell), protects you from wind, rain or snow. It ranges from simple windproof jackets to pricey mountaineering jackets. An outer shell is an important attire in bad weather. If wind and water are allowed to penetrate to your inner layers, you begin to feel cold. Without proper ventilation, perspiration cannot escape, instead condensing on the inside of your shell. Therefore, an outer shell should allow at least some perspiration to escape and treated with some water repellent agent. Fit is another consideration; your outer shell should have room to fit in other layers (first and second layers) and not restrict your movement.

### Outer shells can be categorized as follows:

**Waterproof/Breathable** – The most useful (and probably expensive) choice, and are best for wet, cold conditions. Different brands will have different laminated membranes (e.g. Gore-Tex, eVent, IsoDry) to offer top waterproofing and breathability performance. Some place emphasis on low weight, some on abrasion-resistant capability.

**Water-resistant/Breathable** – This category of shells are usually less expensive than waterproof shells; they are made to block wind and light rain.

**Soft shell** – The emphasis on soft shell is breathability and stretch fabric for added comfort during activities. Soft shell also offers insulation properties which they combine 2 layers into 1. It usually comes with cold or mild weather options.

**Waterproof/Non-breathable** – The most economical shell, waterproof and windproof, is ideal for rainy days with light activities.

**Insulated Shell** – Some outer shells have a layer of insulation built-in, such as fleece, making it convenient for cold, wet conditions. However, the shell is not versatile for layering system in fluctuating temperatures.

### Outer Shells Construction

Over the years, the construction of waterproof-breathable garments has evolved. In the context of waterproof jackets, there are different layers. The first layer is the face fabric, the durability fabric that is the outside layer of protection against the elements. The second layer is the waterproof breathable part of the fabric. The final layer is the layer that protects the waterproof coating or membrane from abrasion and pore-clogging contaminants and helps the jacket feel good on our skin. The methods of construction are named based on how these layers are fused together in the final fabric.



Outer shell aka Waterproof Jackets are worn to protect from wind and snow



Photo credit: Gore-tex

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There are 3 main types of outer shell construction:

### 2-Layer or 2-ply

For a 2-ply jacket, only the face fabric and the waterproof-breathable layer are laminated together. This protective coating enables water to bead on your jacket and roll off. An example of these protective coating is Gore-Tex. (Please note that Gore-Tex is not the only protective coat, there are other types, but Gore-Tex is one of most popular and trusted laminates.) The inner protective layer is a separate fabric or mesh liner that hangs on the inside of the jacket. The principle benefit is comfort, as that hanging liner forms a nice interface with the skin. The drawbacks are weight, bulk (the hanging liner makes the garment harder to pack down), and breathability issues (the liner is one more layer moisture needs to get through). This is most commonly seen in casual and fashion jackets, and some rain pants.

### 2.5-Layer or 2.5-ply

The 2.5-ply jacket is the most common type of construction for lightweight rain gear. The face fabric and waterproof-breathable layer stay more or less the same as 2-ply, but the inner protective fabric is eliminated in exchange for a printed or sprayed-on partially protective layer. This is the lightest, most flexible, most packable, and often least expensive construction available. The main drawbacks are durability, because reducing the protective layer increases wear on the waterproof-breathable layer, and breathability, because the spray-on protective layers do not reliably breathe as well as hanging mesh or laminated scrim.

### 3-Layer or 3-ply

A 3-ply jacket has the microporous membrane (e.g. Gore-Tex) laminated between the face fabric and a protective knit backing as opposed to on top of it with two layer. The jacket then has three layers as such, the outer fabric, the protective coating in the middle, then an inner layer usually made with some kind of sewn-in lining like mesh or nylon. However, to our eyes, it looks like one layer. This makes the fabric lighter, more packable, and more durable (because the waterproof-breathable layer is never exposed, even to the inside of a hanging liner). The drawbacks to 3 layer construction are that losing the liner decreases comfort, laminating three layers together decreases the flexibility of all three, and more intensive production drives up the cost.

Here is a simple comparison chart:

	PROs	CONs
<b>2-Layer or 2 ply</b>	<ul style="list-style-type: none"> <li>- Flexible material</li> <li>- Comfortable</li> <li>- Cheaper</li> </ul>	<ul style="list-style-type: none"> <li>- Not as breathable as 3-ply</li> <li>- Not as durable as 3-ply</li> <li>- Not same level of protection as 3-ply</li> </ul>
<b>2.5-Layer or 2.5 ply</b>	<ul style="list-style-type: none"> <li>- Flexible material</li> <li>- Lightest among all</li> <li>- Probably most packable</li> <li>- Cheaper than 3-ply</li> </ul>	<ul style="list-style-type: none"> <li>- Not as breathable as 3-ply</li> <li>- Not as durable as 3-ply</li> <li>- Not same level of protection as 3-ply</li> </ul>
<b>3-Layer or 3 ply</b>	<ul style="list-style-type: none"> <li>- Very durable</li> <li>- High level of protection</li> </ul>	<ul style="list-style-type: none"> <li>- Most expensive</li> <li>- Usually bulkier and heavier</li> </ul>



## Hardshell and Softshell

### What is a hardshell?

A hardshell jacket is a waterproof jacket with a hood, it serves as the outermost layer. They are designed to provide lightweight, durable and waterproof breathable protection in rain or snow. Hardshell jackets tend to be stiffer than softshells.

### What is a softshell?

A softshell jacket is flexible and can help protect you from the elements, but not to the degree a hardshell jacket is intended to. It is a water-resistant, stretchy-and-breathable shell that offers breathable protection from light snow and rain. Most softshell jackets feature a soft lining or fleece lining that offers added warmth.

### The benefits of hardshell and softshell

Hardshell	Softshell
<ul style="list-style-type: none"> <li>▪ <b>Weather protection:</b> Hardshell jackets are often engineered to protect against wind and rain, and can be used as a shelter</li> <li>▪ <b>Resist wear and tear:</b> The tightly woven fabrics help maintain the quality of this outerwear option</li> <li>▪ <b>Breathable:</b> Hardshell jackets made with three-layer fabric help reduce the accumulation of sweat during outdoor activities</li> <li>▪ <b>Ready for adventure:</b> These durable jackets are often designed for extreme sporting activities</li> </ul>	<ul style="list-style-type: none"> <li>▪ <b>Mobile:</b> The fabrics used in softshell jackets are flexible, allowing for maximum movement</li> <li>▪ <b>Comfortable:</b> The inner lining, often made of fleece, is comfortable and provides warmth</li> <li>▪ <b>Packable:</b> The thinner, easy-to-work fabric makes a softshell jacket simple to stuff into a pack or even to be folded into a pillow</li> <li>▪ <b>Water resistant:</b> Though typically not entirely waterproof, a softshell can stand up to a run in a light rain or snow</li> </ul>