Sourdough Manual

Klondike Derby 2015

Camp Marin Sierra
Marin Council, B.S.A.
Talako Lodge
Feb. 27-March 1, 2015

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General Information

Water Supply

The winter water supply at Marin Sierra is limited, and we're not yet sure if troops will be able to draw water from the lodge, so plan to melt the cold white stuff or bring a supply to last you the weekend. To make a water machine, stuff a clean burlap sack with snow and suspend it over a pot near the fire. As the snow melts it drips into the pot. Near a warm fire this arrangement will supply a whole patrol if kept constantly full of snow.

Fires and Fuel

We recommend white gas stoves for cooking. They burn hot in cold weather and don't use large volumes of fuel. Liquid propane bottles may also be used, but they put out less heat in cold weather, so cooking may take forever. Don't forget a few small squares of plywood to set the stoves on.

Fires for cooking and warmth may be built in your campsite. Bring your own wood! The stores of wood at the lodge are to be used only by the units renting the lodge throughout the winter. If you wish to forage for wood around the camp, you may.

Starting fires

Winter camping offers scouts a chance to really test their fire starting skill. When you really need the fire, don't be caught without a few tricks up your sleeve. The camp rules prohibit the use of liquid fire starters, but there are lots of other options that will get you a rip roaring fire in a short time. Some people call the use of fire starting aids cheating, but if it gets the job done, call it Yankee ingenuity. For an example of a failed fire starting attempt, see the Jack London short story "To Build a Fire." Simple paraffin wax fire starters can be made with string and newspaper, see the Scout handbook. Small pieces of Duraflame logs also work well. Experiment in a safe area at home to make sure your fire aids work. Light them first and build your fire on top. No fire starter works well without plenty of dry kindling. Keep a supply of tinder and kindling in plastic bags. Cedar shingles are great if you have them. If you have no dry wood, split open a log. Water does not usually penetrate wood more than 1/2 inch.

Warning! Root Fires! Remember, much of the ground around the camp is burnable, even under snow. Open fires will burn through the snow and may light the ground beneath. These fires can burn for weeks and come to the surface hundreds of feet away when the woods are dry. **Plan your fire in a safe place and make sure it is out when you leave**. *Note: This is what caused the Mt. Vision fire in Marin County a few years ago!*

Camp Marin Sierra rules for fires. Remember, stoves and lanterns are also open fires.

- **Cooking fires may be built in any safe campsite area that has no limbs within 10 feet overhead and is cleared to mineral earth in a 10 foot radius.**
- **Fires require separation from the ground. This can be done with a 55 gallon drum or other Camp Ranger approved device.**
- **At least one bucket of water and one shovel shall be present at each campsite.**
- **A fire shall never be left unattended unless property banked in a sheepherder stove.**
- **All campfires shall be approved by the Camp Director, Camp Ranger or staff member.**
- **No liquid fuel type heaters are allowed in camp. LPG and liquid fuel type stoves are permitted when used in accordance with the clearing instructions at the beginning of this section.**
- **An adult (at least 18 years of age) or staff member shall be in direct supervision of a stove.**
- **LPG and liquid fuel lanterns are permitted only when used on top of a sturdy table or hung in accordance with the clearing instructions at the beginning of this section. A lantern shall not be moved when lit or hot. An adult (at least 18 years of age) or a staff member shall be in direct supervision of a lantern.**
- **All liquid fuel except that contained within a liquid fuel type stove or lantern or within approved backpack type fuel bottles shall be deposited with the camp director or camp ranger for proper storage. No other liquid fuel shall be stored in campsites or vehicles.**
- **No open flames are allowed in tents. Use only battery operated lanterns and/or flashlights.**
- **No fireworks are allowed on B.S.A. property.**
- **Smoking is only allowed in designated areas which shall conform to the clearing instructions at the beginning of this section when out-of-doors. (Smoking is considered to be an open fire.)**
- **Campfire permits shall be obtained by the Camp Ranger or Camp Director annually or as required.**
- **Flares and torches are not normally allowed in camp and shall be used only as a part of a ceremony as approved by the Camp Director or Camp Ranger. Use of liquid fuel for starting any type of fire is prohibited.**

PATROL or TROOP EQUIPMENT *(Use this list as a guide. You can add as you please.)*

Duty roster

Food

Food (normal menu)
Emergency food
Menu
Condiments - sugar, salt, pepper, etc.

Food Preparation Equipment

2 stoves, white gas is best, with windscreens
Liquid fuel in approved bottles *(see the attached camp rules for fires and stoves)*
2-3 pots, 2-4 quart size, with lids *(water boils 3 times faster when covered)*
Water container, filled (5 gallon insulated is best)
Water purification tablets, filter etc.
Coffee pot
Can Opener
2 large spoons
1 pair pot tongs
Cloth pot holders

Clean-up

Scouring pads and other cleanup stuff
Toilet paper

Fire

Fire starting kit (matches, paraffin starters, steel wool, etc.)
Firewood, kindling and cover
Fire buckets (required)

Light

Lantern (it gets dark early in winter)

Tents & Equipment

Tents and ground sheets (see Shelter)
Tarps (lots)
Group first aid kit
Trash bags (bring lots, they are good for many things besides trash)
1 folding saw (avoid axes, the blades become brittle in cold and campsites are crowded)
Shovel (several if you plan to build snow shelters)
Rope, cord etc. (this is another thing you should have plenty of)
Repair kit (wire, pliers, tape, string, needle, thread, safety pins, file, etc.)
Whisk brooms (for brushing off snow)
American flag and Troop flag on pole

COMPETITION EQUIPMENT

Each patrol competing should have a sledge and the following equipment. This list is not final; it may be changed or added to at the whim of the Patrol. Refer to the event descriptions to determine what else you might need. Sledge must be at least 6 feet long and weigh 50 pounds.

Patrol flag
Troop number and patrol name on sledge
Rain gear for each scout
Notebook and pen or pencil
Scout handbook
2 blankets
Ice rescue materials
Rope
6 foot poles or staves
Can Opener
Tin can or pot, 1 quart+
Spade shovel or trowel
Firewood
Matches
Tinder
Compass
First aid kit

THE WELL DRESSED SOURDOUGH

Do you want to stay warm in the snow? Just remember **C.O.L.D.**

Keep **CLEAN**. Keep yourself and your clothes clean. Dirt and body oils which build up on clothing destroy its insulating properties.

Avoid **OVERHEATING**. Clothing is designed to be taken off or added in layers to maintain an even body heat. Increased activity produces more heat and perspiration. Don't let yourself get damp, see below.

Wear clothes **LOOSE** and in **LAYERS**. You can peel or add a layer or two depending on air temperature or your activity.

Keep **DRY**. Wet clothing removes body heat 240 times faster than it will dissipate through dry clothing. Wet is trouble!

Staying Warm *by Rick Curtis*

The essence of staying warm in the winter is having the proper clothing layers and knowing how to use them effectively.

Heat Loss

The body basically acts as a furnace, producing heat through chemical reactions and activity. This heat is lost through conduction, convection, evaporation, radiation, and respiration. As physical activity increases so does heat production and conversely as activity decreases so does heat production. The key to keeping warm is to add insulation to the body.

Insulation

The thermal insulation of clothing is proportional to the thickness of the dead air space enclosed. Dead air is defined as any enclosed unit of air that is small enough that natural convection currents would not arise in it. Such currents have been detected in units as small as 2 millimeters in diameter. The dead air next to the skin is heated up by the body and provides a layer of warmth around the body. The clothing is not what is keeping you warm it is the dead air. This is because the denser a material the faster it can transfer heat through conduction, the density of air is obviously minuscule compared to a piece of a fabric. The "clo" unit was developed to provide a measurement of insulating effectiveness. One clo is roughly equal to the insulating value of an ordinary wool business suit. Each inch of thickness of conventional insulating materials (wool, pile, down) provides a theoretical value of about 4.7 clo or a practical "in use" value of 4.0 clo.

The Layering Principle

The key to providing this dead air space is through having a number of layers of clothing. Each layer provides a certain clo value of dead air space. This allows you to add or shed layers to increase or decrease your accumulated dead air space as the temperature changes and/or as your activity level changes. Remember, your body is the heat source, the clothing layers only serve to trap the heat and slow down your heat loss to the cold environment. If you have too much clothing on, you will overheat and start to sweat. You need to find the proper heat balance between the number and types of layers and your activity level.

Why not just have lots of layers on and sweat? Heat loss from a wet surface can be up to 25 times greater than a dry surface (due to the higher density of water). If you sweat and get soaked, you will lose heat much more quickly through evaporation of the water. Also you are loosing an incredible amount of water through sweating since the air is so dry. Too much water loss leads to dehydration which significantly increases the risk of hypothermia. So you want to control your layers so as to be warm at the activity level you are in but not sweating profusely.

Thus, traveling in the winter is a *constant* process of adjusting your layers to keep comfortable. This means having a number of layers you can add or subtract and allowing for versatility within layers. Convection may account for the greatest amount of heat loss under most conditions. In order to properly insulate, you need to have an outer layer that is windproof.

Another convective factor is the "bellows action" of clothing. As you move a bellows action occurs which tends to pump your accumulated warm air out through openings in your clothing and sucks the cooler air in. In some conditions this action can reduce your body's personal insulation by 50% or more. Thus, it is important that *all* layers have effective methods of being "sealed" (i.e. buttons, zippers etc.) Openings in layers allow you to ventilate, to open the "chimney damper" if you are beginning to overheat, without having to actually remove a layer. So opening and closing zippers on a jacket, or armpit zips will allow you to either ventilate if you are getting too hot or seal up if you are getting chilly, all without having to add or take off a layer. With clothes that are too loose, the bellows action pumps warm air out through the openings. You need to have clothes that fit properly but not tightly. Too tight, and the clothes compress and actually reduce dead air space in layers below as well as restricting body movement.

Another general rule is that the efficiency of clothing is proportional to the diameter of the body part it covers. Thus a given thickness of insulation added to your trunk will be more thermally efficient than the same thickness added to your arm or leg. It will also help maintain that body core temperature. This is why vests work well to maintain body heat. There is an optimal thickness of insulation for each body part. Beyond that the added bulk tends to be more of a hindrance in movement than the added insulation is worth.

Have you ever noticed that your hands feel colder after putting on a thin pair of gloves? This is because when insulation is wrapped around a curved surface, the cross-sectional area of the insulation through which the heat may flow is greater as is the surface area from which the heat may be lost. This means that the total insulation efficiency of a given thickness progressively decreases as curvature sharpens over a surface. In addition, small cylinders, such as fingers, show a paradoxical effect. The addition of a thin layer of insulation actually increases heat loss until a thickness of about 1/4 inch is reached. This heat resistance gains as additional thickness is added. However, added thickness beyond 1/4 inch increases warmth very little in proportion to its thickness. This is one reason that thin gloves don't keep your hands particularly warm.

Clothing Materials

Some of the different types of materials for winter clothing and insulation are discussed below.

1. **Wool** - derives its insulating quality from the elastic, three-dimensional wavy crimp in the fiber that traps air between fibers. Depending on the texture and thickness of the fabric, as much as 60-80% of wool cloth can be air. Wool can absorb a fair amount of moisture without imparting a damp feeling because the water "disappears" into the fiber spaces. Even with water in the fabric wool still retains dead air space and will still insulate you. The disadvantage to wool is that it can absorb so much water (maximum absorption can be as much as 1/3 third the garment weight) making wet wool clothing very heavy. Wool releases moisture slowly, with minimum chilling effect. Wool can be woven in very tight weaves that are quite wind resistant. An advantage to wool is that it is relatively inexpensive (if purchased at surplus stores). However, it can be itchy against the skin and some people are allergic to it.

2. **Pile or Fleece fabrics** - is a synthetic material often made of a plastic (polyester, polyolefin, polypropylene, etc.). This material has a similar insulative capacity as wool. Its advantages are that it holds less water (than wool) and dries more quickly. Pile is manufactured in a variety of different weights (thicknesses) offering different amounts of loft and insulation. This allows for numerous layering possibilities. The disadvantage of pile is that it has very poor wind resistance and hence a wind shell on top is almost always required. Versions of pile are available that have a middle windproof layer.

3. **Polypropylene and other Hydrophobic fabrics** - polypropylene is a synthetic, plastic fiber which offers dead air space and a fiber which cannot absorb water. The fiber is hydrophobic so it moves the water vapor away from the source (the body). Polypropylene layers are extremely effective worn directly against the skin as a way of keeping the skin from being wet and reducing evaporative heat loss. As the water moves away from the body it will evaporate, but each additional millimeter of distance between your skin and the point of evaporation decreases the amount of body heat lost in the evaporative process. Some fabrics rely on the chemical nature of the fiber to be hydrophobic. Others fabrics use a molecular coating the achieve the same end.

4. **Vapor Barrier Systems** - another way to stay warm in the winter is through vapor barriers. The body is always losing water through the skin even when we are not active. This loss is known as insensible perspiration and occurs unless the air humidity is 70%. This insensible perspiration goes on at the rate of nearly half a quart every 24 hours. Since it takes 580 calories per gram to turn liquid water into water vapor, heat is continually lost through insensible perspiration as well as through sweat from any activity. A vapor barrier is a clothing item which is impervious to water thereby serving as a barrier to the transportation of water vapor. When worn near the skin it keeps water vapor near the skin. Eventually the humidity level rises to the point where the body senses a high humidity level and shuts off insensible perspiration. This prevents evaporative heat loss and slows dehydration.

   Vapor barriers should not be used directly against the skin because any evaporation of moisture directly at the skin surface leads to heat loss. Wearing polypropylene or some other hydrophobic layer between the skin and the vapor barrier allows the moisture to be transported away from direct skin contact. There is no doubt that vapor barrier systems are effective **for some people in some conditions.** The issues you must consider before using a vapor barrier are activity level, amount you naturally sweat, and "moisture comfort." If you are not active, such as when using a vapor barrier liner at night in a sleeping bag, the system will work well. A vapor barrier sleeping bag liner will typically permit you to sleep comfortably in temperatures 10 - 15 degrees colder than in the bag alone. However, some people find that they are not comfortable with the level of moisture in the bag and fell clammy. If this interferes with sleeping it may be a problem, better to have a better insulated sleeping bag. Vapor barrier liners for sleeping bags also help in another way. In cold conditions, the moisture from your body escapes upward through the bag, when reaching the cold outside of the bag it condenses into liquid or event frost. Over a number of days this moisture level in your bag increases. If you can't dry out the bag it will slowly get heavier and heavier as it holds more water. With a down bag, this moisture can actually soak the feathers and cause the bag to loose significant amounts of loft (dead air space), thereby reducing it's effectiveness.

   When you are active, like snowshoeing, and you are wearing a vapor barrier such as a vapor barrier sock, you must carefully monitor how you sweat. If you are someone who sweats a lot with activity, your foot and polypropylene liner sock may be totally soaked before the body shuts down sweating. Having this liquid water next to the skin is going to lead to increased heat loss. If you don't sweat much, your body may shut down perspiration at the foot before it gets actually wet. This is when the vapor barrier system is working. The important point is that heat loss comes from water changing state from a liquid to a gas. Liquid water next to the skin leads to significant heat loss. Water vapor next to the skin does not. You must experiment to determine if vapor barrier systems will work for you.

5. **Polarguard, Hollofil, Quallofil and others** - these are synthetic fibers which are primarily used in sleeping bags and heavy outer garments like parkas. The fibers are fairly efficient at providing dead air space (though not nearly as efficient as down). Their advantages are that they do not absorb water and dry fairly quickly. Polarguard is made in large sheets. Hollofil is a fiber similar to Polarguard but hollow. This increases the dead air space and makes the fiber more thermally efficient. Quallofil took Hollofil one step further by creating four "holes" running through the fiber.

6. **"Superthin" fibers - Primaloft, Microloft, Thinsulate and others -** the principal behind these synthetic fibers is that by making the fiber thinner you can increase the amount of dead air space. For example, take an enclosed space 5 inches wide and place 2 dividers into that space, each 1 inch thick. You have an effective air layer of 3 inches. If you take the same 5 inch space and divide it with 4 dividers, each 1/4 inch thick you now have an effective air layer of 4 inches. You have gained one inch. Under laboratory conditions a given thickness of Thinsulate is almost twice as warm as the same thickness of down, however, the Thinsulate is 40% heavier. Thinsulate is made in sheets and therefore tends to be used primarily for outer layers, parkas and pants. New materials such as Primaloft and Microloft are superthin fibers that are close to the weight of down for an equivalent fiber volume. They are now being used in parkas and sleeping bags as an alternative to down. They stuff down to a small size and have similar warmth to weight ratios as down without the worries about getting wet.

7. **Down** - feathers are a very efficient insulator. They provide excellent dead air space for very little weight. The major problem with down (and it can be a major problem) in the winter is that down absorbs water. Once the feathers get wet they tend to clump, and lose dead air space. Using down items in the winter takes special care to prevent them from getting wet. For example, a vapor barrier sleeping bag liner in a down bag will help the bag stay dry. Down is useful in sleeping bags since it tends to conform to the shape of the occupant and

prevents convection areas. Down is very compressible, which is an advantage when putting it into your pack but also realize that your body weight compresses the feathers beneath you and you need good insulation (foam pad, etc.) underneath you, more so than with a synthetic bag. Some people are allergic to down. The effectiveness of a down bag is directly related to the quality of the feathers used. Since down is made of individual feathers, sleeping bags are garments must have baffles sewn in to prevent the down from shifting in the bag which would create cold spots.

8. **Radiant Barriers** - some portion of body heat is lost through radiation. One method of retaining this heat is through use of a reflective barrier such as aluminum. This is the principal used in "Space Blankets" and is also used in some bivy sacks and sleeping bags.

Note: Cotton is basically useless in winter time. It wicks water, but unlike polypropylene, cotton absorbs this moisture and the water occupies the space previously occupied by dead air. This means a loss in dead air space, high evaporative cooling, and a garment that is almost impossible to dry out.

The Body and Clothing

1. **Head** - because the head has a very high surface to volume ratio and the head is heavily vascularized, you can lose a great deal of heat (up to 70%) from the head. Therefore, hats are essential in winter camping. The adage - if your toes are cold, put on a hat - is true. A balaclava is particularly effective and versatile. A facemask may be required if there are high wind conditions due to the susceptibility of the face to frostbite.

2. **Hands** - mittens are warmer that gloves because you don't contend with the curvature problem described above. Also the fingers tend to keep each other warm, rather than being isolated as in gloves. It is useful to have an inner mitten with an outer shell to give you layering capabilities. Also "idiot strings" are important to keep you from losing mittens in the snow. However, gloves are always essential as well in winter because of the need for dexterity in various operations.

3. **Feet** - finding the right footgear depends a great deal on the activity you are involved in as well as temperature and environment. The two general modes of travel are skiing or snowshoeing (in areas with only a few inches of snow you can hike in just boots).

    - **Insulated Boots** - such as Sorels or "Mickey Mouse" boots. These are rubber or leather and rubber boots that use a layer of wool felt to provide dead air space. The Mouse boots can be Army surplus or modern copies (avoid the copies since they are often poorly made). With the true Army boots, the black boots are rated to -20 degrees and the white ones to -40 degrees. The one drawback with Sorels is that the wool felt liner is exposed. Breaking through a frozen stream may soak the liner which will be difficult to dry. They can be used with snowshoes, crampons and skis (with special bindings).
    - **Plastic Mountaineering Boots** - plastic shell mountaineering boots use inner boots made with wool felt or a closed cell foam insulation. These can be very warm and easily used with ski bindings, crampons, and snowshoes. Depending on the inner boot, you may need insulated overboots to add enough insulation to keep your feet warm.
    - **Mukluks** - one piece moccasins which reach to the knee. They are used with felt liners and wool socks. The Mukluk itself serves as a high gaiter. They are flexible and breathable. They work with snowshoe bindings and can be used on cross-country skis with special bindings (Berwin Bindings) and with hinged crampons (not for technical ice). They are extremely comfortable, but since they are not waterproof they are best used in dry cold winter settings where water and rain are not a problem (e.g. stream crossings, possibility of rain, etc.)
    - **Heavy leather mountaineering boots** with an insulated overboot - this can be effective but the system still is not very thermally efficient and may lead to frostbite of the feet *(not recommended).*

    1. **Socks** - one of the best systems for keeping feet warm is using multiple layers. Start with a thin polypropylene liner sock next to the skin to wick moisture away followed by 1 - 2 pairs of wool or wool/nylon blend socks. Make sure the outer socks are big enough that they can fit comfortably over the inner layers. If they are too tight, they will constrict circulation and increase the chances of frostbite. Keeping your feet dry is essential to keeping your feet warm you may need to change your socks during the day. Foot powder with aluminum hydroxide can help. High altitude mountaineers will put antiperspirant on their feet for a week before the trip. The active ingredient, aluminum hydroxide will keep your feet from sweating for up to a month. (Some medical research has suggested a link between aluminum and Alzheimer's Disease but small exposure [as of the original writing of this article] does not appear to be a problem).
    2. **High Gaiters** - are essential for winter activity. They keep snow from getting into your boots and keep your socks and pants legs free from snow.
    3. **Insulated Booties** - these are booties insulated with a synthetic fill that typically have a foam sole to insulate you from the ground. They are very nice to have to wear in your sleeping bag at night.
    4. **Camp Overboots** - are shells with an insulated bottom. These can be worn over insulated booties for traipsing around in camp. Also for those middle of the night visits to the woods.

4. **Outer Layer** - it is essential to have an outer layer that is windproof and at least water resistant. In some cases it may be best to have the garment waterproof. It also needs to be able to be ventilated. There is a big trade off between waterproofness and ability to ventilate. A completely waterproof item will keep the water that is moving through your other layers trapped, adding to weight and causing some heat loss. However, in wet snow conditions, if the garment is not waterproof it can get wet and freeze. Gore-tex and other similar fabrics provide one solution. These fabrics have a thin polymer coating which has pores that are large enough to allow water vapor to pass through but too small to allow water droplets through. Nothing is perfect, however, and although Gore-tex does breathe, it doesn't breath as well as straight cotton/nylon blends. If you opt for a straight wind garment, 65/35 blends of cotton and nylon work well. The other approach is to have a waterproof garment with sufficient ventilation openings to allow water vapor to escape. This provides the ability to work in wet snow without worrying about getting the garment soaked. Part of the basis for making the decision is the area and you are traveling in. If you are in the dry snow of the Rockies you needn't worry so much about waterproofness. If you are in the northeastern mountains where freezing rain is a possibility or very wet snow, you need to be prepared to be wet.

5. **Zippers** - are wonderful accessories for winter clothing. Having underarm zippers on jackets can greatly increase your ability to ventilate. Having side zippers on pants can allow you to ventilate and to add or subtract a layer without taking off skis or snowshoes.

6. **Miscellaneous** - knickers with knicker socks can make a good combination. You have the option of ventilating by opening up the bottom of the knickers and/or rolling down your socks. Also bibs are helpful (both pile and outer waterproof layer) because they prevent cold spots at the junction between tops and bottoms. Underwear is also available in the traditional union suit design which accomplishes the same thing. Snaps on jackets etc. can be a problem because they fill with snow and ice and fail to work. Velcro works much better as a closure.

Clothing Techniques

1. When you first get up in the morning (and at the end of the day in camp), your activity level will be low as will be the temperature. You will need to have many, if not all, of your layers on at this point until breakfast is over and you have started to become active.
2. When you get ready to be active, you will need to take off layers since you will begin generating heat. A good rule of thumb is to strip down until you feel just cool, not chilled just before activity. Failure to do this will mean overheating, sweating, losing heat and you will have to stop in 10 minutes down the trail anyway to take layers off. Open or closing zippers, rolling sleeves up or down, taking a hat off or putting one on will all help with temperature regulation.
3. If you stop for more that a few minutes, you will need to put on another layer to keep from getting chilled. Keep a layer close at hand.
4. Whenever you get covered with snow, either from a fall or from dislodged snow from a tree, it is essential to brush yourself off to keep your clothing free of snow. Failure to do this often results in the snow melting into your clothing and refreezing as ice.
5. At the end of the day, as activity decreases and temperature drops, you will need to add layers. Once you start to cool down it takes a lot of the body's resources (calories) to heat up again so layer up ASAP before you get chilled. It may be good to put on more that you think you need; it will only get colder. If you are too warm, you can open up layers and ventilate to reach the proper temperature.

Sleeping Bags

Sleeping bags for winter camping should be rated to temperatures below what you will likely experience if you want to be comfortable. If the nighttime temperature can drop to -15o Fahrenheit, then your bag should be rated to -30o Fahrenheit. There are a variety of different fills for sleeping bags: down, Primaloft, Microloft, Qualofill, Polarguard, etc. The bag itself should be a mummy style bag with a hood. It should also have a draft tube along the zipper and a draft collar at the neck. In sleeping bags, you want the bag to snugly conform to your body. If the bag is too big, you will have large spaces for convection currents and you will be cold. In a bag that has too much space, you may need to wear clothing layers to help fill up the space. You can opt for the expedition bag which is rated to -30o Fahrenheit or you can use a three season bag rate rated to 0o Fahrenheit and augment it with a vapor barrier liner (adds 5-10 degrees), a bivy sack (adds 5-10 degrees), and/or an overbag (a summer weight bag that fits over your mummy bag - adds 15 - 20 degrees make sure it is big enough to fit over the mummy without compressing it). Keep in mind that each of these options has advantages and disadvantages in terms of price, weight, and volume taken up in your pack.

Foam Pads

You also need to insulate yourself from the underlying snow. Foam pads (Ensolite) or inflatables (Thermarest) work well. Your insulation should be a least 1/2" thick (two 3/8 " summer pads work well, or use a Thermarest on top of a 3/8 " foam pad). It best to use full length pads so that all of your body is insulated.

Winter Clothing

The clothing you pack should be your own combination of the several options available. You should be prepared for the worst weather anticipated, but not over packed. The use of the layer principle allows you to stay warm without a lot of extras. For weekend trips you need only change the lower layers to keep clean. In the coldest conditions you will need 2-4 layers on your legs and 4-6 layers on your upper body. Pay close attention to the places where clothes come together, wrists, ankles, neck and

waist. Make sure they're not exposed while you're moving around. Don't forget to waterproof your boots. For more information on winter clothing see the Boy Scout Handbook and Fieldbook.

The clothing list that follows is an example only. It lists options, not absolute necessities. Use the illustration on the **"Well Dressed Sourdough"** page to plan, and lay out your clothing on the floor to make sure you have it all. Remember, avoid cotton and try to use wool. Don't bring denim jeans or jackets!

On your head and neck Number to pack
- Wool cap or ski mask 2
- Full brim hat (felt or canvas)
- Scarf
- Sunglasses
- Sunscreen
- Lip balm

Rain gear
- Poncho (this is best)
- Rain slicker
- Trash bags (for your clothes or as emergency poncho)

On your body (4-6 layers)
- T-shirt 2-3
- Long sleeve shirt (wool) 1-2
- Fleece jacket, synthetic or wool sweaters (I or 2)2
- Insulated vest
- Jacket (wool, nylon, gore-tex, leather)
- Parka with hood
- Nylon windbreaker

On your hands
- Insulated gloves (vinyl, gore-tex, waterproofed fabric)1-2 pair
- Wool gloves
- Mittens (oversized-can be worn over gloves for added warmth)

On your legs (2-4 layers)
- Underwear 2
- Longjohns 1-2
- Fleece pants (must bring waterproof/breathable shell)
- Trousers (wool army pants are great)
- Powder pants
- Nylon rain pants or snow chaps

For bedding down
- Wool cap
- Thermal shirt (fleece or polypropylene is best)
- Pants or long johns (fleece or polypropylene is best)

On your feet and ankles
- Wool or wool/polypropylene socks 6 pair (recommended) 3 pair (minimum)
- All the leather surfaces of hiking boots must be waterproofed (nylon won't keep water out)
- Insulated rubber boots
- After ski boots (moon boots)
- Gaiters
- (Leave your tennis shoes & 1 pair socks in the car for the trip home)
- More socks

HAT - Always carry a head covering. Wool caps are best, they insulate well and cover the ears. Ski masks are great too. Baseball type caps are only good for warm weather.

EYE PROTECTION - Goggles are best, but sunglasses will also reduce glare from the sun off the snow, a situation which will cause painful problems, even snow blindness. Lenses should be polarized and have UV protection

SCARF - Keeps cold air and snow off your neck and out of your shirt.

GLOVES OR MITTENS - Bring 2 pair: one for snowball fights, the other for the rest of the time. Breathable wool stays dryer than vinyl.

PANTS, 2 TO 4 LAYERS - Start with long johns, finish with water resistant chaps or nylon rain pants. In between you can wear layers of fleece pants, or wool. Powder pants or wool army pants are great for an outer layer. Suspenders are useful because they don't cinch like a belt to make breathing tough.

GAITERS - These are sleeves of water resistant fabric that lace up in back and tie at the top, below your knee. They keep snow out of your boots.

BELT PACK - This is for all those things that would normally go in your pockets, knife, sunscreen, etc. When you're wearing over pants, you can't reach your pockets.

6 LAYERS ON TOP - Start with a T-shirt or long johns and add layers of loose fitting wool or synthetic sweaters or sweat shirts. Top it all off with a loose, water resistant jacket (maybe borrow Dad's nylon windbreaker). Take a poncho too. It keeps falling snow away from your clothes so you stay warmer.

SOCKS - Wear two pair if they'll fit in your boots. Use wool or fluffy synthetics. Polypropylene blends and boot liners will keep your feet dryer. Change your socks often to stay warm and prevent blisters.

BOOTS - Proper footgear is essential; you're standing on ice. Keep your feet dry. A boot should fit somewhat loose for warmth, but the adage "cool is comfortable" is true: the feet should not sweat profusely. Avoid rubber boots without insulation, they'll turn your toes to ice cubes. Moon boots are great, but if they're too loose, you may lose them in deep snow. Leather hiking boots work well when

treated with Sno Seal, silicone, or shoe grease. Fabric sided hiking boots can be treated with silicone sprays but can't be completely waterproofed.

MATERIAL COMPARISONS

PLASTICS RULE! - Your best bet for staying warm at the Klondike Derby is to wear some of the new "miracle" man made fibers. They are light, warm, and they dry quickly. This family of materials include Nylon, Polyester, Fiberfill, Holofill, Qualofill and a whole range of other synthetic fibers. This is what almost all skiing and snowboarding clothing is made out of today. Even down (feather) jackets and sleeping bags usually have synthetic shells.

SPEAKING OF DOWN…

Duck or goose down clothes and sleeping bags are some of the warmest pieces of equipment that you could own, but THEY DON'T WORK WHEN THEY ARE WET! This doesn't mean that they can't be used successfully, but you must be very careful to keep them dry. If you have a down sleeping bag, it is critical that you have a good waterproof groundcloth under it and a good tent above it. If you have a down jacket or vest, it should either be waterproof (such as Gore-Tex) or it should be used as one of the inner layers of clothing under a waterproof shell.

A WORD ABOUT WOOL

Your best bet for staying warm at the Klondike Derby is to wear wool. Wool is thin for its warmth value, stays warm when its wet, dries fast, breathes to allow perspiration to evaporate and the fuzz keeps snow from sticking.

AVOID COTTON LIKE THE PLAGUE !!!!!

Cotton is a popular fabric because it is light and cool. IT HAS NO PLACE IN THE SNOW. Denim is the worst. It takes two minutes to get wet and two weeks to dry.

Let's review that last item one more time. . . .

Cotton is DANGEROUS for the snow. Don't bring it, don't wear it, and don't pretend you weren't warned about this.

SLEEPING SYSTEMS

These are items that you will need ***IN ADDITION* to your sleeping bag.**

Ground cloth

purpose: to keep ground moisture out and to help protect your tent and sleeping bag and keep them clean
qualifications: large enough to cover your sleeping area, but not too large. Thick enough to prevent punctures and rips.

Bottom Insulation

purpose: your body compresses the sleeping bag and loses all of the loft below you. It also prevents conduction.
good materials to use alone:

- any closed-cell foam pad - (doesn't soak up water, doesn't let air pass through it, prevents convection)
- Therm-A-Rest - (waterproof, prevents heat loss through conduction, convection and radiation below you)

bad materials to use alone (but may be used in combination of two or more)

- cots - (lets air circulate beneath you)
- open cell foam pads - (soaks up water just like a sponge and lets air circulate)
- newspaper - (soaks up water)

bad materials to use anytime:

- air mattresses - (your body doesn't have enough energy to heat up the air in it)

Avoid Dehydration -- You Need Water in Winter

Your body requires water in winter just as it does in summer. Under normal winter conditions the average adult loses 2 to 3 quarts of water per day through sweating, respiration, and elimination. Cold, dry winter air can cause you to dehydrate quickly, especially with windy and/or sunny conditions. Dehydration upsets your body's metabolism making you less hungry and increasing your susceptibility to hypothermia.

Unfortunately, cold temperatures tend to suppress thirst. You can become dehydrated without being thirsty which is not usually true in summer. To get adequate quantities of water in winter you may need to force yourself to drink liquids.

The need to remove clothing to eliminate body wastes and the lack of readily available water, as well as suppressed thirst, are factors that tend to inhibit your intake of water. Many people have a pronounced tendency to put off consuming water unless they are thirsty. In normal living situations we depend on our thirst system to maintain an adequate intake of water, but this cannot be relied upon in cold weather.

An alternative water machine can be contrived using a large sheet of black plastic on a sunny day. Position it on a slope, sprinkle powder snow on top and direct the flow of water to your pot or No.10 can. On a cloudy or severely cold day this method will not work so avoid relying on it exclusively.

FIRST AID - COLD-WEATHER PROBLEMS

Condition, Cause, Symptoms, and Treatment

Condition: **Hypothermia**

Cause: Cooling of the inner body core to below normal temperature, inadequate clothing, inadequate shelter, prolonged exposure to high winds, dampness, or cool temperatures, insufficient generation of body heat overexerting oneself. Slim athletic persons are more susceptible because their bodies lack resources of fat to produce energy.

Symptoms: Uncontrollable shivering, difficulty in speaking, loss of muscle coordination, exhaustion, ability to reason impaired, slowing of pulse and respiration, cannot stand or walk, eventually unconsciousness and death.

Treatment: Prevent further heat loss. Replace wet clothing with dry. Shelter from wind and weather. Give hot, sugary drinks, or warm food, if subject is conscious. Warm subject from inside out if possible. Keep subject awake until his body has been warmed. For severe hypothermia apply warm objects to subject's ribs, head and neck and groin areas. Handle with extreme care--do not rub or massage extremities. Get subject to a doctor as soon as possible.

Condition: **Windburn**

Cause: Excessive exposure of skin to wind.

Symptoms: Burning irritation and reddening of affected skin.

Treatment: Apply ointment designed to treat windburn or sunburn. Prevent further exposure of flesh to wind.

Condition: **Frostbite**

Cause: Freezing of portion of the body. Usually an exposed part of the face or extremity. Most often occurs in cold, windy conditions. Can also occur from grabbing metal items with bare hands, spilling of gasoline or fuel on the body, or restriction of blood circulation.

Symptoms: Grayish or yellow-white spots on the skin, numbness in affected part, sometimes painful. Frost-nip, the first sign of frostbite, will cause a tingling sensation as part is warmed.

Treatment: Do not rub the affected part. Do not forcibly remove clothing adhering to affected part, thaw it loose. Warm frozen part on bare flesh under armpits or stomach of person not having problems or re-warm in 108-110 degree F. water. Walk out on frozen feet; once they've been warmed, further travel is impossible. Do not allow part to refreeze.

Condition: **Snow blindness**

Cause: Excessive exposure of unprotected eye to extreme light, usually on snow, sand, or water.

Symptoms: Burning and reddening of eyes, eyes may water and swell shut, throbbing pain around eyeballs, forehead, flashes of light cause pain. Halo seen when looking at lights.

Treatment: Apply cold compresses over eyelids. Give aspirin to subject. Place light-proof bandage over eyes, or put subject in dark room with minimal light. Do not use eyedroppers or ointment. Use caution to prevent reoccurrence.

Condition: **Trench Foot**

Cause: Prolonged exposure (usually 48 hours or longer) of feet or flesh to moisture at temperatures just above freezing, causing death to affected tissue.

Symptoms: Feet and toes or other affected flesh, are pale and feel cold, numb, and stiff.

Treatment: Remove constrictive clothing and warm affected part at 70 to 80 degrees F. If water is used, it should feel slightly cool to forearm. Protect injured part with dry dressings. Litter patient if necessary.

Condition: **Dehydration**

Cause: Loss of body fluids from sweating and/or insufficient intake of water.

Symptoms: Body temperature rises, subject feels less need to drink. Greater water loss from sweating, dark urine.

Treatment: Regular intake of water at frequent intervals. Pace work. Replace body salt loss also by eating salty foods.

Condition: **Carbon Monoxide Poisoning**

Cause: Fire burning in an unventilated shelter or incomplete combustion in a ventilated, shelter. Carbon monoxide is freely generated by a yellow flame stove; flame should be blue. Avoid using flames inside shelters.

Symptoms: There may be none. Unconsciousness and death may occur without warning. Some times there may be pressure at temples, burning of eyes, headache, pounding pulse, drowsiness, or nausea.

Treatment: Get subject into fresh air at once. Keep warm and at rest. If necessary, apply artificial respiration. Give oxygen if available.

Condition: **Sunburn**

Cause: Excessive exposure of skin to sun's ultraviolet radiation.

Symptoms: Reddish skin, burns, blisters, swelling, or puffiness of extremities, insufficient sweating.

Treatment: Cool the skin, cover exposed areas, treat for burns and shock. Prevent further exposure to sun.

SNOWSHOES & SNOWSHOEING

While the exact origin of snowshoes is unknown, foot extension devices originated in Central Asia as early as 4000 BC. Much later, the North American Indians became great innovators in designing snowshoes. In the 1600's, the French who moved into the St. Lawrence River area intermingled with the Algonquin Indians and quickly learned how to use snowshoes in winter.

Today, this winter sport still has plenty of practical application as well as being fun. Even if you prefer cross-country skiing, you need to know how to snowshoe when the snow is too powdery, where a slope is too steep to negotiate on skis, or in heavy timber where skis are not sufficiently maneuverable. It may also be more practical to don snowshoes to go outside for an arm load of wood to burn in your fireplace or wood burning stove. There are times when a bit of snowshoeing can save a lot of back breaking snow shoveling.

The purpose of snowshoes is to permit the wearer to travel atop snow instead of plunging through powder or crust with virtually every step and quickly becoming overheated and/or exhausted. Stepping out of a hole requires great effort since it requires lifting the foot and leg upward against gravity and forward against the snow.

Snowshoes spread your weight over a greater surface of the snow providing various degrees of flotation - the ability to stay on or near the surface of the snow. The amount of flotation provided depends upon three factors: (1) the snow conditions (powdery, crusted, slushy, etc.), (2) the weight of the snowshoes including pack and (3) the amount of surface over which that weight is distributed. The area covered by the bottoms of the snowshoes determines the distribution of weight. You have no control over snow conditions, limited control over your weight including pack, but considerable control of the amount of area over which your weight is distributed.

A large pair of boots cover about 50 square inches of surface on the bottom. If you weigh, let us say, 150 lb. including your pack, you will exert a pressure of 3 lb. per square inch. This concentrated pressure on a relatively small area usually will cause your boot to plunge into the depths of the snow. Snowshoes on the other hand, vary from about 300 to as much as 600 square inches of surface area. Thus, with small snowshoes such as bearpaws, you will exert a pressure of only 1/2 lb. per square inch and with large snowshoes, such as the trail type, you will exert as little as 1/4 lb. per square inch of surface. Most snow conditions will support you rather well in large snowshoes because your weight will be widely distributed over the surface of your snowshoes. In fresh, powdery snow, you may sink in several inches even with large snowshoes, but it will be far easier to walk with snowshoes than without them. In other words, you will have a lot more flotation with snowshoes.

Klondike Derby Sled Plans

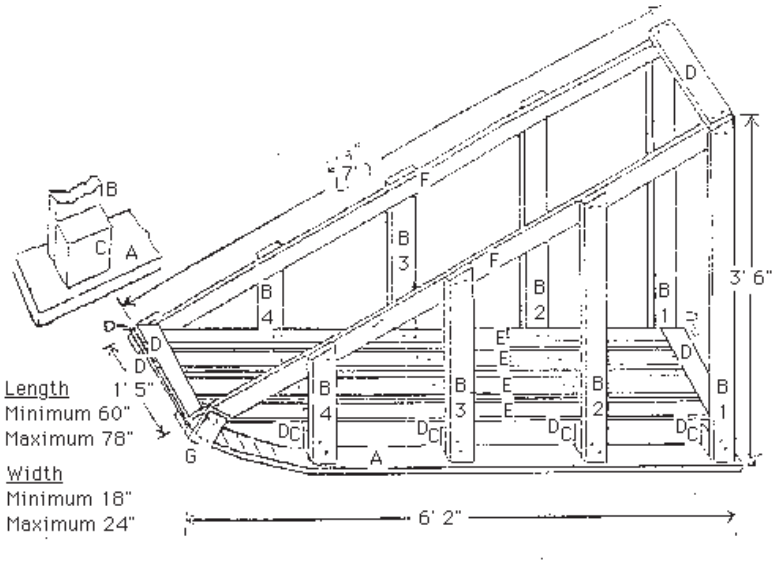
The following plan is for a sled that has minimum and maximum dimensions as shown. There is no absolute requirement for these dimensions, but these are typical of those used in most areas.

The sled below is show as a guide. Your own design may be used if it conforms to the minimum and maximum dimensions. Make sure the sled is strong enough to bear the weight of your equipment and will hold together for a long trip. It is best to use screws rather than nails. Drill first to avoid splitting wood. Varnish bottom of runners and wax before using. Wire netting or a canvas snow curtain may be added to prevent items from falling off of the sled.

Secure a towing rope at the front and secure a brake rope at the rear.

Materials:

Item	Label	Quantity	Dimensions
Runners	A	2	1" x 4" x 6'2"
Uprights	B1	2	1" x 4" x 3'6"
	B2	2	1" x 4" x 2'8"
	B3	2	1" x 4" x 1'9"
	B4	2	1" x 4" x 10"
Upright Supports	C	8	2" x 4" x 4"
Cross Supports	D	6	1" x 4" x 1'5"
Floor Strips	E	4	1" x 4" x 6'
Hand Rails	F	2	1" x 2" x 7'
Front Supports	G	2	1" x 4" x 6"



Japeechen District Klondike Derby

Approximate Dimensions: HEIGHT = 40 inches, LENGTH = 6 feet, WIDTH = 18 inches.

Paint your sled bright colors -- varnish the bottom of the runners -- then wax before use! You can add a canvas snow curtain to keep equipment dry. Lace the sides with nylon rope to keep equipment from falling off the sled.

Use screws instead of nails and pre-drill pilot holes to prevent splitting. Use glue in addition to screws.

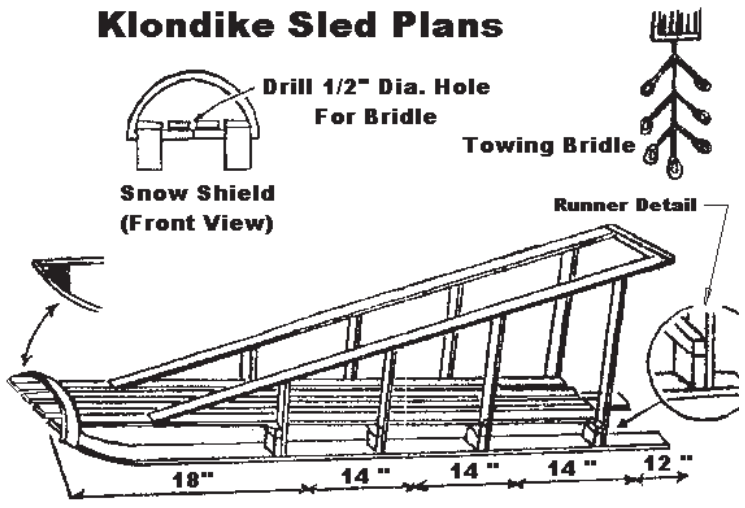
An old set of downhill skis or pvc pipe works well as runners. Make your sled strong, but light!

Mount a pole on your sled to fly your patrol flag!

Use hardwoods such as maple, oak or ash to make your sled. Pine is too soft!

Bill of Materials

*2 pcs. 4" x 1/2" x 6'6" - for Runners (use skis!!)
*6 pcs. 1" x 1" x 18" - Cross Supports
*8 pcs. 1" x 2" x 6" - Upright Supports
*4 pcs. 1/2" x 4" x 5' - Floor Cover
*2 pcs. 1" x 2" x 12" - Front Upright
*2 pcs. 1" x 2" x 26" - 2nd Upright
*2 pcs. 1" x 2" x 38" - 3rd Upright
*2 pcs. 1" x 2" x 40" - Rear Upright
*2 pcs. 1/2" x 2" x 6' - Hand Rail - sand smooth!
*1 pc. 1/2" x 2" x 30" - Front Curved Snow/Ankle Guard
*1 pc. 2" x 2" x 18" - Tow Bar
*Rope for Towing Bridle - 1/2" Dia. minimum
*Wood Screws
*Wood Glue
*Paint & Varnish



SHELTERS

During winter, shelter is very important. At night temperatures can drop far below freezing. If you have the right kind of shelter you won't even notice the change. You must be prepared for rain, snow, and wind. Think of what happens when a foot of snow falls on top of your tent or snow cave. Does it collapse? If it's wet out, will you be dry? Can you move around enough to change clothes? Also pay close attention to the pad you sleep on. Its the only thing between you and the snow. Plan carefully!

When choosing a tent to use you should think of space, warmth, and stability. Try to get a tent that is rated for more people than will be in it. When the label says "four man tent" it usually means four stunted nine-year-olds. You need room for packs and for changing. Big dome tents are good for this, so are tents with a "boot" at the rear for storage.

When the air is cold outside the tent, it makes water vapor on the inside condense on the walls. In the morning you'll be swimming in your own breath if your tent is sealed tight. To avoid this, use a tent with a net top and a rain fly, or leave the door open a bit. Be sure the tent is waterproofed top and bottom, and always use a ground cloth. If you have one, spread a blanket on the floor to keep off the chill of cold nylon.

Some tents are not made to be snowed on. A-frame tents often sag towards the center when loaded, but they can be used if you are careful to occasionally take the snow off. Dome tents and arch tents may fare a bit better, but you should never leave more than a few inches on the roof. Snow on the tent can be helpful, it traps air and acts as an insulator, so you stay warmer.

After you pick your tent site, prepare the snow to sleep on. Pack it down flat with skis, snowshoes, or boots. As soon as your tent is up, crawl inside and smooth the floor. By nighttime the snow will be hard as a rock, so do a good job.

Tent stakes won't hold in snow, and even dome tents should be anchored for wind. To make a "deadman" anchor, tie a short cord around a few foot-long sticks. Dig a hole about a foot deep where you want the anchor. Fan out the sticks at the bottom and bury them. Then just tie your tent rope to the cord. Always use a separate anchor cord. The knots may freeze, and you may have to cut the cord.

NATURAL SHELTERS

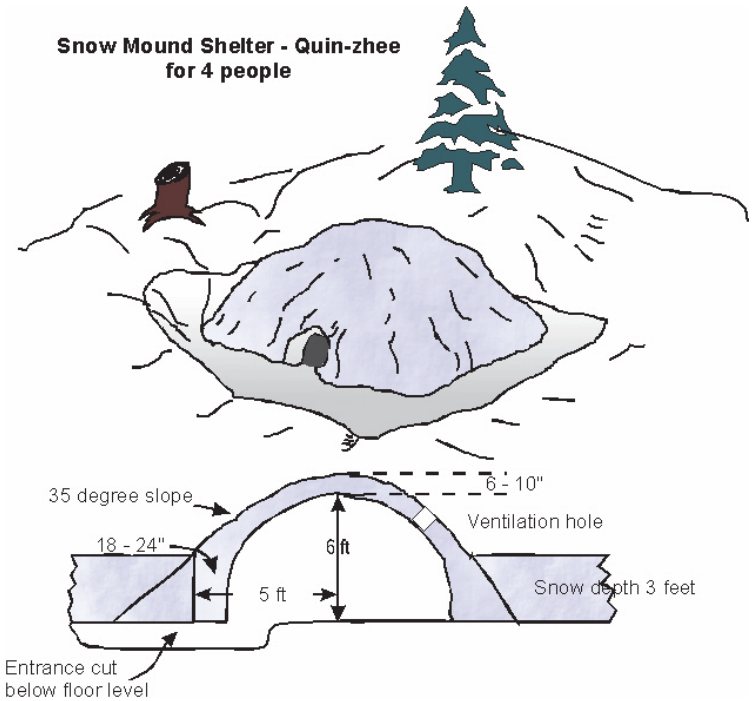
Here are some descriptions of shelters that can be built from natural materials. Diagrams of some of these structures are also included.

SHELTER TYPE: Snow Dome - Quinzhee Hut

TIME: 15-20 man hours

HOW TO CONSTRUCT:

- Trample out a circle in the snow and all the snow within that circle. This will be the size of your quinzhee hut. Pile up mound of snow 6-8 feet high and 12 feet in diameter.
- http://www.geocities.com/Yosemite/Gorge/1613/ar00/arbuildquincy.jpgUse your shovels, snowshoes or your hands to throw snow from the outside of your circle into the middle and create a mound. Throw as much snow into the center as you want your snow shelter to be big.
- Whack at the mound with skis, shovels or body, as it becomes bigger. The more you disturb the snow the stronger it will set up.
- Once you are satisfied with the pile of snow you have created let it rest for at least three to four hours.
- "Pin-cushion" the hut with sticks 8-12" long in various areas around the dome
- To begin hollowing out your quinzhee dig down and then in. Make sure the entrance is facing away from the wind. As you form a tunnel entrance to your shelter, make sure someone on the outside to help shovel away the snow as it comes out. (Also it's safer should something goes wrong and your structure falls in on you!).
- Scoop out the ceiling. Use arcing strokes to create a dome shape inside. This will keep your snow structure strong. As you arch out the roof watch for the sticks to tell you when to stop digging. The more you shave snow away from the walls more light will come in. This is your key to know when to stop shoveling



- Use the interior snow to reinforce the sides of the hut or build up the entrance walls
- Important: carve in small air holes in the sides to ventilation
- Have a set of dry clothes to put on once you are done.
- Get spray bottles containing water with food coloring and paint your quinzhee
- Destroy the quinzhee when you are finished with it. It could be a danger to others or to wildlife

ADVANTAGES: This provides more permanent long-term shelter. Shelter will be tall enough to stand inside. A single candle will provide plenty of heat, if the entrance is kept closed.

PRECAUTIONS: Stay as dry as possible. Avoid overheating while building shelter. Keep digging tool inside in case shelter becomes drifted over. Make several ventilation holes in case one closes. Do not build fire or use stove inside. The danger of carbon monoxide poisoning is too great.

In a selected spot, place an upright marker (ski pole, ice axe, etc.) to mark the center. Tie a cord to the marker and scribe a circle in the snow to indicate the pile size. The rule of thumb for size: if the snow in place is not to be dug out, the radius should be the interior size plus about 2 feet; if the snow in place is to be dug out, about 1 foot can be subtracted from the radius for each foot of in-place snow. Piling the snow for a two person shelter will take two people about an hour. Pile loose snow within the marked circle with shovels, tarp etc. Don't compact the snow. When the mound is the right size and shape, do not disturb it; allow it to compact naturally - minimum time one hour. Chances of collapse are greatly reduced if you let it settle for two hours. Thirty-five degrees is the natural angle at which loose snow rests. Be sure to allow the snow to settle at this angle. Otherwise you will have thin spots or a buckling roof when you excavate the interior. After compaction you are ready for digging. The entrance direction should be away from the prevailing incoming weather. From the entrance point start digging toward the marker. Pass the snow out to helpers. As soon as you reach the marker, do no not disturb it. This is your guide for excavating the interior. Clear out the inside to the intended radius. To check on wall and roof thickness, measure with a stick poked through. When the dimensions check, remove the marker and trim the interior. Then install a vent in the roof. Get rid of waste snow promptly before it hardens. The process is a wet one so make sure you have waterproof gear on and good shovels for making the mound and digging out.

Snow cave digging under tree branches

SHELTER TYPE: Snow Cave

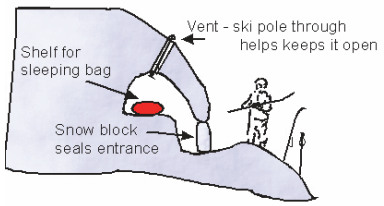
TIME: 3-4 man hours

HOW TO CONSTRUCT: Find drift 6-8 feet high on the side of hill or ridge. Tunnel into drift with a T-shaped entrance. Use your arms to push snow out of arms of "T". Once inside is large enough, close top arms of "T" with snow blocks. Pack down one arm of "T" and sleep on this higher bench. Walk in and out of shelter along trunk of "T".

ADVANTAGES: End result is large enough for 3 persons, one across back of "T", and one on each side. Horizontal bar of "T" permits quick removal of snow from this interior. Provides "long-term" type of shelter.

PRECAUTIONS: Avoid overheating while building shelter. Stay as dry as possible. Make several ventilation holes in case one closes. Keep digging tools inside in case shelter gets drifted over. Do not build fire inside the danger of carbon monoxide poisoning is too great.

Snow cave on a slope



A snow cave can be dug into a hillside. Dig the entrance up so that the door is below the sitting level. Also there are natural snow caves formed by the overhanging branches of trees covered with snow. By digging down you can get into the cave beneath the branches. In both cases you should poke a ventilation hole and keep it clear.

SHELTER TYPE: Snow Pit

TIME: 1/2 man hour

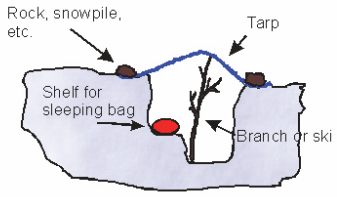
HOW TO CONSTRUCT: Deep snow is required. Simply dig out a pit large enough to sit and/or lie in. If you have a tarp or other large piece of material, place it over the top. Weight down the edges with branches and cover with snow. Tunnel into one end of the shelter for access. Entry way can be filled, keep out cold once you are inside.

ADVANTAGES: Shelter is easy to build and gets you out of the wind quickly.

PRECAUTIONS: Select area out of wind for shelter so the tarp will not be apt to bIow away. Put some type of insulation under you to keep warm and dry. Be sure you have several ventilation holes. Check them frequently to avoid clogging.

This structure can be created by digging a trench in the snow down to ground level (if possible). The structure should be a little longer than your body and 3 - 4 feet wide. Line the bottom with insulative material to insulate you from the cold ground (in an emergency you can use 5-6 inches of evergreen boughs). A roof can be made of skis and poles or overlapping boughs and sticks then covered with a tarp and then loose snow or blocks of hard pack snow. The doorway will be a tunnel in from the side. This can be plugged with a door of hard pack snow. ***A ventilation hole must be poked into the roof for air flow.*** Keeping a stick in this hole and shaking it every so often will keep the hole open. If possible, the entrance should be lower than the level of the trench, this keeps the coldest air in the entrance rather than in the trench.

Snow Trench Shelter



SHELTER TYPE: **Snow Trench**

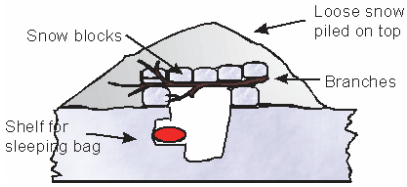
TIME: 2 -4 Man hours

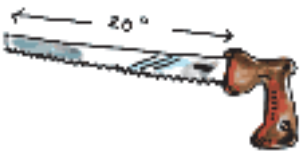
HOW TO CONSTRUCT: Snow must be firm enough to cut blocks. Cut blocks to form trench just large enough to lie in. Lean ends of blocks together over trench forming a pup tent like top.

ADVANTAGES: Shelter provides excellent wind break and provides good insulation against cold.

PRECAUTIONS: Handle blocks with care so they do not crumble. Put insulation around you to keep warm and dry.

Snow Mound Trench Shelter





SHELTER TYPE: **Igloo**

TIME: 15-25 man hours

Building an Igloo

The following is reprinted from *"The Complete Wildnerness Training Guide"* written by Hugh McManners and published by Dorling Kindersley.

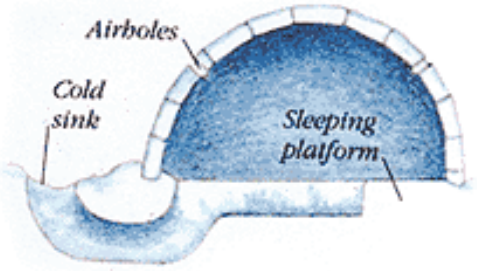
Provided temperatures remain below 32 degrees F, constructing snow shelters is relatively easy. Sheltering from the wind is the first priority, since the wind can drastically decrease the air temperature. Temperatures below 14 degrees F become increasingly unpleasant, so that it becomes necessary to construct shelters in which heat can be retained extremely well. These can range from a simple, hollowed-out heap of snow to an igloo, which can take a few hours to construct. In a long-term shelter, such as an igloo, heavy, cold air can be diverted away from the occupants by digging a cold sink to channel the air down and away from the shelter. It is important to allow for adequate ventilation in all snow shelters in order to prevent suffocation.

1. Cut blocks from dry, hard, hard snow, using a snow saw or large knife. Each block should be about 3 ft. (1m) long, 15 in. (40cm) high, and 8 in. (20cm) deep.

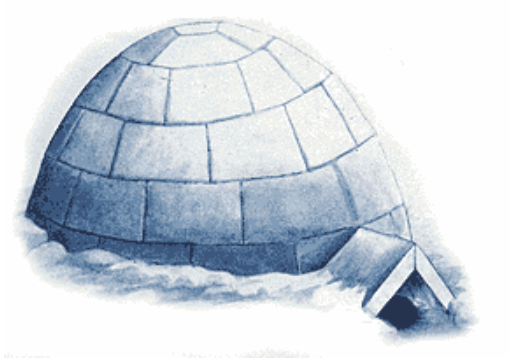
2. Form a circle with blocks around the hole created where you cut the blocks. Cut the circle in a spiral from the top of the last block to the ground ahead of the first block. This will make it easy to construct a dome.

3. Build up walls, overlapping the blocks and shaping them so that they lean inward. Cut a hole under the wall for the cold sink and entrance. Put several blocks along one wall as a sleeping platform

4. The last block must initially be larger than the hole. Place the block on top of the igloo, then, from inside, shape and wiggle it to slot exactly into the hole.



5. Hot air from your body and stove rises and is trapped inside the dome. Cold air falls into the sink and flows away to the outside. It is essential to cut ventilation holes in the walls with an ice ax.

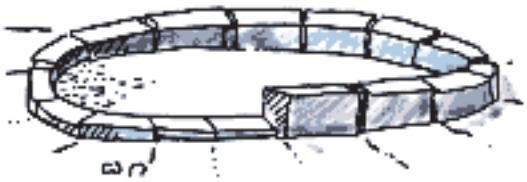


Finished Igloo. With warmth inside the igloo, the surface of the walls will melt and freeze over, to form a smooth, airtight ice surface. The roof over entrance tunnel prevents snow from blowing into igloo.

WARNING! It is vital to make at least one airhole in the roof to avoid suffocation. The igloo will get very warm inside with heat from your body, even if it is cold and windy outside. Without ventilation, lethal carbon dioxide will build up. Also, the use of stoves in an enclosed shelter is not recommended due to dangerous build-up of carbon monoxide.

How to Build an Igloo

by Gene Leach (1/10/03)



The following tips are provided for constructing an igloo with blocks of snow. Two or three people ease the work and speed construction.

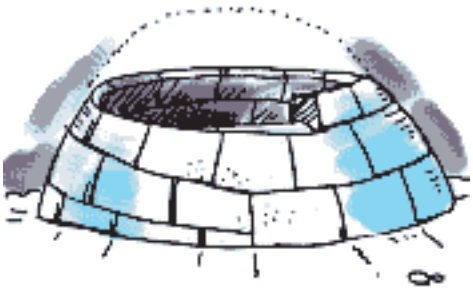
<u>One snow shovel, a snow saw per person and a pair of heavy duty rubber gloves per person are all that is needed for construction.</u>

For comfort, put on a wind breaker or gortex parka and pants to keep the loose snow off your clothes.

Finding the right type of snow for cutting snow blocks is critical. Snow texture and consistency is important. The best snow is usually found on a north facing slope. Snow melted by the sun during the day and refrozen at night, contains ice and will not bond well.

The size of the igloo is mentioned for it is easy to initially plan an igloo larger than needed, invoking too much work. Pack out an area where you plan to build the igloo. Draw a circle with the radius equal to the length of a ski pole. For more than two, a slightly larger radius is suggested.

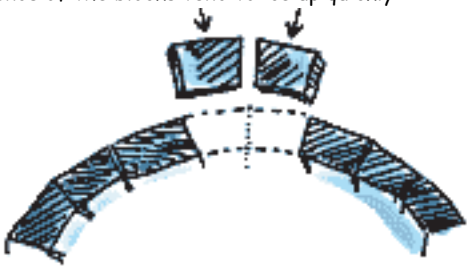
The snow blocks, dimension two feet long with a one foot by one foot cross section, are laid around the circle.



After completing the first row of snow blocks around the base of the igloo, use a snow saw to create a circular ramp that starts flush with the ground and curves around the entire first row of snow blocks. This ramp starts at ground level and finishes one block high adjacent to the starting point. Start the second row by placing the first block on the lowest point of the circular ramp and continue placing snow blocks around the second row.

With the second row, start sloping the top of the blocks with the snow saw so that an imaginary line, from the top of the block, passes through the center of the circle. The next round of blocks are laid, again making sure the slope of the top block points to the center of the circle.

When bonding a snow block to its neighbor, it may be necessary to make a small fresh cut for the ends of the blocks tend to ice up quickly preventing a good bond from forming.



Each new block is supported both by the blocks beneath and by its neighbor to one side. It's the support of the block to one side that allows you to lean each row of blocks in a little further.

One member of the group should stay inside to support and trim each block while the other member(s) cut, carry and place the blocks.

All of this takes about to two hours but is rewarding when you come to the last few blocks, which are laid close to horizontal overhead. Carve an entrance in the side. Fill the cracks with snow. If the bonding has been good, a very strong structure now exists.

Be certain that there is a small vent in the top when using a candle or stove.